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THE FEASIBILITY STUDY REPORT
IN SUPPORT OF INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE
ON
A MINI-CEMENT PLANT AT THAYET, MAGWE DIVISION THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

(PROJECT NO. DP/BUR/80/015)

(FINAL REPORT)

MARCH 1988

16768

PREPARED BY

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
VIENNA, AUSTRIA

AND

ONODA ENGINEERING AND CONSULTING CO., LTD.
TOKYO, JAPAN

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PREFACE

In response to the request of the Government of the Socialist Republic of the Union of Burma, United Nations Industrial Development Organization (UNIDO) decided to conduct a feasibility study in support of International Drinking Water Supply and Sanitation Decade (IDWSSD) on a mini-cement plant at Thayet, Magwe Division and subcontracted it to a consulting firm named Onoda Engineering and Consulting Company (OEC), Tokyo, Japan. OEC sent to the Socialist Republic of the Union of Burma a field survey team headed by Mr. Taro Kojima from October 12 to November 2, 1987.

The survey team exchanged views with the staff concerned of the Government of Burma and UNIDO, Rangoon, and conducted a field survey in the project areas. Upon returning to Japan, the team promoted analytical and design work based on the data collected in Burma, and prepared the draft final report. According to the conclusion of discussion meeting held on March 11th, 1988 in Rangoon among the staff concerned of Burma, UNIDO and us, the team reviewed several points of the draft final report and has prepared this final report. We hope that this report will serve for the development of the project and contribute to the promotion of the IDWSSD Programme.

In conclusion, I wish to express my deep appreciation to the officials concerned of the Government of Burma and UNIDO, Rangoon for their close cooperation and hospitality extended to our team, without which our task couldn't have been completed so successfully.

Tokyo, March 1988

K. Hyakutake
Kengo Hyakutake
President
Onoda Engineering and
Consulting Co., Ltd.

CURRENCY IN BURMA

The local currency in Burma is Kyats (K) and the following is the official rate of exchange with reference to the U.S.Dollar and the Japanese Yen. The financial and economic analysis in this report is carried out based on these official rates of exchange.

1 U.S.$ = 6.62 Kyats
1C0 Japanese Yen = 4.6 Kyats
1 Kyat = 100 Pyas
(as of October, 1987)

ABBREVIATIONS USED IN THE REPORT

U.S.$	=	U.S.Dollar
Ks	=	Kyats
T/D or tpd	=	Metric Ton/Day
T/Y	=	Metric Ton/Year
H/D	=	Hour/Day
D/Y	=	Day/Year
kW	=	Kilowatt
kWh/T	=	Kilowatt Hour/Metric Ton
%	=	Percentage
μ	=	Micron
g/Nm^3	=	Gramme/Standard Cubic Meter
F.Y.	=	Fiscal Year
GNP	=	Gross National Product
GDP	=	Gross Domestic Product
IDWSSD	=	International Drinking Water Supply and Sanitation Decade
UNDP	=	United Nations Development Programme
UNIDO	=	United Nations Industrial Development Organization
CIC	=	Ceramic Industries Corporation
CC	=	Construction Corporation
IWTC	=	Inland Water Transportation Corporation
IPD	=	Industrial Planning Department
RWSD	=	Rural Water Supply Department
Government	=	The Government of the Socialist Republic of the Union of Burma
DGSE	=	Department of Geological Survey and Mineral Exploration

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I.1.1 Project background

The project has been planned to set-up a mini-cement plant, the product of which can be available for construction of many components of the International Drinking Water Supply and Sanitation Decade. The planning of the project has had a checkered history of more than five years.
The project idea is to establish a mini-cement plant unit at the Thayet cement plant by installing a 200 tpd wet process kiln using the existing equipment as much as possible. (Refer to Chapter II.1)

I.1.2 Project parameter

Raw materials are limestone, marl, clay, iron ore, river sand and gypsum, all of which are available in Burma.
Fuel is natural gas which is presently used in the Thayet cement plant.
Product is ordinary portland cement specified by British Standards.
Plant capacity is decided to be 200 tpd taking into account the present market situation and the operation conditions of the existing equipment.
Plant location is selected to be Thayetmyo, Magwe Division, Burma. (Refer to Chapter II.2)

I.1.3 Economic, financial and social policies

The economic goals of the Burmese way to Socialism are to raise the standard of living and to reduce inequalities in distribution of income. For this purpose, the Burma Socialist Programme Party has adopted a Twenty-Year Long Term Plan in which the guidelines were laid down to double the national standard of living by the end of the plan period (1974/75 - 1993/94) and to transfer Burma to an agro-industrialized country. Review has been briefly made on statistical figures of each Four-Year Plan. (Refer to Chapter II.3)

I.1.4 Project promoter

The project is being promoted by the Ministry of No.1 Industry, Burma and the Ceramic Industries Corporation (CIC) is representing the Ministry.
The CIC will call for tender from foreign suppliers for supply of machinery and equipment through coordination with the Industrial Planning Department. The civil work and erection of machinery and equipment will be carried out by the Construction Corporation of Burma. After the project will be commissioned and taken over, the management of the plant will be conducted under the CIC's supervision. (Refer to Chapter II.4)

I.1.5 Studies and investigations already performed

Several studies and investigations already performed on the Thayet cement plant and mini-cement projects have been introduced in this report.
From practical and technical points of view, production of cement employing a vertical shaft kiln or a fluidized bed burning process seems to be unsuitable for this project for the time being. (Refer to Chapter II.5)

I.2 Market and Plant Capacity

I.2.1 Present situation of cement industry

Presently in Burma, there are three cement plants which nominal production capacity is 3,200 tpd in total. A map showing the location of each plant has been prepared. (Refer to Chapter III.1)

I.2.2 Demand and supply of cement

According to the data available, 451,522 tonnes of cement were produced in Burma in the fiscal year 1986/87, 405,382 tonnes of which were consumed for domestic uses and the rest was exported for foreign currency to buy spare parts for the existing cement plants.

A yearly growth rate of cement production is expected to be about 8%. However, since there is a high demand for cement in Burma to the extent that one ton of cement is sold by more than US$400 in the black market, shortage of cement supply will continue in future even after completion of the project.

Yearly cement consumption per capita in Burma was 10.7 kg in the fiscal year 1986/87, which is considered to be the lowest in Asian countries. (Refer to Chapter III.2)

I.2.3 Marketing of cement

The retail and the ex-factory selling prices of cement are determined and controlled by the Government. The present selling price is 336.6 Kyats per tonne of cement on ex-factory basis and 509 Kyats on ex-warehouse basis in Rangoon respectively.

The selling price includes Goods and Service taxes and inland transportation cost to the depots from the Thayet plant. (Refer to Chapter III.3)

I.2.4 Production programme and sales forecast

Production programme is assumed as follows:

1st year	80% of normal capacity
2nd year	90% of normal capacity
3rd year and thereafter	100% of normal capacity

Taking into consideration the expected distribution ratio to different depots, the selling price on ex-warehouse basis is assumed to be 492.22 Kyats per tonne of cement on weighted average.
The whole quantity of cement produced after completion of the project is expected to be sold, because there is a high demand for cement in Burma. (Refer to Chapter III.4)

I.2.5 Plant capacity

Taking into account the results of discussion on production technologies and the present conditions surrounding the project, the plant capacity is finally decided to be 200 tpd. Yearly normal production capacity is also decided to be 60 thousand tonnes with 300 working days per year. (Refer to Chapter III.5)

I.3 Materials and Inputs

I.3.1 Qualitative specifications and supply of raw materials

(1) Limestone

The limestone of Htone Toung quarry contains about 50% of CaO on the average and the amount of harmful compositions are lower than the allowable limit and so this limestone is of good quality for manufacturing ordinary portland cement.
Minable reserves are approximately 15 million tonnes which will last for more than 50 years for the Thayet cement plant after completion of the project.

(2) Marl

The marl is produced from the overburden of the limestone bed. Quality variation of the marl is rather high so that special management is required to control the marl quality within the allowable limit.

(3) Clay

The clay is only used in case the slurry has an excess content of $CaCO_3$.

(4) River sand

The river sand scattered along the bank of Irrawaddy river will be used as siliceous materials of cement. Quality of the river sand is good and stable for manufacturing portland cement.

(5) Iron ore

The iron ore will be procured from a regional company in Pakokku. Fe_2O_3 content in the ore varies so much that special consideration is required to the quality control.

(6) Gypsum

Gypsum will be procured from the Government supplier (No.3 Mining Corporation). SO_3 content of gypsum is ranging from about 31% to 43% which is suitable in quality for cement manufacturing. (Refer to Chapter IV.1)

I.3.2 Qualitative specifications of process materials

(1) Slurry

At present, the quality of slurry has been controlled within the targetted values so that for the project the slurry is also expected to be good in quality.

(2) Clinker

The clinker to be produced in the project is expected to have the quality of 1.25 - 1.35 litre weight with free CaO of less than 1%.

(3) Cement

The kind of cement to be produced in the project is ordinary portland cement stipulated in the British Standards (1958), which is the same in quality as the cement presently produced in the

Thayet plant. The products of good quality can be produced with raw materials and through the process of the project. (Refer to Chapter IV.2)

I.3.3 Qualitative specifications and supply of energy, utilities and paper bag

(1) Energy

Natural gas from the Pyaye gas station is suitable in quality as fuel for clinker burning. Gas pressure shows, however, somewhat large fluctuation which may cause supply problems in future.

(2) Water

Water for both drinking and industrial uses can be taken from the Irrawaddy river. The present water supply capacity seems sufficient for the project.

(3) Electric power

Electric power for the project will be supplied by Electricity Power Corporation (EPC). Since electric power demand in the project is estimated nearly the same as the present one, the existing facilities of power supply are sufficient for the project.

(4) Paper bag

Paper bags are five plys at present, about 7% of which are broken down during packing and loading of cement. Bulk shipment of cement is recommended to increase gradually in the future. (Refer to Chapter IV.3)

I.3.4 Consumption of input materials

Consumption of such inputs into the project as raw materials, utilities and energy has been calculated and summarized in Table 4-11, 4-12, 4-13 and 4-14 respectively. (Refer to Chapter IV.4)

I.3.5 Estimate of variable production cost

Based on the unit price given by CIC and the results obtained in the study, variable production cost exclusive of labor and maintenance cost has been calculated to be 194.37 Kyats per ton of cement. (Refer to Chapter IV.5)

I.3.6 Materials supply programme

Taking into account the increase of production by 200 tpd, the additional inventory of raw materials is considered in the project to cover the consumption for 10 days. (Refer to Chapter IV.6)

I.4 Location and Site

I.4.1 Location and site

The location for the project has been selected to be in the existing Thayet plant. The reasons of selection have been discussed from technical, economical and social viewpoints. (Refer to Chapter V.1 and V.2)

I.4.2 Local conditions

The natural and social conditions such as climate, availability of electricity, water and fuel, manpower, transportation, etc. have been discussed. For implementation of the project, there is no constraint in local conditions. (Refer to Chapter V.3)

I.4.3 Environment impact

The direct increase of employment opportunity by the project is expected to be 50 persons. No great impact on the regional population and improvement of infrastructure may be expected. (Refer to Chapter V.4)

I.5 Project Engineering

I.5.1 Project layouts

Considering the basic principle of the project and the investigation results on the existing plant, the project layouts have been prepared. (Refer to Chapter VI.1)

I.5.2 Scope of the project

Examining various factors in detail, the most suitable process for the project has been selected, and scope of the project has been decided for each process department. (Refer to Chapter VI.2)

I.5.3 Technology and equipment

Taking into account materials and inputs for the project and the present conditions of the existing plant, conceptional design of machinery and equipment has been carried out and specifications of main equipment are determined. In addition, the investment cost has been calculated for civil engineering work, building, plant machinery & equipment and auxiliary & service equipment which is totalling to 53,121 thousand Kyats. As to the standards of machinery and equipment, foreign standards internationally accepted may be used. (Refer to Chapter VI.3)

I.5.4 Alternative

A semi-dry 2-stage suspension preheater process with less heat consumption has been studied as a possible alternative plan from the technical point of view. Conceptional design of machinery and equipment has been prepared. (Refer to Chapter VI.4)

I.6 Plant Organization and Overhead Cost

I.6.1 Administration of the plant

No modification of the present organization of the plant is required for the project, because the increase of employees is expected only 50 and the manufacturing process is the same as the existing one.
For improvement of administration of the plant, recommendation has been made on maintenance management, process operation management and safety control.
(Refer to Chapter VII.1)

I.6.2 Overhead cost

Various overhead costs have been discussed and only the following is applied to the financial evaluation of the project:

° Maintenance cost	11.2 Ks/t-cement
° Royalty for raw materials	1 K/100 ft^3-limestone
° Insurance cost	0.25% of investment cost for civil engineering works, machinery & equipment
° Goods & service tax	67.32 Ks/t-cement
° Distribution cost	44 Ks/t-cement
° Depreciation & financial cost	Refer to Chapter X

(Refer to Chapter VII.2)

I.7 Manpower

Manpower requirement for the project is discussed and manpower allocating plan has been prepared. Total nos. of employees will increase by 50 in the category of technician only and the estimated cost of manpower is about 140 thousand Kyats per year. (Refer to Chapter VIII.1 and VIII.2)

I.8 Implementation Schedule

Considering the results of discussion on various types of contract, the equipment supply contract on CIF basis, inclusive of supervisory services during construction and commissioning, is most desirable for the project. It is not necessary that foreign consultants be hired for the project, because CIC has sufficient experiences in the wet process kiln and Construction Corporation (CC) that is considered to be assigned for construction has also experiences in the similar field. Tentative schedule of the project implementation is as follows:

° Preparation work from financing arrangement to award of contract	:	12 months
° Design and supply of machinery & equipment	:	12 months
° Construction works	:	9 months
° Trial runs & commissioning	:	3 months
Total	:	3 years

Work schedule of the project has been prepared in bar chart, and responsibilities and roles of CIC, equipment suppliers and contractors have been discussed. (Refer to Chapter IX)

I.9 Financial Evaluation

I.9.1 Conditions and method of the project evaluation

The project evaluation has been carried out using the COMFAR computer programme on the following conditions:

(1) Investment cost

Only the investment cost newly required for the project is considered, disregarding the values of the existing equipment commonly used in the project with existing lines.

(2) Variable production cost

Refer to Table 4-15.

(3) Fixed production cost

The factory overheads and administrative overheads of the existing plant operation are not taken into account, because these will remain the same, irrespective of whether the project is implemented or not.

(4) Source of finance

Foreign portion and local portion of the new investment are considered to be financed by the following currencies respectively.

° Foreign currency

interest rate	:	2.5%/annum
grace period	:	10 years
repayment	:	in 20 equal yearly installments

- Local currency
  - interest rate : 5%/annum
  - grace period : none
  - repayment : in 5 equal yearly installments

The total capital requirement for the project is summarized as follows:

(Unit: thousand Kyats)

	Foreign portion	Local portion	Total
Fixed capital	32,205	21,341	53,546
Working capital	1,074	248	1,322
Total	33,279	21,589	54,868

As to the input data into the COMFAR programme such as sales revenue, production cost, disbursement schedule of the capital requirement, etc., refer to the attached sheets. (Refer to Chapter X.1)

I.9.2 Result of calculation

(1) Basic plan

As method for profitability analysis, Internal Rate of Return (IRR), pay-back period and break-even point have been adopted.
The calculated results on the basic plan are as follows:

IRR : 10.97%
Pay-back period : 7.1 years
Break-even point: 62.1% (in 3rd year)

Judging from the above figures, the project can be said financially viable.

(2) Sensitivity analysis

Sensitivity analysis regarding IRR and break-even point has been made on the following factors to the basic plan.

- Production cost
- Investment cost
- Sales price
- Case of import tax free

(Refer to Chapter X.1)

I.9.3 Examination of financial viability of the existing plant

Even if the project itself is financially viable, it is meaningless unless the existing plant as a whole is financially viable after completion of the project. To examine this point, calculation has been carried out based on the present financial status in case of the project being not implemented. The result shows that the project can so much improve profitability of the existing plant. And also, financial analysis has been carried out for the alternative case in which manufacturing process of cement is changed.
The study shows that the basic case is most profitable.
(Refer to Chapter X.2)

I.10 Economic Analysis

(1) Economic internal rate of return (EIRR)

Making the following price adjustment using conversion factors given by CIC, EIRR of the project has been calculated to be 12.97%.

- Conversion factor on foreign exchange : 1.15
- Conversion factor on unskilled labor cost: 0.5
- Tax and duties imposed locally: To be omitted

The above value is higher than the cut-off rate of EIRR which is estimated to be about 12% in Burma. Thus the project is quite favorable from economic point of view.

(2) Absolute efficiency test

Taking 3rd year, the absolute efficiency test of the project has been conducted and it is proved that the project can pass the said test.

(3) Net national value added

Calculation on the net national value added has been carried out using the Social Discount Ratio (SDR) of 6.5% which is given by CIC.
The obtained result shows the net national value added of 69,461 thousand Kyats.

(4) Import substitution effect

Assuming that cement price on CIF Burma basis is US$40 per tonne of bagged cement, the study has been made on the net saving amount in both current price and present value being discounted at 10%.
The study shows that a ratio of the net present value of the saving to a foreign loan is 2.5 and the effect of the project on foreign currency saving is great.

(5) Other impact

The following economic benefit can be expected:

- Promotion of IDWSSD Programme
- Increase of cement production
- Increase of employment opportunity
- Effect extended to local industries

(Refer to Chapter XI)

I.11 Conclusion

As a result of above study and examination, the project to set-up a mini-cement plant with a capacity of 200 tpd in the Thayet plant is proved to be feasible in terms of technical and economic points. Also the project is considered to be able to add a great benefit to the national economy due to the high demand and low productivity of cement of the existing cement plants.

CHAPTER II PROJECT BACKGROUND AND HISTORY

II.1 Project Background

II.1.1 Introduction

The Socialist Republic of the Union of Burma (Government) is giving the highest priority to raising the living standards of its people by improvement and changes in economic and social sectors. In this regards, a National Meeting on the strategy and detailed planning for the International Drinking Water Supply and Sanitation Decade (IDWSSD) was held in Rangoon in the sponsorship of Construction Corporation (CC) in January 1982. The objective of IDWSSD is to improve the health of the people and their living standards by providing safe drinking water and sanitation to about five million inhabitants of towns (including cities of Rangoon and Mandalay) and sixteen million inhabitants of villages by 1990.

The additional population that will need to be served during the Decade is two million in the urban areas and thirteen million in the rural areas.

Since several constraints were found to the implementation programme of IDWSSD, the Government desired to remove these constraints by the technical assistance of the United Nations Industrial Development Organization (UNIDO) and the United Nations Development Programme (UNDP). In May 1984, therefore, a project document concerning the technical assistance in expediting certain projects and studies was signed after several discussions by the Government and UNDP/UNIDO.

A group of these, under the control of the Ministry of No.1 Industry is concerned with production units for the supply of materials required for the IDWSSD programme. They include plastic appliances extrusion plants, plastic pellet manufacture, a welded steel pipe plant and a mini-cement plant. The Project office was opened in 1984 at 31, Kaba Aye Pagoda Road, Rangoon and a proposal for Detailed Work Plan for the project "Feasibility Studies in Support of IDWSSD (Project No. BUR/80/015)" was prepared.

Three different industrial corporations, which cooperate and co-ordinate with the Industrial Planning Department (IPD) of the Ministry of No.1 Industry, are closely involved in carrying out the project outputs and activities. These corporations are:

(1) Ceramic Industries Corporation (CIC) for a mini-cement plant
(2) Metal Industries Corporation for a welded steel pipe plant
(3) Pharmaceutical Industries Corporation for plastic appliances extrusion plants and small batch type plastic pellets manufacturing plant

The IPD supports the Project Office in co-operation and co-ordination with other Departments and Corporations involved in implementation of the other projects under the national IDWSSD Programme.

The four senior industrial investment project officers are headed U Chit Wai who is a national project director from the IPD, and U Myint Swe has been appointed and selected as a senior industrial investment project officer for a mini-cement plant.

Most of the data and information in this study were mainly collected through U Myint Swe and U Chit Wai during the field survey conducted by the consultant from October 12th to November 2nd, 1987.

II.1.2 Historical development

As aforementioned, the Government is giving the top priority to the raising of the living standards of the population. Plans are being designed and implemented to improve the economic and social situation of the population with special consideration given to the rural areas.

Health is one of the important sub-sectors of the social sector. Great efforts are being made to implement a countrywide public programme.

In this respect, safe drinking water supply and sanitation are considered as pre-requisites to health.

During the First and Second Four-Year Plans, Water Supply and Sanitation Works were carried out mainly by using very limited local resources.

Starting from the Third Four-Year Plan, substantially increased consideration was given to the activity and sizeable foreign assistance had been secured in this field. Equipment consisting of drilling rigs, pumps, engines, casings and pipes worth approximately thirty million U.S.Dollars was received as grant aid. A twenty million U.S.Dollars loan was obtained to cover the foreign exchange component of Rangoon Water Supply Project. Over two thousand villages were equipped with deep tube wells providing safe drinking water.

Though achievement of the Third Four-Year Plan has been impressive, there is still a large part of the population unserved with drinking water and without adequate sanitation. It is proposed that approximately 13,500 major villages (from the total of 65,000 villages) be

included in the programme for the period of the Fourth and Fifth Four-Year Plans. By reaching this target, drinking water and sanitation would be provided to 50% of the country's population by 1990. This would mean an increase in coverage by 250% in comparison with the present situation.
In January 1980, the Research Policy Direction Board of the Government had formed a National Committee to deal with Water Resources and Utilization. After thoroughly considering the strategy for the IDWSSD Programme, the National Committee set up a Technical Committee for IDWSSD to formulate the details of the proposed strategy and draw up tactics for achieving the objective of IDWSSD.

A National Meeting on the strategy and detailed planning for IDWSSD was held in Rangoon in January 1982. The Technical Committee for IDWSSD prepared a country report which was submitted to the National Meeting. The report described several constraints in the implementation of the IDWSSD Programme, which are greatly hampered by the lack of drilling equipment, pumping units (including prime movers, combustion engines and electric motors), pipings (steel and plastic pipes and accessories, such as joints, elbows, tees, valves and taps) and cement.

According to studies carried out during from 1982 to 1984, to overcome these shortages and at the same time to reduce the requirement of foreign exchange by 50% (from the estimated U.S.$120 million to approximately U.S.$60 million) the establishment of the following units was proposed;

(1) Under the Ministry of No.1 Industry

(a) Four plastic appliances extrusion plants with a capacity of 5 tpd each, conveniently located in focal points of demand areas in order to reduce the transportation cost. (Estimated foreign exchange component is worth U.S.$2 million).

(b) A welded steel pipe plant with a capacity of 5 tpd of pipes of various sizes to be made from locally produced steel. (Estimated foreign exchange component is worth U.S.$5 million)

(c) Several mini-cement plants using appropriate technology based on paddy husk and lime-stones, of a combined capacity of more than 100 tpd, conveniently located in focal points of demand in order to reduce transportation cost. (Estimated foreign exchange component is worth U.S.$10 million)

(2) Under the Ministry of No.2 Industry

(a) A factory to produce various sizes and types of water pumps, air compressors, electric motors, petrol and diesel engines and water meters as well as necessary spare parts. (Estimated foreign component is worth U.S.$10 million)

In order to obtain the required capital, the national authorities concerned were obliged to submit to the financing sources the comprehensive technical and economic data on the identified projects. These are several national institutions in charge of investment preparation in the Government, and a number of investment projects based on their preparatory works have been implemented. However, the national consulting organizations still require further strengthening in the urgent and technically complex task to prepare feasibility studies for the production units in support of the IDWSSD Programme. For this reason, UNDP co-operation was requested by the Government under mutual understanding that the feasibility studies will be subcontracted to professional consulting firms, while the preparatory works will be carried out with UNDP assistance.

After several discussions between the responsible authorities of IPD and UNDP, the project document was finalized and signed in the month of May, 1984 by the Government and UNDP. A project director from IPD and four project managers from three different Industries Corporations were appointed and the Project Office was established under the control of the Ministry of No.1 Industry.

In November 1984, the data collecting mission on a mini-cement plant from CIC went to Lashio Township and the report was submitted in December 1984.

In February 1985, UNIDO Consultant, Dr. George R. Gouda visited Burma and prepared Terms of Reference for preparation of the feasibility study on several mini-cement plants based on the paddy husk and limestone. However, the Development Center for Ceramic and Clay Technology under CIC produced the rice husk ash cement in its laboratory and proved the disqualification of the said cement, due to its poor quality, to utilize in the IDWSSD Programme.

Accordingly the Tripartite Review Meeting among IPD, UNDP and UNIDO, which was held at the IPD office on November 20th 1985, recommended to delete the preparation of the feasibility study on the rice husk ash cement and to include two feasibility studies for portland mini-cement plants with capacities of 100-200 tpd each, one coal fired and one gas-fired.

The Government, therefore, has requested UNDP/UNIDO to examine the feasibility of installing a new 200 tpd cement plant at the Thayet cement plant. According to the Government request, UNIDO senior industrial Development Officer, Mr. Carl Rydeng finalized in March, 1987 the Terms of Reference for the preparation of the said feasibility study on a mini-cement plant at Thayet.

In October 1987, the contract was awarded by UNIDO to Onoda Engineering and Consulting Co., Ltd., Japan to prepare the said feasibility study on setting-up a gas-fired rotary kiln production line of 200 tpd at the existing Thayet cement plant. Onoda Engineering and Consulting Co., Ltd. despatched its field survey mission to the project area in Burma from October 12th to November 2nd 1987, to investigate the local conditions and to collect data and information necessary for the study.

The study in this report was carried out substantially based on the data and information collected during the field survey.

II.1.3 Project idea

The idea of this project is to set-up a mini-cement plant unit at the existing Thayet cement plant by installing a new 200 tpd gas-fired wet process rotary kiln by using as much as possible equipment of the old production line 1. The product is ordinary portland cement which can be available for construction of many of components of the IDWSSD Programme such as pump houses, small storage tanks, surface well lining, household septic tanks, drainage facilities, etc.

II.2 Project Parameters

II.2.1 Raw materials

Raw materials are limestone, marl, clay, iron ore, river sand and gypsum, all of which are available in Burma. The plant location is fixed to be Thayetmyo, Magwe Division and the quarry of limestone, marl and clay near the plant has the resources enough to cover the necessary quantities to be consumed at the rated plant output during more than 60 years, except iron ore and gypsum which are brought in the plant from Pakokku, Hsidaw and Minbu in Burma.

II.2.2 Fuel

Natural gas is available in Burma and according to the Terms of Reference, the fuel for the project is finally selected to be natural gas which is used at present in the Thayet plant.

II.2.3 Product

The final product is ordinary portland cement specified by British Standards 12-1958.

II.2.4 Plant capacity

The plant capacity is also decided to be 200 tpd that is reasonable from technical and economical points of view, taking into account the present market situation and the operation conditions of the existing plant equipment.

II.2.5 Plant location

The plant location is selected to be Thayetmyo, Magwe Division.

II.2.6 Market

The market demand for cement is quite high, but the present official exfactory price of cement is less than the actual production cost. One of the reasons is seemingly that extremely lower output against the rated plant capacity, due to shortage of spare parts for equipment, pushes up the production cost.

II.3 Economic, Financial and Social Policies

II.3.1 National development plan

The economic goals of the Burmese way to socialism are to raise the standard of living and to reduce inequalities in the distribution of income. The means by which these goals are to be accomplished entail the social development and the gradual transformation of ownership to the State Sector.

For this purpose, the Burma Socialist Programme Party has adopted a Twenty-Year Long Term Plan in which the guidelines were laid down to double the national standard of living by the end of the plan period (1974/75 - 1993/94) and to transfer Burma to an agro-industrialized country.

To attain these aims and objectives, the following policies have been put down:

(1) To set up production in agriculture, livestock and fishery, and forestry sectors for export purposes
(2) To establish industries for manufacturing consumer goods and substituting the imported items
(3) To produce minerals and to establish heavy industries
(4) To provide more employment opportunities for workers
(5) To train workers in many fields of industry

The following targets on the annual growth rate of Gross National Product (GNP) were set for the Five Four-Year Plans.

Table 2-1 Annual Average Growth Rate

(Unit: %)

	Proposed	Achieved
Second Four-Year Plan (1974/75 - 1977/78)	4	5.1
Third Four-Year Plan (1978/79 - 1981/82)	5	6.2
Fourth Four-Year Plan (1982/83 - 1985/86)	7	5.5
Fifth Four-Year Plan (1986/87 - 1989/90)	6	
Sixth Four-Year Plan (1990/91 - 1993/94)	7.6	
Average	5.9	

Source: Guideline of Twenty-Year Long Term Plan

II.3.2 Sectoral economic growth rate

The actual economic growth rate achieved by respective sectors during the Fourth Four-Year Plan period is shown in comparison with the predetermined targets as follows:

Table 2-2 Sectorial Economic Growth Rate

(Unit: %)

Sectors	Target	Achievement	Difference
- Production	7.4	5.7	-1.7
Agriculture	5.6	4.7	-0.9
Fishery & Livestock	8.1	6.4	-1.7
Forest	4.9	4.1	-0.8
Mining	13.6	12.7	-0.9
Industry	8.2	6.1	-2.1
Electricity	17.3	14.6	-2.7
Construction	5.4	5.4	0
- Services	5.8	5.8	0
- Trade	7.2	4.5	-2.7
- Gross Domestic Product	7.0	5.5	-1.5

Source: Fourth Four-Year Development Plan

As clearly shown in the above table, all sectors except services department could not achieve the targetted economic growth rate.

II.3.3 Targets for export, import, consumption and investment

Targetted values in the last year of the Fifth Four-Year Plan (1989/90) and average annual growth rates are as shown below:

Table 2-3 Targets for Import, Export, Investment

	Current price (million Kyat)	Average growth rate (%)
Value of exports	5,573	7.6
Value of imports	7,020	4.9
Value of consumption	61,270.9	5.0
Value of investment	10,448.9	1.4

Source: Fifth Four-Year Plan

II.3.4 Economic indices

Several economic indices which will be of importance for overall economic judgment of the project are outlined below:

Table 2-4 GDP and per capita income

Fiscal Year	GDP at price constant 1969/70 (million Kyats)	Index (1961/62)	Population (million)	Per Capita income	
				Kyat	Index (1961/62)
1961/62	7,798	100	22.7	345	100
1969/70	9,976	127	27.8	382	110
1972/73	11,538	135	28.9	363	105
1973/74	10,812	138	29.5	361	104
1974/75	11,101	142	29.8	364	105
1975/76	11,562	148	30.5	375	108
1976/77	12,265	157	31.1	388	112
1977/78	12,996	166	31.9	408	118
1978/79	13,843	177	32.6	432	125
1979/80	14,562	186	33.3	445	128
1980/81	15,718	201	34.8	468	125
1981/82	16,716	214	34.8	488	141
1982/83	17,905	299	35.6	516	149
1983/84					
1984/85					
1985/86					

Source: Report to Pyithu Hluttaw

Table 2-5 Balance of Payment

(Unit: million Kyats)

Fiscal Year	Receipt	Payment	Surplus (+) or Deficit (-)
1978/79	4,859	4,655	+204
1979/80	6,180	5,577	+603
1980/81	6,332	6,114	+218
1981/82	7,484	7,792	-308
1982/83	7,533	8,449	-916
1983/84			
1984/85			
1985/86			

Source: Report to Pyithu Hluttaw

Table 2-6 Balance of Trade

(Unit: million Kyats)

Fiscal Year	Exports	Imports	Surplus (+) or Deficit (-)
1978/79	1,853	3,224	-1,371
1979/80	2,696	4,310	-1,614
1980/81	3,225	4,635	-1,410
1981/82	3,453	5,611	-2,158
1982/83	3,036	6,314	-3,278
1983/84	3,420	5,197	-1,777
1984/85	3,195	5,041	-1,846
1985/86	2,654	4,802	-2,148
1986/87	2,925	4,513	-1,588

Source: Report to Pyithu Hluttaw

Table 2-7 Foreign Exchange Reserves

(Unit: million Kyats)

End of F.Y.	Gold	Foreign	Total
1978	67.2	802.4	869.6
1979	71.0	1,003.1	1,074.1
1980	74.8	1,601.7	1,676.5
1981	74.8	1,819.9	1,894.7
1982	74.8	1,511.7	1,586.5
1983	74.8	547.8	622.6
1984	74.8	799.3	874.1
1985	74.8	414.2	489.0
1986	74.8	355.5	430.3

Source: Report to Pyithu Hluttaw

Table 2-8 Consumer Price Index in Rangoon

Year	Annual Average	Yearly increasing rate (%)
1978	100 (base)	-
1979	106.08	6.08
1980	107.16	1.02
1981	107.46	0.28
1982	112.00	4.22
1983	118.29	5.62
1984	124.02	4.84
1985	132.47	6.81
1986	142.95	7.91
Average	-	4.60

Source: Report to Pyithu Hluttaw

More information on the economic development in Burma is shown in Appendix II "Implementation of four Four-Year Plans."

II.4 Project Promotor

II.4.1 Name and address of promotor

(1) Name
Ceramic Industries Corporation (CIC)

(2) Ministry
Ministry of No.1 Industry

(3) Address
No.192, Kaba Aye Pagoda Road, Rangoon, Burma, P.O. Box 338

(4) Cable
CERAMICS

(5) Telex
21500 and 21513 SETTMU BM

(6) Talephone
56073, 56074, 56077 and 56078

II.4.2 Duties and responsibilities of promotor

(1) Nos. of plants and projects under controlled
16 existing plants

(2) Duties and responsibilities

To fulfill the socialist economy by controlling the planning and manufacturing of the state-owned factories in the production of construction materials and consumer goods such as cement, bricks, asbestos cement sheets and pipes, porcelainware, marbles, tiles, glass hollow-wares, glazed and unglazed structural clay brocks, refractories and sheet glass.

II.4.3 Role of promotor in the project

The CIC will be the executing agency of the project, and the contract will be signed between the equipment supplier and the CIC.

The CIC will call for tender from foreign suppliers for supply of machinery, equipment, materials, supervisory service and test operation. The civil work and erection of machinery and equipment will be carried out by Construction Corporation (CC) in Burma. The project will be carried out and operated under responsibility of the CIC through coordination with the Industrial Planning Department (IPD) and other state agencies concerned.

After the plant will be commissioned, the management of the plant will be conducted under the CIC's supervision, inclusive of controlling sales quantities and unit price of cement.

There is no necessity in the project to provide any engineering services for construction assistance from foreign consulting firms, because the CIC has enough experience and knowledge concerning the wet rotary kiln process which is expected to adopt for the project.

II.4.4 Financial possibilities

It is intended to obtain a fund loan from financial institute(s) of any foreign country to finance the foreign currency covering machinery, equipment, materials and engineering for the plant, whereas the construction and inland transportation costs will be financed by the local currency by the Government.

II.5 Studies and Investigations already Performed

(1) Investigation on limestone quarry

(a) Title
Raw material supply for the cement mill Thayetmyo from the limestone quarry Htone Taung.

(b) Author
MINROH-Ingenieurgesellschaft fur die Gewinnung und Verwertung von mineralischen Rohstoffen mbH, West Germany, July 1985

(c) Conclusion
The limestone production capacity of the quarry can reach more than 410,000 T/Y with three-shift operation 5 days per week for limestone and marl, and two-shift operation 5 days per week for overburden, after completion of improvement of equipment and exploitation method.

The limestone reserves of the quarry exceeds the consumption for 58 years with a rehabilitated cement plant capacity (700-800 tpd).

(2) Feasibility study on Thayetmyo cement factory

(a) Title
Feasibility study on rehabilitation and extension, Thayetmyo cement factory

(b) Author
Ceramic Industries Corporation, June 1985

(c) Conclusion
The most economical alternative to rehabilitate and extend the Thayetmyo cement plant up to 1,200 tpd capacity is to build a new 1,200 tpd dry process kiln line with raw material mixing bed and clinker silos. The production of cement by this alternative plan is economically viable in comparison to the imported cement.
The following points should be especially covered in the project:
- decision on clay component to be used in final raw mix
- modification and completion of crusher equipment delivered to site
- study on exact needs for enlargement of ropeway capacity
- decision on use of required land for new kiln line
- decision on power supply
- preparation of a new plant layout
- elaboration of a detailed project schedule to minimize downtimes of the present production lines

(3) Terms of Reference for feasibility study on rice husk ash cement

(a) Title

Terms of Reference for feasibility study for several mini-cement plants in Burma

(b) Author

Mr. George R. Gouda (UNIDO Consultant) and Mr. Myint Swe (Senior Industrial Investment Project Officer), March 1985

(c) Conclusion

Kyaukse Township (Mandalay Div.), Pyinmana Township (Mandalay Div.), Ngape Township (Magwe Div.) and Pataung Township (Pegu Div.) have been preliminary selected to establish four mini-cement plants, based on the availability of the raw materials to produce rice husk ash cement, and utilization of limestone and rice husk ash. These sites are in rural areas to be developed, so the demand for cement is high. Suggested capacity of each plant is 10 tpd.

Final selection of site locations and plant capacity is left to the consulting firm and the smallest size available for vertical shaft kiln. Building any cement plant in Burma is adding a great benefit to the national economy due to the high demand and low production efficiency of the existing plants.

The study report was prepared based on the method to mix the buried lime and rice husk ash, which seems most economical among three different process.

Note: After this study report was prepared, it was proven by the laboratory test that rice husk ash cement is inadequate in quality for the use of IDWSSD Programme. Therefore, the recommendation to delete further study on rice husk ash cement was finally accepted by IPD.

(4) Studies on mini-cement plant

There is no studies on a mini-cement plant carried out in Burma except on the above mentioned rice husk ash cement.
The following is a list of the recently issued references available for the study on a mini-cement plant.

(a) New cement process-fluidized bed clinker burning process, reported on Japan Consulting Institute (JCI) news, September 1986

(b) Development of fluidized bed clinker burning process (in Japanese), reported by K. Sutoh at the conference of Japanese cement manufacturers, June 1987.

(c) The vertical shaft kiln, prepared by M.B.K. Warrier, Cement Industry, 1983

(d) Semen Kupang, a modern shaft kiln cement works in the island of Timor/Indonesia, prepared by E.G. Loesche and C. Frommelt, Zement-Kalk-Gips No.12, 1984

(e) Vertical shaft cement kiln (in Japanese), prepared by S. Mizutani, October 1987

The conclusions in the above-mentioned reports are outlined below.

(a) The fluidized bed clinker burning (FCB) process requires to establish the technology on countermeasures to coating troubles inside a shaft kiln and control method of particle size distribution of product which takes a role as fluidizing media, and to develop a cooler with high efficiency for producing high quality cement. For the purpose, a pilot plant with a capacity of 50 tpd was constructed and has been tested for about 18 months. The test results show that:

- Size distribution control of seed clinker is absolutely required for stable operation
- Feed amount control of seed clinker is also severely required.
- Automatic control equipment is also necessary to operate the plant stable.
- Quality of cement produced by the plant is quite good same as ones by a rotary kiln.
- There are several problems, especially coating trouble inside a cooler, to be improved for continuous stable operation of the plant with a practical production capacity.

For these reasons, no full-scale plant using FCB process has been yet constructed.

(b) There are about 3,560 cement kilns of vertical shaft type in the world at present. Quality of cement produced by a vertical shaft kiln is commonly inferior to that produced by a rotary kiln, and cement by shaft kiln can be generally said to be not available to building construction. One of the reasons of inferior quality of the produced cement by a shaft kiln is that some parts of clinker have a high level free lime due to the operation to avoid overburning of clinker which causes coating troubles inside a shaft kiln. Of course, a vertical shaft kiln has the following advantages over a rotary kiln.

- Less cost
- Less space requirement
- Less power consumption
- Higher specific output per unit of volume
- Longer brick life
- More flexible operation
- More suitable for capacities less than 200 tpd

Being simpler, lighter and occupying less space, the vertical shaft kiln is ideal for mini-cement plants.

However, it is also required to develop the clinker burning system which can solve both troubles of overburning and high free-lime. From practical and technical points of view, production of cement employing a vertical shaft kiln seems to be unsuited for the time being for a mini-cement plant for the IDWSSD programme.

CHAPTER III MARKET AND PLANT CAPACITY

III.1 Present Situation of Cement Industry

III.1.1 Location and outline of the cement plants

Presently there are three cement plants in Burma, namely, Thayetmyo plant, Kyangin plant and Pa-an plant. These cement plants are managed by Ceramic Industries Corporation (CIC) which is under the authority of the Ministry of No.1 Industry.
The location of each cement plant is shown in Fig. 5-1 (Map of Burma).

(1) Thayetmyo plant

Thayetmyo plant is located on the west bank of the Irrawaddy River, 355 km north of Rangoon, and has three production lines.

(a) No.1 kiln line

No.1 kiln line was established in 1935 by Burmese private cement company and nationalized in 1954. This line having the production capacity of 200 t/d in wet process was supplied by F.L. Smidth & Co. (Denmark).
The operation of this line started in 1937, however, was forced to stop its operation in November 1983 due to worn out and non-availability of necessary spare parts.

(b) No.2 kiln line

This line was constructed by D.I.A. Investment Export (German Democratic Republic) in 1962 and started its operation in August, 1962. The rated production capacity is 400 t/d in wet process.

(c) No.3 kiln line

This line was constructed in 1969 by Kawasaki Heavy Industries (Japan) and the rated capacity is 400 t/d in wet process.

(2) Kyangin plant

Because the cement production in Thayetmyo plant could not meet the national demand, in spite of the above extensions, the new cement plant (Kyangin plant) was established.
This plant has now four production lines.

(a) No.1 and No.2 kiln lines

These two production lines were established by Kawasaki Heavy Industries (Japan) in 1976. The total capacity is 800 t/d (400 t/d x 2) in wet process.

(b) No.3 and No.4 kiln lines

These two lines were also constructed by Kawasaki Heavy Industries (Japan), and put into operation in 1985. The total capacity is 800 t/d (400 t/d x 2) in wet process.

(3) Pa-an plant

Pa-an plant located on the west bank of Salween River was constructed by Five Cail Babcock (France) with a capacity of 800 t/d in dry process. Operation was commenced in June, 1986.

General description of each cement plant is made in Table 3-1 (Cement Plants in Burma).

Table 3-1 Cement Plants in Burma

Plant Name	Kiln No.	Capacity t/d	Capacity *2 t/year	Process	Start of Operation	Name of Supplier
Thayetmyo	*1 1	200	60,000	Wet	1937	F.L. Smidth & Co. (Denmark)
	2	400	120,000		1962	D.I.A. Invest Export (German Democratic Republic)
	3	400	120,000		1969	Kawasaki Heavy Industries (Japan)
	(Total)	(1,000)	(300,000)			
Kyangin	1	400	120,000	Wet	1976	Kawasaki Heavy Industries (Japan)
	2	400	120,000		1976	
	3	400	120,000		1985	
	4	400	120,000		1985	
	(Total)	(1,600)	(480,000)			
Pa-an	1	800	240,000	Dry (S.P)	1986	Five Cail Babcock (France)
Total		3,400	1,020,000			

Source: CIC

Note: 1) No.1 kiln of Thayetmyo plant stopped its operation in November 1983.

2) The annual capacity of the plant was calculated on the basis of 300 working days per year.

III.2 Demand and Supply of Cement

III.2.1 Present situation of cement production and consumption

There are now 3 cement plants of which respective nominal rated capacity is 240,000 t/y (Thayetmyo), 480,000 t/y (Kyangin) and 240,000 t/y (Pa-an), and the total production capacity reached to 960,000 t/y in 1986.

(1) Production/Import/Export/Consumption of Cement

Table 3-2 and Fig. 3-1 shows respectively actual results of production, import, export and local consumption of cement for the last 27 years.

According to the Table 3-2, shortage of cement was covered by import till 1963, however the import of cement has stopped after the completion of No.2 kiln line (120,000 t/y) of Thayetmyo plant in 1962.

During F.Y. 1976/77 to 1983/84 and in F.Y.1986/87, some portion of cement was exported to earn the foreign exchange for procuring spare parts for the existing cement plants.

From F.Y. 1985/86, the cement production increased rapidly due to the completion of Kyangin extension project in 1985 and the completion of Pa-an plant in 1986.

Table 3-2 Cement Production and Cement Consumption

Fiscal Year	Production (tons)	Import (tons)	Export (tons)	Consumption (tons)	Yearly growth rate (%)
1960-61	40,500	99,000		139,500	-
61-62	32,800	128,000		160,800	15.3
62-63	120,100	38,000		158,100	(-) 1.7
63-64	115,800			115,800	(-) 26.8
64-65	137,800			137,800	19.0
65-66	141,000			141,000	2.3
66-67	145,700			145,700	3.3
67-68	158,200			158,200	8.6
68-69	180,000			180,000	13.8
69-70	164,200			164,200	(-) 8.8
1970-71	171,900			171,900	4.7
71-72	172,400			172,400	0.3
72-73	220,100			220,100	27.6
73-74	50,060			*1 50,060	-
74-75	202,040			202,040	(-) 8.2
75-76	197,760			197,760	(-) 2.1
76-77	255,320		50,320	205,000	3.7
77-78	272,980		97,650	175,330	(-) 14.5
78-79	274,039		109,702	164,337	(-) 6.3
79-80	387,824		122,060	265,764	61.7
1980-81	376,892		71,745	305,147	14.8
81-82	308,663		100,272	208,391	(-) 31.7
82-83	335,363		41,590	293,773	41.0
83-84	323,890		39,974	283,916	(-) 3.4
84-85	299,374			299,374	5.4
85-86	434,591			434,591	45.2
86-87	451,522		46,140	405,382	(-) 6.7

Source: CIC

Note 1) Production in fiscal year 1973/74 shows 6 months results due to change of fiscal year.

Fig. 3-1 Cement Production in Burma

(2) Production performance of cement plants

Production performance of each cement plant for the last 10 years is summarized in Table 3-3. According to the table, the maximum productivity is expected about 70% of the rated production capacity under the current conditions.

Table 3-3 Cement Production Performance

(Unit: t/y)

Fiscal Year	Thayet		Kyangin		Pa-an		Total		Productivity
	Cap.	Prod.	Cap.	Prod.	Cap.	Prod.	Cap. (A)	Prod. (B)	(B)/(A) (%)
1977-78	300,000	135,706	240,000	137,274			540,000	272,980	50.6
78-79	300,000	102,061	240,000	171,978			540,000	274,039	50.7
79-80	300,000	195,855	240,000	191,969			540,000	387,824	71.8
80-81	300,000	205,115	240,000	171,777			540,000	376,892	69.8
81-82	300,000	146,865	240,000	161,798			540,000	308,663	57.2
82-83	300,000	180,108	240,000	155,255			540,000	335,363	62.1
83-84	*1 240,000	182,205	240,000	141,685			480,000	323,890	67.5
84-85	240,000	180,120	240,000	119,254			480,000	299,374	62.4
85-86	240,000	147,483	*2 480,000	287,108			720,000	434,591	60.4
86-87	240,000	113,895	480,000	286,395	*3 240,000	51,232	960,000	451,522	47.0

Source: CIC

Note 1) No.1 kiln (200 t/d) stopped its operation in November 1983.

2) Kyangin extension (400 t/d x 2) completed in September 1985.

3) Pa-an kiln (800 t/d) completed in June 1986.

(3) Cement demand and supply position

As a governmental procedure, all the cement produced is alloted through CIC to the respective ministries in accordance with their requirements. (The cement to be consumed by private sectors is alloted to the Ministry of Trade.)

Table 3-4 shows the total cement demand required by various ministries and supply position for the last 20 years.
According to Table 3-4, the cement supply was far below the total requirements (except F.Y. 1967/68).

The detail of minsitry-wise cement demand and supply for the last 9 years is shown in Table 3-5.

Table 3-4 Cement Demand From Various Department

(Unit: thousand tons)

	Demand from various Department	Supply from the Local Cement Plants	Deficit (-)/ Surplus (+)
1965-66	175	141	(-) 34
1966-67	191	146	(-) 45
1967-68	152	158	(+) 6
1968-69	202	180	(-) 22
1969-70	221	164	(-) 57
1970-71	245	172	(-) 73
1871-72	307	172	(-) 135
1972-73	340	220	(-) 120
1973-74	377	*1 50	(-) 327
1974-75	416	202	(-) 214
1975-76	459	198	(-) 261
1976-77	505	205	(-) 300
1977-78	230	175	(-) 55
1978-79	239	164	(-) 75
1979-80	320	266	(-) 54
1980-81	384	305	(-) 79
1981-82	409	208	(-) 201
1982-83	593	294	(-) 299
1983-84	786	284	(-) 502
1984-85	815	299	(-) 516
1985-86	949	435	(-) 514

Source: CIC

Note 1) Production in F.Y. 1973/74 shows 6 months results due to change of fiscal year.

Table 3-5 Ministry-wise Cement Demand and Supply (1/2)

(Unit: ton)

Sr. No.	Name of Ministries	1977-78		1978-79		1979-80		1980-81		1981-82	
		Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply
1	Ministry of Construction	80,000	49,892	88,000	53,161	95,000	74,116	92,947	67,861	95,300	56,926
2	Ministry of Trade	70,000	51,135	70,000	17,317	50,000	37,852	88,735	45,084	54,902	23,571
3	Ministry of Defence	22,900	10,994	22,100	12,460	21,900	31,732	22,500	29,223	16,000	17,182
4	Minsitry of Agriculture and Forest	16,705	11,354	13,486	15,177	54,302	28,880	64,488	39,372	99,505	27,085
5	Ministry of Transport and Communication	7,850	1,452	4,696	3,431	5,202	4,663	5,976	4,426	5,510	2,991
6	Ministry of No.1 Industry	9,693	10,566	12,802	8,692	20,777	15,967	23,322	24,533	26,665	19,400
7	Ministry of No.2 Industry	13,200	13,283	21,260	20,430	57,970	38,931	70,870	53,222	77,780	37,347
8	Ministry of Mines	1,331	388	1,393	454	2,115	1,553	2,801	3,037	4,358	2,214
9	Ministry of Homs & Religious Affairs	8,762	6,727	6,188	1,867	12,661	2,994	12,855	14,327	26,968	8,911
10	Ministry of Education	-	-	-	-	-	-	-	2,794	-	4,256
11	Minsitry of Co-Operatives	-	9,396	-	711	80	987	-	1,770	1,200	626
12	Ministry of Information	-	-	-	-	-	-	43	72	37	34
13	Ministry of Culture	-	-	-	-	-	-	-	40	-	14
14	Ministry of Planning and Finance	-	-	-	-	-	-	-	-	-	-
15	Ministry of Social Welfare	-	-	-	-	-	-	-	-	10	3
16	Ministry of Labour	-	-	-	-	-	-	-	-	-	-
17	Ministry of Health	-	-	-	-	-	-	75	427	486	972
18	Welfare and Development	-	10,188	-	30,632	-	28,085	-	18,958	-	4,809
	Total	230,441	175,375	239,925	164,332	320,007	265,760	384,612	305,146	408,721	206,341

Source: CIC

Table 3-5 Ministry-wise Cement Demand and Supply (2/2)

(Unit: ton)

Sr. No.	Name of Ministries	1982-83		1983-84		1984-85		1985-86	
		Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply
1	Ministry of Construction	147,900	109,159	190,000	117,584	159,000	86,159	145,386	121,242
2	Ministry of Trade	63,862	15,278	131,958	6,734	139,728	9,710	163,028	27,713
3	Ministry of Defence	29,650	27,234	30,580	23,284	30,830	21,846	30,197	25,178
4	Ministry of Agriculture and Forest	79,901	41,901	82,806	36,815	64,905	36,177	63,950	57,233
5	Ministry of Transport and Communication	6,160	3,671	8,555	2,351	13,485	3,102	11,314	4,782
6	Ministry of No.1 Industry	29,654	9,672	21,916	6,416	34,132	9,472	59,737	20,995
7	Ministry of No.2 Industry	82,771	51,091	96,609	50,426	87,985	40,155	49,040	32,740
8	Ministry of Mines	7,110	3,229	6,154	2,296	6,225	4,245	5,241	3,478
9	Ministry of State & Religious Affairs	34,747	8,505	33,567	3,331	40,440	3,367	25,486	4,020
10	Ministry of Education	74,261	2,454	67,861	5,951	80,380	3,668	18,673	2,887
11	Minsitry of Co-Operatives	16,224	2,803	17,350	1,658	42,500	2,135	44,049	7,067
12	Ministry of Information	1,010	125	1,272	96	831	40	319	71
13	Ministry of Culture	69	41	99	25	151	12	112	51
14	Ministry of Planning and Finance	4,215	1,901	4,612	354	1,770	187	1,585	240
15	Ministry of Social Welfare	92	18	36	24	40	10	26	21
16	Ministry of Labour	140	43	45	20	91	-	152	25
17	Ministry of Health	3,159	1,106	3,106	383	8,245	779	181,584	2,275
18	Ministry of Livestock and Fisheries	-	-	8,295	4,396	11,724	2,735	10,206	5,142
19	Ministry of Energy	-	-	-	-	-	-	27,566	19,560
20	Others	64,770	42,691	80,283	61,746	92,805	75,575	111,035	99,871
	Total	645,695	320,922	785,104	323,890	815,267	299,374	948,686	434,591

Source: CIC

III.2.2 Future forecast of cement demand and supply

(1) Future forecast of cement demand

As explained in Chapter III.2.1 (3), the cement production and supply is controlled by CIC. According to the data from CIC, the cement demand by respective ministry and the potential demand are summarized in Table 3-6 of which details are shown in Table 3.7.

Table 3-6 Demand Forecast

(Unit: t/y)

Fiscal Year	Demand Forecast by Ministry	Potential Demand Forecast	Total Estimated Demand
1987-88	788,456	118,268	906,724
1988-89	828,106	124,215	952,321
1989-90	832,706	124,905	957,611
1990-91	847,376	127,106	974,482

Source: CIC

Considering many planned projects described below and extremely high selling price in the unofficial market etc., CIC considers approximately 15% of demand forecasted by ministries as potential demand.

Proposed major development projects and large construction sites are as follows:

(a) Kinda dam project (Upper Burma)
(b) Rangoon airport extension project
(c) Rangoon Mandalay highway construction project

(d) Dockyard project (Thilawa)
(e) Container yard construction at Rangoon Jetty
(f) Prome-Rangoon highway project
(g) Bassein-Manywa highway project
(h) Sedawggi dam project (Mandalay Div.)
(i) Nawin dam project (Near Prome)
(j) Irrawaddy river crossing bridge project
(k) Industrial training center (Upper Burma)

Table 3-7 Forecast of Ministry-wise Cement Demand

(Unit: ton)

No.	Name of Ministries	1986-87	1987-88	1988-89	1989-90	1990-91
1	Ministry of Defence	29,200	29,200	29,200	29,200	29,200
2	Ministry of Construction	130,000	130,000	130,000	130,000	130,000
3	Minsitry of Agriculture and Forests	98,500	99,000	99,000	99,200	99,500
4	Ministry of No.2 Industry	53,984	50,400	77,130	69,630	76,000
5	Ministry of Power & Energy	27,560	27,560	27,560	27,560	27,560
6	Ministry of Transport and Communication	11,320	11,320	11,320	11,320	11,320
7	Ministry of No.1 Industry	88,595	52,800	88,595	88,595	88,595
8	Ministry of Livestock and Fisheries	11,570	11,570	11,570	11,570	11,570
9	Ministry of Mines	5,240	5,240	5,240	5,240	5,240
10	Ministry of State & Religious Affairs	26,000	26,000	26,000	26,000	26,000
11	Ministry of Education	18,670	18,670	18,670	18,670	18,670
12	Minsitry of Co-Operatives	48,000	51,200	55,020	57,020	60,020
13	Ministry of Trade	80,000	90,000	100,000	110,000	120,000
14	Ministry of Health	12,000	12,000	12,000	12,000	12,000
15	Ministry of Information	320	320	320	320	320
16	Ministry of Culture	120	120	120	120	120
17	Ministry of Planning & Finance	1,585	1,585	1,585	1,585	1,585
18	Ministry of Social Affairs	26	26	26	26	26
19	Ministry of Labour	150	150	150	150	150
20	Welfare, Development & Others	127,500	171,295	134,600	134,500	129,500
	Total	770,340	788,456	828,106	832,706	847,376
21	Potential Demand (15%)	115,551	118,268	124,215	124,905	127,106
	Grand Total	885,891	906,724	952,321	957,611	974,482

Source: CIC

(2) Future prospect of cement supply

Supply of cement from the existing 3 cement plants is forecasted as per Table 3-8 hereunder. From the table, short supply of cement is expected to be still continued even though Kyangin expansion project and the new plant in Pa-an have been completed.

Table 3-8 Forecast of Cement Demand and Supply

(Unit: ton)

Fiscal Year	Estimated Demand	Estimated Supply				Estimated Deficit(-)
		Thayet	Kyangin	Pa-an	Total	
1987-88	906,700	120,000	336,000	144,000	600,000	(-) 306,700
1988-89	952,300	120,000	336,000	168,000	624,000	(-) 328,300
1989-90	957,600	120,000	336,000	168,000	624,000	(-) 333,600
1990-91	974,500	120,000	336,000	168,000	624,000	(-) 350,500

Source: CIC

Production rate is estimated as follows:

Thayet : 400 t/d x 2 lines x 300 d/y x 50% = 120,000 t/y
Kyangin : 400 t/d x 4 lines x 300 d/y x 70% = 336,000 t/y
Pa-an : 800 t/d x 1 line x 300 d/y x 60% = 144,000 t/y (1987/88)
: 800 t/d x 1 line x 300 d/y x 70% = 168,000 t/y (1988 -)

(3) Growth of volume of construction works

According to Table 3-5 (Ministry-wise Cement Demand and Supply), the major quantity of cement being consumed by the Ministry of Construction is sharing about 30% of the total production of cement in Burma.

Table 3-9 shows the trend of volume of construction works for the last 6 years.

According to the table, the volume of construction works of each sector is 88.1% for the state sector, 11% for the private sector and 0.9% for the cooperation sector respectively in case of F.Y. 1985/86.

The average rate of growth is assumed approximately 8.4% per year from the actual growth rate for the last 6 years.

Table 3-9 Volume of Construction Works

(Unit: thousand kyats)

Particulars	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86
(A) State Sector	(17,739)	(19,190)	(23,901)	(25,127)	(27,396)	(27,640)
1) Construction Works	(15,531)	(16,635)	(21,303)	(22,194)	(24,134)	(23,916)
- Road and bridge	1,492	1,472	2,140	2,072	2,203	2,304
- Industrial building	8,747	9,539	12,011	13,781	14,221	13,446
- Irrigation	2,556	3,133	3,503	3,148	3,407	3,376
- Electrical power transmission	563	669	755	798	1,235	1,272
- Railtruck, jetty	540	559	587	571	530	1,033
- Mine development	210	144	101	118	159	78
- Others	1,423	1,119	2,206	1,706	2,379	2,407
2) Renovation	(2,208)	(2,555)	(2,598)	(2,933)	(3,262)	(3,724)
- Road, bridge	1,634	1,967	2,065	2,352	2,442	2,541
- Building, others	574	588	533	581	820	1,183
(B) Co-operative Sector	90	125	222	278	350	294
(C) Private Sector	3,160	3,162	3,171	3,180	3,213	3,438
Total	20,989	22,477	27,294	28,585	30,959	31,372

Source: Report to the Pyithu Hluttaw 1986/87

From Table 3-2 (Cement Production and Cement Consumption), Table 3-4 (Cement Demand from Various Department) and Table 3-9 (Volume of Construction Works), respective progress rate for the last 6 years is assumed as follows;

(a) growth rate of cement production
: approx. 7.9% per year

(b) growth rate of volume of construction works
: approx. 8.4% per year

(c) growth rate of demand from various department
: approx. 20% per year

If annual growth rate of 8% is applied for computation of future demand, the future cement demand and supply is assumed as shown in Table 3-10.

As clearly shown in the table, the gap between future demand and supply of cement is expected to be continued.

Furthermore, judging from the Table 3-11 showing cement consumption per capita in Asian countries, the cement consumption per capita in Burma is very low when compared to the other Asian countries.

Table 3-10 Calculated Results of Cement Demand and Supply

Fiscal Year	Forecast of Cement Demand with annual growth rate of 8%	Production Forecast				Surplus (+)/ Deficit (-)
		Thayet	Kyangin	Pa-an	Total	
1986-87	451,500	114,000	287,000	50,500	451,500	
87-88	487,600	120,000	336,000	144,000	600,000	(+) 112,400
88-89	526,700	120,000	336,000	168,000	624,000	(+) 97,400
89-90	568,800	120,000	336,000	168,000	624,000	(+) 55,200
90-91	614,300	120,000	336,000	168,000	624,000	(+) 9,700
91-92	663,400	120,000	336,000	168,000	624,000	(-) 39,400
92-93	716,500	120,000	336,000	168,000	624,000	(-) 92,500
93-94	773,800	120,000	336,000	168,000	624,000	(-) 149,800
94-95	835,700	120,000	336,000	168,000	624,000	(-) 211,700
95-96	902,600	120,000	336,000	168,000	624,000	(-) 278,600
96-97	974,800	120,000	336,000	168,000	624,000	(-) 350,800
97-98	1,052,700	120,000	336,000	168,000	624,000	(-) 428,700
98-99	1,137,000	120,000	336,000	168,000	624,000	(-) 513,000
99-2000	1,227,900	120,000	336,000	168,000	624,000	(-) 603,900
2000-01	1,326,100	120,000	336,000	168,000	624,000	(-) 702,100
01-02	1,432,200	120,000	336,000	168,000	624,000	(-) 808,200
02-03	1,546,800	120,000	336,000	168,000	624,000	(-) 922,800
03-04	1,670,600	120,000	336,000	168,000	624,000	(-) 1,046,600
04-05	1,804,200	120,000	336,000	168,000	624,000	(-) 1,180,200

Note: This forecast is based on the case without new installation of 200 t/d plant at Thayet.

Table 3-11 Per Capita Cement Consumption in Asian Countries

(Unit: kg)

	1963	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Thailand	30	33	39	49	60	66	68	73	72	74	77	74	79	90	107	116	137	136	133	130	144	161
Indonesia	5	6	7	5	5	6	8	10	12	13	17	20	21	21	22	26	27	36	44	49	54	52
Malaysia	94	98	92	74	62	70	65	66	103	117	130	141	159	151	160	180	203	227	237	316	302	336
Singapore				203	370	451	366	372	426	504	514	541	549	646	557	544	582	587	682	915	1,352	1,374
Philippines	40	44	50	52	67	75	70	66	67	73	71	66	83	81	73	73	77	80	72	75	85	64
Hong Kong	283	328	350	285	167	163	190	221	321	289	289	301	272	357	445	512	473	643	650	918	604	563
Taiwan	115	120	142	149	180	231	252	252	279	313	354	391	405	496	523	591	662	752	684	590	584	561
Korea	40	42	52	65	93	111	138	169	190	174	215	229	243	250	305	403	424	345	321	313	442	456
Japan	290	319	313	361	401	447	477	528	544	616	715	639	547	572	608	689	705	704	659	584	591	587
Nepal	4.2	4.4	7.9	8.7	3.4	6.1	6.6	8.7	7.6	7.8	8.9	12.9	17.1	12.1	-	8	9	10	10	13	13	12
India	20	20	22	22	22	22	25	26	27	28	26	24	26	29	29	32	30	30	33	31	39	39
Bangladesh							(9)	2	2	2	3	4	4	4	(5)	5	8	10	10	11	12	14
Pakistan	19	26	19	19	19	24	24	44	40	39	53	59	47	43	44	55	52	55	49	57	59	60
Sri Lanka	26	24	25	29	25	34	34	31	32	31	35	34	26	27	28	40	45	65	57	54	47	43
Afghanistan	6	9	11	11	8	5	4	6	5	4	5	4	4	7	15	15	26				18	19
Burma	8	7	5	6	7	7	7	6	6	7	7	5	6	7	7	7	11	8	7	6	8	8
Laos				15	18	17	14	16	21	14	9	9	10			17	17					
Cambodia				33	42	26	24	18	5													
Viet Nam	27	26	34	90	75	79	69	49	63	49	42	2[illegible]	22			20	23	26	.	11	13	15
China	12	15	22	24	26	29	34	39	47	53	49	44	54	64	68	73	78	80	80	107	105	117
Brunei	120	186	208	337	375	420	474	450	465	484	397	545	798	644	726	490	310	458	458		848	723
Macao	31	85	100	122	56	46	63	70	114	147	240	155	100	113	175	182	315	341	480		563	447

Source: CEMBUREAU

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III.3 Marketing of Cement

III.3.1 Price of cement

The retail and the ex-factory selling prices of cement are determined and controlled by the government. The present selling prices which are controlled by CIC are listed in Table 3-12.

Table 3-12 Selling Prices of Cement

(Unit: kyat/ton)

Depot	Ex-Factory	On-Barge	On-Truck	Ex-Warehouse
Rangoon	336.60	475.00	488.00	509.00
Mandalay	336.60	484.00	497.00	516.00
Myede	336.60		413.00	458.30

Note 1) Above prices are official selling price while un-official prices are assumed approximately five times of the official selling prices.

2) Ex-factory price was raised in 1982 from 278.75 ks/ton to 336.60 ks/ton.

3) Selling prices are gross of 25 percent of goods and services taxes. (67.32 kyat/ton)

4) Most of the cement in Thayet are sold on the basis of ex-warehouse sales.

III.3.2 Cement distribution

From the Thayet plant, the produced cement is transported in 50 kg-bags by barges to depots in Myede, Mandalay and Rangoon. From there the cement is distributed to other cities.
Local waterways being used to distribute the cement from Thayet plant are under the control of the IWTC (Inland Water Transport Corporation).

Table 3-13 shows the yearly distribution of cement from Thayet plant to three depots for the last four years.

Table 3-13 Yearly Distribution of Cement (Thayet)

(Unit: ton)

Depot \ Fiscal Year		1983-84	1984-85	1985-86	1986-87
Rangoon		60,733	66,841	38,276	9,700
	%	33	37	26	9
Mandalay		56,656	56,399	63,089	53,860
	%	31	32	43	47
Myede		66,720	54,411	44,865	50,329
	%	36	31	31	44
Total		184,109	177,651	146,230	113,889
	%	100	100	100	100

Source: Data from Thayet plant

According to the above table, the cement from Thayet plant has been transported to three depots at almost equal ratio till F.Y. 1985/86.
However, yearly distribution to Rangoon depot was suddenly decreased in F.Y. 1985/86 due to the completion of Kyangin Extension Project in 1985 and start of operation of Pa-an plant in 1986.

Considering the change in these distribution situations of bagged cement, the distribution ratio in F.Y. 1986/87, namely approximately 10% for Rengoon, 50% for Mandalay and 40% for Myede is expected to continue in future.

The Construction and Electrical Stores Trade Corporation (CESTEC) transports the cement from CIC's depots to the private customers and also to some governmental departments.

CESTEC has their own stores, and sets up the retail selling price.

Table 3-14 shows an example of retail selling price in Mandalay, Magwe and Sagaing Division.

Table 3-14 Retail Selling Price

Cities		Retail Selling Price
Mandalay City	(Mandalay Div.)	636.00 (Kyat/t)
Magwe City	(Magwe Div.)	636.00
Chauk City	(Magwe Div.)	636.00
Pakokku City	(Magwe Div.)	636.00
Monywa City	(Sagaing Div.)	698.00

Source: UNIDO, Rangoon

On the other hand, according to the financial statements from CIC, the average selling and distribution costs in F.Y. 1984/85 and F.Y. 1985/86 are 43.05 kyat/ton and 43.6 kyat/ton respectively.
From Table 3-13, distribution to Myede (very near from the Thayet plant) is expected to increase, resulting in decrease of the average selling and distribution cost. However, 44 kyat/ton of the average selling and distribution cost seems still a good estimate for calculation of profitability for this study, because of a possibie

future escalation in the average selling and distribution cost.

III.4 Production Programme and Sales Forecast

For study of production programme and sales forecast for the new production line, the following have been taken into consideration.

Construction period: 2 years
Start of operation : 1991

III.4.1 Production programme

Taking into account the production technology to be adopted in the project and the present skill of employees, the production programme is assumed as follows:

Table 3-15 Production Programme

Year	1	2	3-15
Production rate (%)	80	90	100
Operation days a year	300	300	300
Normal capacity (tpd)	200	200	200
Output per year (tpy)	48,000	54,000	60,000

III.4.2 Sales forecast

(1) Selling price

As explained in Chapter III.3 (Marketing of Cement), the selling price of cement is regulated by the government on a depotwise basis.

Therefore, taking into consideration the actual results in F.Y. 1986/87, the distribution ratio to different depots and the selling prices of bagged cement have been assumed as follows:

Table 3-16 Selling Price

Depot	Distribution rate (%)	Selling Price (Kyat/t)
Rangoon	10	509.00
Mandalay	50	516.00
Myede	40	458.30
Weighted average	-	492.22

(2) Sales revenue

Considering the production programme shown in Table 3-15 and the selling price in Table 3-16, sales revenue is calculated as follows;

Table 3-17 Sales Revenue

Year	1	2	3-15
Sales volume (tpy)	48,000	54,000	60,000
Unit selling price (K/t)	492.22	492.22	492.22
Sales revenue (10^3Ks)	23,626	26,580	29,533

III.5 Plant Capacity

III.5.1 Determination of nominal plant capacity

In general, a normal plant capacity of a cement plant should be determined considering various factors of reserves of raw materials, infrastructure, manufacturing process, construction cost, production cost, market penetration of the output and so on.
The nominal plant capacity of this project, however, has been already determined to be 200 tpd through several investigations and studies carried out by IPD.

This nominal plant capacity is considered to be reasonable for the following reasons.

(1) Market demand of cement extremely exceeds the amount of supply, and the whole amount of cement produced by a new kiln can be expected to be sold easily.

(2) Since the Thayet plant is the northernmost cement plant in the country, the project to set-up a new kiln in the Thayet plant will contribute to solve the cement shortage problems prospected in the northern parts in future.

(3) Judging from the Consultant's proposed manufacturing process, a mini-cement plant with several hundred tonnes per day capacity is economical.

(4) In order to minimize the whole investment costs, it is most desirable to utilize as much as possible the existing equipment and facilities which capacity is 200 tpd.

(5) In case a new kiln capacity is set to be 200 tpd, the existing facilities for cement transportation are expected to be sufficient.

(6) In case of 200 tpd capacity, utilities supply equipment are also usable as they are.

(7) As discussed in Chapter VI, the wet process kiln is most desirable from technical and economical viewpoints, because the No.2 and No.3 kilns are of the same process, i.e. wet process.

The nominal plant capacity has been finally determined to be 200 tpd, considering the above mentioned conditions.

III.5.2 Determination of normal plant capacity

Cement kilns should be operated continuously as long as possible with least down-time in order to keep high plant productivity and less heat consumption. It is, however, impossible to continue the operation of a kiln continuously all the year round without scheduled and/or accidental down-time, mainly due to kiln brick maintenance and accident. Moreover, since there are various types of machinery and equipment in a cement plant, plant stoppage for maintenance of these machinery and equipment is required for the stable and effective operation of the plant.
Taking into account these plant conditions and downtime caused by supply cut of utilities, working days of a new kiln are set to be 300 days per year. A normal plant capacity together with the other main department is shown in below tables.

Table 3-18 Capacity of Kiln

Kiln	No.1	No.2	No.3	Total
Nominal capacity (t/y)	60,000	120,000	120,000	300,000
Normal capacity (t/y)	60,000	* 60,000	* 60,000	180,000
Working day (days/y)	300	300	300	-

Note 1) The reason why the figures are lower compared to the nominal capacity is that major machines of the line are suffered from troubles mainly caused by a lack of spare parts.

Table 3-19 Capacity of Major Equipment

Equipment	Nominal Capacity (t/h)	Normal Capacity (t/h)
Crusher	150	120
Ropeway	150	135
Raw mill	80	50
Kiln	41.7	25
Cement mill	61	43
Packer	150	130

Selection method and specifications of the major equipment are described in Chaper IV Materials and Inputs.

CHAPTER IV MATERIALS AND INPUTS

IV.1 Qualitative Specification and Supply of Raw Materials

IV.1.1 Limestone

Limestone quarry, named Htone Toung quarry, is located about 3.6 km to southwest of the plant site, as shown in Fig. 4-1.

The exploitable total reserves of the deposit have been estimated two times in the past by foreign consultants. According to these studies, the total reserves of limestone are about 11-15 million tonnes.

This means that the life of this quarry after completion of a mini-cement plant project is estimated to be about 50 years which can be said sufficient for this project. However, this quarry is suffering from a much-overburden problem which influences the quantity and quality control in the plant.

The quality control standard values for mining are specified as $CaCO_3$ content is more than 80% and MgO content is less than 4% respectively. Daily average chemical analysis data for 1985 of the received limestone in the plant storage hall are as shown in Table 4-1.

Judging from the results of the table, it can be said that even though there are two major problems, i.e. overburden and delivery during the rainy season, the quality variation is rather low and mining control has been carried out quite well. Therefore, the present limestone quality will be good for a mini-cement plant project.

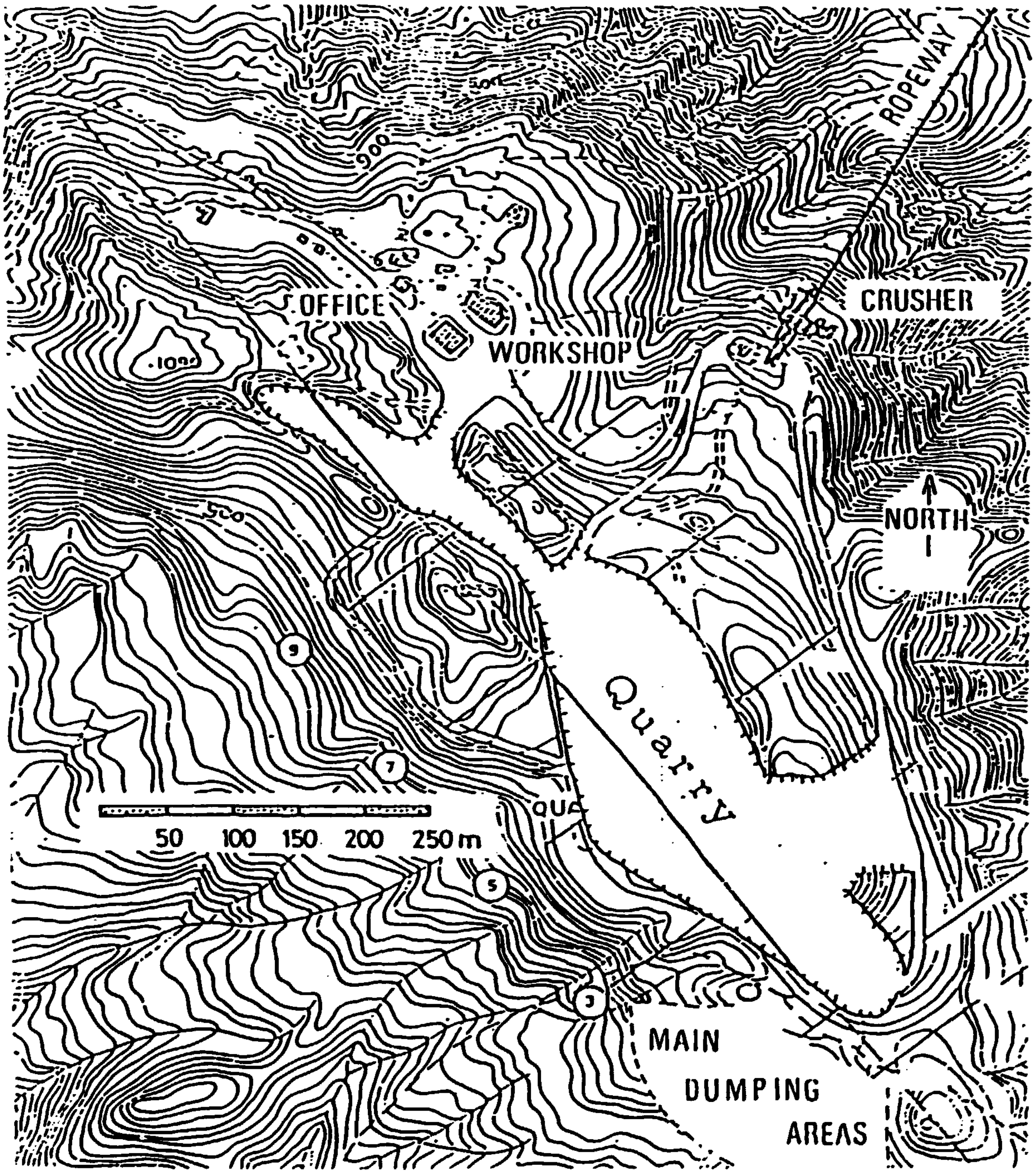


Fig. 4-1 Htone Toung limestone quarry

Table 4-1 Chemical Analysis of Limestone in 1985

(Unit: wt% on dry basis)

Month	L.O.I	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total	Moisture
Jan.	37.80	8.02	3.30	1.22	47.90	1.28	0.20	99.32	1.55
Feb.	39.42	7.08	1.60	0.86	49.10	0.97	0.22	99.26	1.12
Mar.	39.22	7.03	1.57	0.74	49.82	0.77	0.24	99.49	0.79
Apr.	36.02	13.88	1.76	0.66	45.80	0.94	0.23	99.29	1.19
May	39.17	6.56	2.06	1.13	48.85	1.12	0.20	99.09	0.65
Jun.	40.92	3.62	1.42	0.54	52.30	0.75	0.20	99.76	2.39
Jul.	42.94	1.50	0.40	0.36	53.80	0.42	0.09	99.51	4.14
Aug.	40.24	5.96	1.34	1.10	50.20	0.59	0.18	99.61	4.64
Sep.	42.04	1.09	0.28	0.32	54.10	0.44	0.21	98.48	4.22
Oct.	41.85	1.88	0.86	0.22	53.00	0.64	0.31	98.76	2.32
Nov.	42.11	2.38	0.14	0.78	52.70	1.06	0.26	99.43	1.60
Dec.	39.96	4.70	1.04	0.58	51.60	0.71	0.24	98.83	1.03
Ave.	41.15	5.31	1.31	0.71	50.76	0.81	0.22	99.27	2.14
Max.	42.94	13.88	3.30	1.22	54.10	1.28	0.31	-	4.64
Min	36.02	1.09	0.40	0.22	45.80	0.42	0.09	-	0.65
σ	1.90	3.47	0.81	0.31	2.32	0.26	0.05	-	1.37

Source: CIC

IV.1.2 Marl

Marl is produced from the overburden zone overlaying the main limestone bed. It is not a well-defined rock type but consists of a mixture of the different rocks in variable proportions.
Daily average chemical analysis data for 1985 of the received marls are shown in Table 4-2.
According to the table, quality variation is rather high. In addition, the moisture content increases to about 8-9% in the rainy season.
In case of implementation of a mini-cement plant project, the latter will cause jamming troubles at the feed hopper and the inlet chute of the mill and their fluctuation of slurry quality which has to be well prevented.

IV.1.3 Clay

Clay is extracted from the deposit at the foot of the quarry hill along the ropeway some 1.5 km from the plant site.
This material is used only in case the slurry has an excessive $CaCO_3$-content which has to be reduced with as little material as possible.

IV.1.4 Siliceous material (river sand)

As siliceous material, river sand from the bank of Irrawaddy river, is scooped and used. Daily average chemical analysis data for 1985 of the siliceous material are shown in Table 4-3.
As shown in the table, the quality of the present river sand is rather fluctuates especially in SiO_2 content which is the main component.

Table 4-2 Chemical Analysis of Marl in 1985

(Unit: wt% on dry basis)

Month	L.O.I	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total	Moisture
Jan.	25.77	30.38	9.11	2.73	30.40	1.32	0.14	99.79	3.12
Feb.	21.88	34.86	11.35	3.29	26.80	1.52	0.14	99.84	3.20
Mar.	23.11	32.24	13.60	2.61	26.97	0.84	0.18	99.55	3.96
Apr.	21.97	33.00	11.04	4.00	27.80	1.27	0.38	99.46	2.10
May	20.38	36.84	10.49	5.87	24.30	1.51	0.53	99.92	2.21
Jun.	26.48	25.04	11.85	2.23	32.20	1.14	0.97	99.91	8.97
Jul.	23.10	34.27	10.94	3.64	25.80	1.17	0.42	99.34	9.22
Aug.	22.38	30.00	15.20	4.96	25.40	0.98	0.40	99.32	9.51
Sep.	25.50	18.18	8.42	2.86	41.70	2.01	0.46	99.13	8.26
Oct.	24.71	25.54	8.32	3.04	36.10	1.51	0.36	99.58	5.59
Nov.	24.24	36.20	8.36	2.58	25.60	2.00	0.32	99.80	3.75
Dec.	32.03	19.36	3.52	4.16	34.20	1.35	0.20	99.82	2.24
Ave.	24.30	29.65	10.29	3.50	30.19	1.39	0.38	99.63	5.18
Max.	32.03	36.84	15.20	5.87	41.70	2.01	0.97	-	9.51
Min	20.38	18.18	3.52	2.23	24.30	0.84	0.14	-	2.10
σ	2.91	6.03	2.83	1.04	5.09	0.34	0.22	-	2.85

Source: CIC

Table 4-3 Chemical Analysis of Siliceous Material in 1985
(River Sand)

(Unit: wt% on dry basis)

Month	L.O.I	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total	Moisture
Jan.	2.11	73.18	16.21	3.87	2.50	1.39	0.05	99.93	0.30
Feb.	6.00	64.61	19.31	5.71	1.80	2.20	0.15	99.77	0.38
Mar.	0.83	83.16	6.55	5.75	1.90	0.70	0.05	98.94	0.13
Apr.	1.51	82.11	6.60	5.85	2.20	0.90	0.20	99.37	0.20
May	1.89	77.56	12.39	4.65	2.40	0.80	0.08	99.73	0.10
Jun.	2.98	79.20	9.64	2.20	4.20	0.78	0.10	99.10	0.32
Jul.	3.00	73.84	13.88	3.72	4.50	0.85	0.12	99.91	0.35
Aug.	2.98	79.52	9.64	2.20	4.20	0.78	0.20	99.52	0.40
Sep.	3.23	78.84	7.94	3.30	4.10	1.16	0.39	98.96	0.52
Oct.	3.05	80.54	7.96	3.04	3.80	1.01	0.35	99.76	0.10
Nov.	2.69	71.76	14.31	5.25	3.20	1.42	0.36	98.99	0.86
Dec.	1.54	84.22	8.20	1.44	3.30	1.03	0.14	99.87	0.41
Ave.	2.65	77.43	11.05	3.91	3.18	1.09	0.18	99.50	0.34
Max.	6.00	84.22	19.31	5.85	4.50	2.20	0.39	-	0.86
Min	0.83	64.61	6.55	1.44	1.80	0.70	0.08	-	0.10
σ	1.25	5.34	3.94	1.47	0.94	0.40	0.12	-	0.19

Source: CIC

IV.1.5 Iron ore (Hematite)

Iron ore (Hematite) as ferrous material is purchased and brought by barge from a regional company, operating in Pakokku located about 250 km to south of the plant site as shown in Fig. 4-2.
The quality of the delivery iron ore is described in the plant operation standard document that specifies Fe_2O_3 content not less than 75%.
Daily average chemical analysis data of the actually received iron ore are shown in Table 4-4, which indicates high quality variation in Fe_2O_3 content.

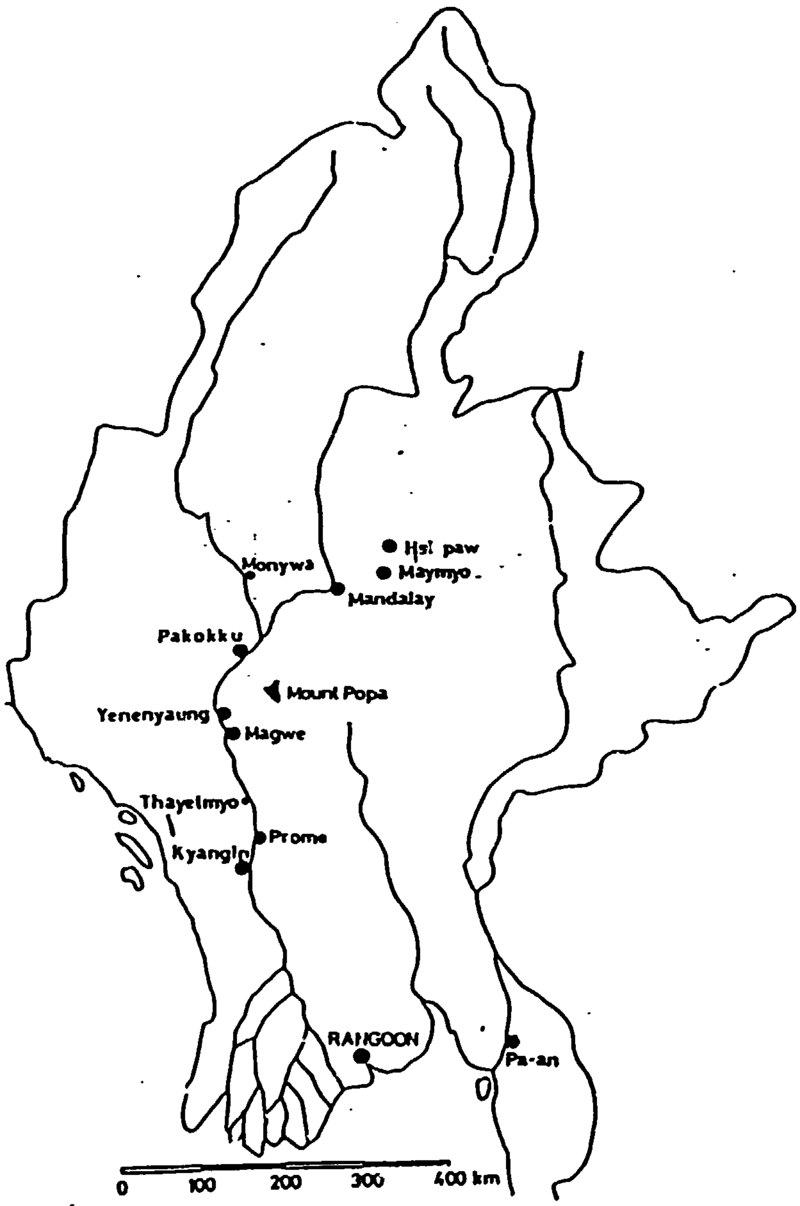


Fig. 4-2 Locality map of raw material occurrences

Table 4-4 Chemical Analysis of Ferrous Material in 1985
(Iron Ore)

(Unit: wt% on dry basis)

Month	L.O.I	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total	Moisture
Jan.	10.19	14.58	7.67	64.13	2.20	0.78	0.10	99.65	1.39
Feb.	12.56	24.64	17.00	41.20	2.00	1.88	0.20	99.48	1.07
Mar.	6.73	4.90	6.45	77.79	2.30	1.42	Nil	99.59	1.21
Apr.	8.00	18.00	10.50	60.74	1.80	0.68	0.10	99.86	1.09
May	8.24	38.64	12.97	36.43	1.40	0.78	0.14	99.60	1.62
Jun.	7.54	12.86	8.36	68.32	1.40	0.54	0.08	99.10	7.58
Jul.	5.71	4.46	1.00	84.00	1.00	0.56	0.04	96.77	6.81
Aug.	3.90	4.36	8.18	82.00	1.00	0.30	Nil	99.74	6.95
Sep.	10.16	4.74	7.08	75.76	1.20	0.80	Nil	99.74	7.00
Oct.	9.23	11.38	7.96	65.60	3.60	1.75	0.33	99.85	1.43
Nov.	7.52	6.09	5.24	78.08	1.90	0.46	0.16	99.95	1.44
Dec.	8.00	23.28	9.16	57.60	1.20	0.68	0.13	99.97	1.01
Ave.	8.15	13.99	8.46	65.97	1.75	0.89	0.11	99.32	3.22
Max.	12.56	38.64	17.00	84.00	3.60	1.88	-	-	7.58
Min	3.90	4.36	1.00	36.43	1.000	0.30	-	-	1.01
σ	2.15	10.19	3.77	14.59	0.71	0.49	-	-	2.75

Source: CIC

IV.1.6 Gypsum

Gypsum is provided to the plant by barge from two suppliers, one is the government supplier (No.3 Mining Corporation) located at Hsi Paw about 150 km northeast from Mandalay, another one is a regional company operating in Pakokku as shown in Fig. 4-2.
The property of Hsi Paw gypsum is massive, about 700 mm long, with black streaks, while Pakokku gypsum consists of thin slabs of fibrous gypsum.
The quality of the delivered gypsum is specified in the plant operation standard document, that is; $CaSO_4 \cdot 2H_2O$ content must not be less than 80%, whereas the actual quality data are shown in Table 4-5. These data indicate that the quality of the received gypsum in the plant fluctuates to a certain extent, and so it is recommended to be careful of quality variation at the cement mill feed system especially during the rainy season.

Table 4-5 Chemical Analysis of Gypsum in 1985

(Unit: wt% on dry basis)

Month	Combined water	Insol. + SiO_2	Al_2O_3	Fe_2O_3	CaO	SO_3	Total	Moisture
Jan.	21.66	7.46	2.78	0.82	30.80	36.09	99.61	1.39
Feb.	21.40	9.20	1.33	0.51	30.50	35.92	98.86	1.07
Mar.	21.32	6.55	1.02	0.34	30.60	39.04	98.87	0.41
Apr.	22.54	9.01	0.81	0.69	30.50	34.60	98.15	0.42
May	21.14	7.81	0.37	0.37	29.60	40.07	99.36	0.98
Jun.	22.70	11.24	0.55	0.81	29.80	34.30	99.40	5.70
Jul.	23.49	14.58	0.40	0.80	27.40	31.71	98.38	5.31
Aug.	19.13	10.77	0.40	0.58	25.30	43.19	99.37	4.71
Sep.	19.61	20.60	2.74	1.58	27.40	26.35	98.18	2.89
Oct.	21.96	9.90	0.85	0.67	31.30	34.21	98.89	1.44
Nov.	20.04	9.12	0.49	0.51	30.80	37.38	98.34	1.37
Dec.	22.20	14.48	0.20	0.36	21.30	40.03	98.57	1.04
Ave.	21.43	10.89	1.00	0.67	28.78	36.07	98.84	2.23

Source: CIC

IV.2 Qualitative Specification of Process Materials

IV.2.1 Slurry

There are three raw mills (No.1b, 2 and 3) in operation and the raw material feeding is carried out by two system, one is for limestone and another is for the mixed material of marl, sand and iron ore.
The slurry is sampled from the slurry basin and examined every two hours at the laboratory, then it is sent to six silos and two slurry basins according to the time schedule for homogenization of slurry, and is fed to each kiln by slurry pumps.
The target value and the control range of the quality of the final slurry for kiln feeding are set as follows.

. Water content	:	40±2%
. Fineness (Residue on 90μ)	:	10±2%
. $CaCO_3$ (titration)	:	76.0±0.2%
. Viscosity (FLS-rings)	:	6.0±2.0 cm
. Hydraulic modulus (HM)	:	2.05±0.05
. Silica modulus (SM)	:	2.4±0.2
. Iron modulus (IM)	:	1.8±0.4

For reference, chemical modulus are calculated by using the average chemical analysis results of the present slurry as follows:

Hydraulic modulus (HM)	:	2.13
Silica modulus (SM)	:	2.41
Iron modulus (IM)	:	2.04

As shown in Table 4-6, all actual data have been controlled within the target values, which proves that the quality of raw mix has been controlled quite well at present.

Table 4-6 Chemical Analysis of Slurry in 1985

(Unit: wt% on dry basis)

Month	L.O.I	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Total	Fineness (90μ)	Moisture (%)
Jan.	35.06	14.21	3.94	2.13	42.65	-	-	97.58	10.8	40.6
Feb.	34.97	14.76	3.86	1.78	42.66	-	-	98.03	10.9	41.2
Mar.	34.95	14.41	4.05	1.66	42.79	-	-	97.85	11.5	41.0
Apr.	34.84	14.31	4.07	2.03	42.68	-	-	97.92	10.7	41.0
May	35.11	14 68	4.19	1.69	42.84	1.15	0.35	99.99	10.6	41.0
Jun.	34.02	13.53	4.37	1.95	43.58	1.79	0.32	99.55	10.4	41.2
Jul.	34.17	13.21	4.35	2.02	43.73	1.58	0.24	99.29	10.2	41.4
Aug.	34.13	14.45	3.32	1.41	43.47	1.51	0.37	98.69	10.5	41.3
Sep.	34.41	14.74	3.42	1.91	42.90	-	-	98.39	10.6	40.4
Oct.	35.09	14.10	3.51	2.08	42.53	-	-	97.30	10.9	40.7
Nov.	34.80	14.48	4.07	2.30	42.63	-	-	98.27	10.6	40.8
Dec.	34.90	14.00	4.35	2.32	42.59	-	-	98.15	10.6	41.0
Ave.	34.71	14.24	3.96	1.94	42.92	-	-	97.76	10.7	41.0

Source: CIC

IV.2.2 Clinker

The quality of clinker is governed by the quality variation of the slurry and the burning condition inside the kiln. Clinker to be produced is specified as follows:

- . Litre weight : 1.25 - 1.35
- . Free CaO : less than 1.0%
- . Color of clinker : dark grey or black

The checking of clinker quality has been carried out every two hours for each kiln.
Monthly average figures of chemical analysis on clinker are as shown in Table 4-7, which show that the quality of clinker in the Thayet plant is approximately stable at present.

IV.2.3 Additive

As additive material, the kiln dust has been mixed by adding less than 1% in the cement mills.

At present, the kiln dust is disposed as waste material from chimney because of the problem of dust transportation equipment due to a lack of spare parts.

Table 4-7 Chemical Analysis of Clinker

	SiO_2 (%)		Al_2O_3 (%)		Fe_2O_3 (%)		CaO (%)		*2 HM		SM		IM		Free CaO (%)	
	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3	Kiln No.2	Kiln No.3
1982	21.93	21.75	6.17	6.19	3.32	3.42	65.20	65.16	2.08	2.08	2.31	2.26	1.86	1.81	-	0.07
1983	21.77	21.72	6.31	6.23	3.41	3.44	65.79	65.93	2.09	2.10	2.24	2.25	1.85	1.81	0.09	0.04
1984	22.12	22.08	*1 3.15	6.32	2.87	3.09	65.52	65.45	2.32	2.08	3.67	2.35	1.10	2.05	0.01	0.04
1985	21.87	21.84	5.77	5.79	3.18	3.10	65.57	65.39	2.13	2.13	2.44	2.46	1.81	1.87	0.09	0.05
1986	21.68	21.56	5.75	5.80	3.31	3.39	65.90	65.60	2.14	2.13	2.39	2.35	1.74	1.71	*3 0.59	*3 0.37
Average	21.87	21.79	5.43	6.07	3.22	3.29	65.60	65.51	-	-	-	-	-	-	-	-

Source: CIC

Note: *1 : The figure seems to be made by a clerical error.
*2 : HM is increasing year by year.
*3 : Measuring method in the laboratory seems to have changed since 1986.

IV.2.4 Cement

The standard values of the ordinary portland cement of the Thayet cement plant consist of two categories; i.e. the plant standard and the national standard based on the British Standard 12, 1958.
Each standard value and daily average figures of physical properties of cement of the plant are shown in Table 4-8 and Table 4-9 respectively.
According to the tables, it can be said as a whole that the cement quality has been controlled within the plant standard, however, the standard deviation of the daily average compressive strength (3 days and 7 days) indicates a high value. The high standard deviation is considered to be due to a high variation in Hydraulic Modulus (H.M) of the raw mixture.
In addition, the cement temperature at the cement mill outlet should be kept lower than 110°C in accordance with the plant standard to prevent the false set of packing cement. However, the actual cement temperature at the outlet of the No.3 cement mill comes high very often as mentioned in the attached assessment report of the existing plant. Accordingly the No.3 cement mill has to be operated intermittently with several hour's running and two hour's stopping for cooling of cement mill periodically. This fact clearly shows that the plant is very serious in keeping the quality and productivity of cement, so before starting a mini-cement plant project, it is recommended to improve efficiency of the dust collector through which increased cooling air can be introduced to the cement mill.

Table 4-8 Quality Standard of Cement (Ordinary Portland Cement)

(As of October, 1987)

	* National Standard		Plant Standard	
	Min	Max	Min	Max
Fineness				
. Blaine (cm^2/gr)	2,250		2,800	3,200
. Residue on 90μ (%)	–		8	12
Chemical composition				
. Lime saturation factor	0.66	1.02	0.90	0.95
. Hydraulic modulus (H.M)			2.00	2.10
. Siliceous modulus (S.M)			2.1	2.4
. Iron modulus (I.M)	0.66		1.8	2.1
. Insoluble residue (%)		1.5		1.5
. MgO (%)		4.0		4.0
. Sulfur trioxide (%)		3.0		2.5
. Loss of ignition				4
Compressive strength				
. 3 days (lb/in^2)	2,200		2,200	
. 7 days (lb/in^2)	3,400		3,400	
. 28 days (lb/in^2)	-		-	
Setting time				
. initial (min.)	45		45	
. final (min.)		600		600
Soundness				
. Expansion (mm)		10		5

Source: CIC

Note: National standard is equivalent to B.S 12. 1958

Table 4-9 Physical Properties of Cement
(As of 1985)

(Unit: wt% on dry basis)

Month	Specific Surface (cm^2/g)	Lechatelier Expansion (mm)	Vicat (min.)		Compressive Strength (lb/in^2)			Lime Saturation Factor	H.M	S.M
			Initial setting	Final setting	3 days	7 days	28 days			
Jan.	2,801	1	180	230	3,612	4,363	-	0.92	2.04	2.03
Feb.	2,801	0	170	230	3,757	4,624	-	0.94	2.13	2.10
Mar.	2,719	0	165	215	3,902	4,335	-	0.90	2.11	2.33
Apr.	2,774	2	160	210	3,466	4,478	-	0.92	2.14	2.45
May	2,801	1	160	210	3,035	4,046	-	0.87	2.00	2.26
Jun.	2,719	2	165	210	3,033	3,757	-	0.90	2.10	2.32
Jul.	2,902	0	160	210	3,612	4,335	-	0.91	2.09	2.17
Aug.	2,824	0.5	160	210	3,612	4,479	-	0.91	2.14	2.50
Sep.	2,801	0.5	160	210	3,179	4,191	-	0.92	2.08	2.39
Oct.	2,824	1	155	205	3,468	4,191	-	0.92	2.12	2.30
Nov.	2,852	0	155	205	3,179	4,046	-	0.93	2.11	2.08
Dec.	2,902	1	165	205	3,251	4,841	-	0.90	2.09	2.27
Ave.	2,810	0.75	163	213	3,426	4,307	-	0.91	2.09	2.27
Max.	2,902	-	180	230	3,902	4,841	-	0.94	2.14	2.50
Min	2,719	-	155	205	3,035	3,757	-	0.87	2.00	2.03
σ	56	-	7	8	274	276	-	0.02	0.04	0.14

Source: CIC

IV.3 Qualitative Specification and Supply of Energy, Utilities and Paper Bag

IV.3.1 Fuel

In 1983, fuel for kiln burning has been changed from oil to natural gas which is supplied from the gas station of Myauma Oil Corporation in Pyaye located about 12 km from the Thayet cement plant. The present gas station is operating #15 gas well, about 3,000 ft deep and approximately 1,000 lb./in^2 of pressure, and #16 gas well is under trial digging at present.

The gas component and the average calorific value are shown in Table 5-6. According to the engineers of the gas station, less variation of gas component is observed at present while the gas pressure shows somewhat large fluctuation which causes supply problems.

IV.3.2 Water

Water for drinking and industrial uses is presently taken to the plant from the Irrawaddy river by 12 sets of water pumps, and is treated without any chemicals by sedimentation ponds installed in the plant. The consumption and quality of water are described in Chapter V.3.2.

For this mini-cement plant project, the present water supply capacity seems to be sufficient, if all sets of water pumps can be operated properly. However, due to the lack of spare parts, several water pumps can not be operated at present.
It is, therefore, recommended to maintain the water pumps under proper condition and to keep suitable quality of water by preventing rust and contamination in cooling water piping.

IV.3.3 Electric power

There are seven diesel engines in the Thayet cement plant, but only one diesel engine can be available for emergency use at present because of the lack of spare parts.

Since the electric power demand is estimated to be nearly the same even after completion of this project, the present capacity and voltage of power supply are considered sufficient for the project. However, as shown in Table 4-10, frequency of power failure including repair of transmission cable is one time every 4 days on average. This will surely affect productivity, quality control, maintenance, etc. of the plant. It is, therefore, recommended to have this problem improved by the power supplier namely Electricity Power Corporation (EPC) for stable operation of the plant.

Table 4-10 Power Failure Frequency and Duration

Month		Frequency	Cumulative Duration (h)
1986	October	4	13:35
	November	5	00:07
	December	5	00:08
1987	January	3	01:59
	February	2	00:04
	March	10	07:11
	April	13	16:38
	May	17	* 115:24
	June	8	15:55
	July	13	03:52
	August	5	00:14
	September	10	* 155:54
Average		7.9	27:30

Source: CIC

Note 1) The figures include repair work time of transmission cable.

IV.3.4 Paper bag

Paper bags for bagged cement are made in the paper bag manufacturing plant in the Thayet cement plant by using the brown paper supplied from the paper factory in Burma. Paper bags are five plys at present, however, about 7% of paper bags are broken down during packing and loading of cement, probably due to poor quality of paper itself.
It seems difficult to improve this poor quality of paper in no distance future, then bulk shipment of cement is recommended to increase gradually in the future.

IV.4 Consumption of Input Materials

IV.4.1 Raw materials

Taking into account the local conditions and the plant operational condition, the study was made in this report based on the present unit consumptions of the raw materials given by CIC during the field survey. Because they are considered reasonable, judging from the Consultant's experience and actual operational results in many cement plants in the neighboring countries.
In case clinker production is 200 tpd and yearly working days are 300 days, each unit and yearly consumption of the raw materials are shown in the following Table 4-11.

Table 4-11 Unit and Yearly Consumption of Raw Materials

Raw materials	Unit Consumption (Dry t/t-cement)	Yearly Consumption (Wet tonnes)
Limestone	1.2097	75,200
Marl (Clay)	0.3722	23,800
Silica	0.0635	3,800
Iron ore	0.0158	980
Total	1.6612	-
Gypsum	0.060	3,700

Source: CIC

IV.4.2 Utilities

In this report, the same figures as the average unit consumptions of fire brick, grinding media, lubricant oil, paper bag and electric power during last 3 years (1984-1986) are applied to the study, which are shown in the following Table 4-12.

Table 4-12 Unit and Yearly Consumption of Utilities

Utility	Unit Consumption (per ton cement)	Yearly Consumption (ton per year)
Fire brick	2.838 kg	170.3
Grinding ball	1.095 kg	65.7
Mill liner	0.215 kg	12.9
Lubricant oil	0.929 l	55.74 kl
Diesel oil	8.7 l	522 kl
Paper bag	21.5 bags	1,290,000 bags
Electric power	125 kWh	7.5 MWh

Source: CIC

IV.4.3 Energy (Natural gas)

Natural gas has been used as fuel for clinker production in the Thayet cement plant.
Heat consumption for clinker burning is usually ranging from 1,300 to 1,350 kcal per tonne of clinker in the wet process, while the actual average results for last 3 years of No.2 and No.3 kilns of the Thayet plant show very high figures shown in Table 4-13.

Table 4-13 Actual Average Heat Consumption

(Unit: 10^3kcal/t-cement)

Year	1984	1985	1986	Average
Max.	2,514	2,094	2,216	2,254
Min.	1,691	1,741	1,696	1,709
Average	1,936	1,853	1,881	1,890

Source: CIC

Of course heat consumption varies according to the type and plant capacity of clinker production process. It can be also reduced to some extent by effective heat management including equipment maintenance as to keep the stable operation of the plant as long as possible.
The above table shows that if the existing plant be operated under the good condition, the unit heat consumption will be managed to be about 1,700 x 10^3kcal per tonne of cement in future.
Considering the matter mentioned above, in this report, the unit heat consumption was estimated to be 1,500 x 10^3kcal per tonne of cement, which is approximately equal to a mean value of the minimum average figure of Table 4-13 and the achievable figure from the technical viewpoint under the good management condition.

The unit and yearly heat consumption are calculated and summarized in Table 4-14, based on the calorific value of 8,120 kcal/m^3 of natural gas.

Table 4-14 Unit and Yearly Heat Consumption

	Unit Consumption (ft^3/t-cement)	Yearly Consumption (million ft^3)
Natural gas	6,540	39.24

IV.5 Estimate of Variable Production Cost

Based on the unit price given by CIC and the results obtained in the above discussion, the variable production cost is summarized in Table 4-15.

Table 4-15 Estimate of Variable Production Cost (Materials and Inputs)

Item	Component	Quantity (t/year)	Unit Price (Ks/t)		Unit Cost (Ks/t-cement)		Annual Cost (10^3 Ks/Year)		
			Foreign	Local	Foreign	Local	Foreign	Local	Total
Raw material	Limestone	75,200	-	13.23	-	16.58	-	995	995
	Marl (Clay)	23,800	-	13.23	-	5.24	-	314	314
	Silica	3,800	-	(negligible)	-	0	-	0	0
	Iron ore	980	-	268.0	-	4.38	-	263	263
	Gypsum	3,700	-	328.73	-	20.44	-	1,226	1,226
Utility	Fire brick	170.3	10,100	1,900	28.66	5.39	1,720	323	2,043
	Grinding ball	65.7	3,787	3,257	4.15	3.57	249	214	463
	Mill liner	12.9	13,800	6,350	2.97	1.37	178	82	260
	Lubricating oil	55.74 (kl)	-	5.24 Ks/l	-	4.87	-	292	292
	Diesel oil	522 (kl)	-	0.55 (Ks/l)	-	4.79	-	287	287
	Paper bag	1.290 (mil.bags)	-	4.14 (Ks/bag)	-	89.01	-	5,341	5,341
	Electric power	7.5 (MWh)	-	0.20 (Ks/kWh)	-	25.00	-	1,500	1,500
Energy	Natural gas	39.24 (mil.ft^3)	-	2.10 (Ks/10^3ft^3)	-	13.73	-	824	824
Total							2,147	11,661	13,808

IV.6 Materials Supply Programme

Since the scope of this project is limited to setting-up a new kiln in the existing plant which is presently in operation, no special consideration on the materials supply programme is required. Because there are storage yards, silos, basins, etc. with a sufficient capacity for limestone, clay, siliceous material, slurry, clinker and cement respectively. As for hematite, no special investment is required because its estimated consumption is about 3 tpd. The existing roof of gypsum yard will be required for additional gypsum receiving and storage.

Taking into account the estimated increase of production capacity by 200 tpd, the additional inventory of the raw materials with a coverage of consumption for 10 days was considered to be required for the project.

CHAPTER V LOCATION AND SITE

V.1 Location

It has been decided through some preliminary investigations carried out by IPD people that the location should be in the existing Thayet cement plant, Magwe Division. This solution of the location is reasonable for the following reasons:

(1) It is easy to obtain raw materials because the quarry of limestone and marl is nearer to the plant. In addition, quality of the raw materials available is suitable for production of cement to be used for the IDWSSD programme.

(2) The limestone reserves of the quarry exceeds the consumption for 58 years with 700-800 tpd cement production capacity of the plant.

(3) Some parts of the existing equipment of the production line 1 can be available. Moreover, common facilities such as the raw materials grinding mill and the clinker grinding mill are also available.

(4) The existing facilities for cement shipment and transportation are available as they are.

(5) No land acquisition and preparation is required.

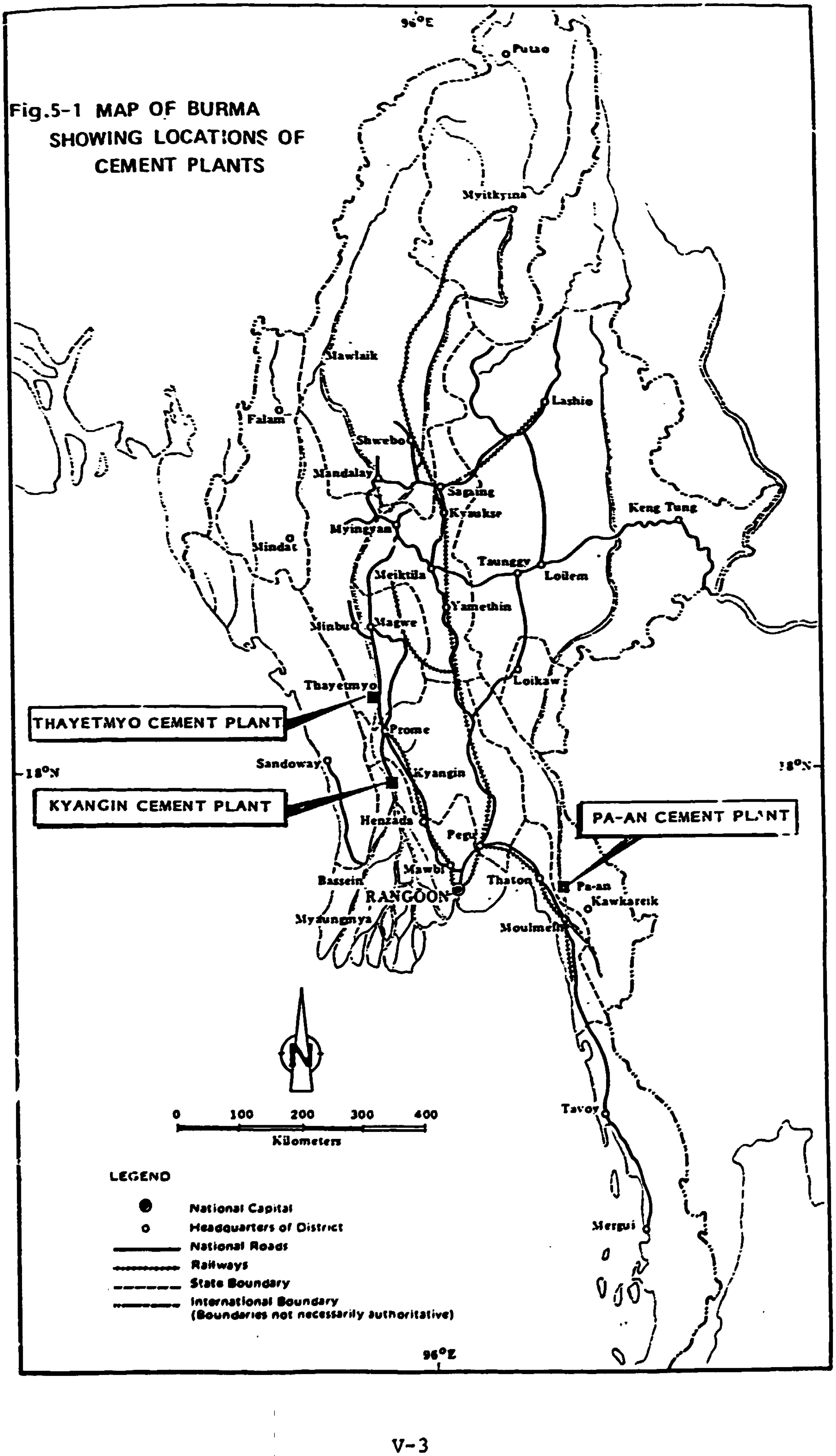
(6) Water and electricity are available without any additional installation to the existing facilities. Fuel is also available.

(7) Since transportation and distribution network of cement has already established, cement sales will be expected to be easy.

(8) The management system necessary for operation of a cement plant is not required to be newly established, because many engineers and workers with high technology and skill to operate a cement plant are already allocated to the existing plant.

Fig. 5-1 shows the location of the Thayet cement plant together with other cement plants.

Fig.5-1 MAP OF BURMA SHOWING LOCATIONS OF CEMENT PLANTS



V.2 Site

The site has already decided to be the place for the existing production line 1. Besides reasons mentioned above in Section V.1, this selection also seems to be reasonable and feasible for the following reasons.

(1) The soil investigation for installation of a new kiln is not required, because a new kiln can be constructed on the existing foundation.

(2) Material handling facilities such as raw meal and clinker transportation equipment can be used in common with No.2 and No.3 production lines.

(3) Utilities supply facilities are available in common with the existing equipment.

On the other hand, it is necessary to provide a new dust collector for a new kiln to reduce the dust emission from the chimney, because the site locates in Thayetmyo Township which population is more than 100,000.
No costs for land acquisition and preparation are required in the project.

V.3 Local Conditions

V.3.1 Natural conditions

(1) Geographical and geological conditions

The official name of Burma is Socialist Republic of the Union of Burma. It is an independent republic in Southeast Asia, having an area of over 678,000 square kilometers. Of the total area 57%

is covered with forest, and the area of cultivated land is about 26 million acres at the present.

Burma is boardered by Thailand and Laos on the east, by China on the north and northeast, by India on the northwest, on the west by Bangladesh and the Bay of Bengal, and on the southwest and south by the Andaman Sea and the Gulf of Martaban. Burma stretches from latitude 10°N to about 28° 30'N and about half of the country is located outside the tropical zones, but Burma is generally considered a tropical country. The total length of Burma is 1,300 miles (north to south) and the widest part is 575 miles (east to west).

There are many mountains which run longitudinal, from north to south. About two thirds of Burma's surface is drained by the Irrawaddy river and its tributaries. The high land regions of Burma are covered with laterite (red soil containing iron oxide and hydroxide of aluminum). The low land region is covered with alluvial soil mainly consisting of clay and silt.

Burma is divided into seven states and seven divisions. The Thayetmyo Township is located in the Magwe Division.

(2) Climatic conditions

Burma lies primarily under the influence of the monsoon winds. There are three seasons as follows:

- Summer	March to mid May
- Rainy season	mid May to mid October
- Winter	mid October to February

The seasonal rainfall is brought about by the shift in direction of the monsoon winds of the Indian Ocean, which blow from the southeast in summer and from the northeast in winter. The average yearly rainfall in Rangoon is about 2,500 mm and in some areas of the Tenasserim and Arakan coasts it exceeds 5,000 mm. The central region is not only away from the sea but also in the rainy shadow of the Arakan Yoma, and rainfall gradually decreases northward. The meteorological data of the site has been recorded at the small meteorological observation station in the Thayet cement plant compound, which is operated by the Rangoon Institute of Meteorology. Further discussion on the meteorological conditions in the site based on the data obtained during the field survey is made below.

(a) Rainfall

The rainfall in the site generally concentrates in the rainy season with some yearly fluctuations, and a very few appreciable rainfall is observed in the summer and winter seasons. The maximum annual rainfall of 1,494.7 mm was recorded during 1965 to 1983 and the maximum monthly rainfall recorded during the same period is 396 mm. The average rainfall-days per year during the same period is 98.1 days.

(b) Temperature and humidity

The temperature in the site peaks from March to May with the daily average maximum temperature of 37.6-41.3°. Although the temperature is relatively high throughout the year, in the winter season it becomes rather lower with the daily minimum temperature of 5°C range. The daily average temperature in the site is ranging from 20.5°C to 32.7°C.

The daily average humidity is high ranging from 80% to 84% in the rainy season. It becomes lower in the summer and winter seasons with average range being 58% and 38%-43% respectively. The daily maximum humidity ranges from 87% to 100% throughout the year.

(c) Wind direction and velocity

The maximum wind velocity recorded in 1983 was 60 miles per hour, and wind direction is generally southwest in the monsoon season and northeast in winter respectively.

(d) River discharge

No river discharge data in the site is available, however the water level of the Irrawaddy river observed at the bank of the Thayet cement jetty varies from about 1.5 m in the winter season and 15 m in the rainy season respectively.

(e) Earthquakes

Some earthquakes have been experienced in the site, however, no earthquake data in the site is available.

Meteorological data (Rainfall, Yearly Rainfall, Temperature and Humidity) are shown in Table 5.1, 5.2 and 5.3.

Table 5-1 Rainfall (Daily Records from 1965 to 1983)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average monthly rainfall in mm	2.6	0.7	1.3	12.9	118.6	186.6	173.1	176.4	140.5	109.6	37.6	3.3
Maximum monthly rainfall in mm	34.3	7.6	24.1	54.6	396.0	281.2	285.8	232.4	307.8	220.2	148.1	27.9
Minimum monthly rainfall in mm	0	0	0	0	3.0	90.4	81.3	130.8	43.9	24.4	0	0
Maximum daily rainfall within month in mm	31.8	7.6	24.1	23.1	150.9	120.1	55.1	69.8	113.5	82.6	41.2	19.0
Average number of rainy days	0.3	0.3	0.3	1.8	9.2	17.8	19.6	21.5	13.9	9.0	4.0	0.8
Average number of days with more than mm rainfall	0.3	0.2	0.1	1.5	8.1	15.9	17.5	18.4	11.6	8.2	3.8	0.6
Average number of days with more than 10 mm rainfall	0.1	0	0.1	0.6	3.3	5.7	5.8	5.9	4.6	3.2	1.6	0.1
Maximum number of rainy days	2	2	3	6	17	24	28	8	22	17	11	4
Maximum number of days with more than 1 mm rainfall	2	1	1	5	16	21	26	24	22	14	10	4
Maximum number of days with more than 10 mm rainfall	1	0	1	2	8	9	9	8	9	7	6	1

Source: CIC

Table 5-2 Yearly Rainfall
(Based on Daily Records from 1965 to 1983)

Average annual rainfall in mm	953.4
Recorded maximum annual rainfall in mm	1,494.7
Recorded minimum annual rainfall in mm	69.8
Recorded maximum monthly rainfall in mm	396
Recorded maximum daily rainfall in mm	150.9
Average number of rainy days per year	98.1
Average number of days per year with more than 1 mm rainfall	85.6
Average number of days per year with more than 10 mm rainfall	31.1
Recorded maximum number of rainy days per year	127
Recorded minimum number of rainy days per year	74
Recorded maximum number of days with more than 1 mm rainfall	116
Recorded minimum number of days with more than 1 mm rainfall	70
Recorded maximum number of days with more than 10 mm rainfall	46
Recorded minimum number of days with more than 10 mm rainfall	19
Maximum rainfall within 2 hours in mm/2h	130
Maximum rainfall within 8 hours in mm/8h	130
Period within two 2/8-hours rainfalls in h	48 (at least)

Source: CIC

Table 5-3 Temperature and Humidity (1983)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Maximum humidity	(%)	95	91	96	87	95	96	100	100	96	97	95	95
Minimum humidity	(%)	38	18	23	20	27	44	50	60	42	47	46	48
verage humidity	(%)	59	43	38	43	56	80	84	84	82	77	59	58
Daily average maximum temperature	(°C)	33.1	37.2	37.6	41.3	38.3	37.4	35.6	36.8	37.2	36.0	35.6	33.9
Daily average minimum temperature	(°C)	5.1	7.9	10.2	19.3	22.8	21.1	22.8	22.8	20	16	7.9	5.6
Daily average mean	(°C)	20.8	20.6	27.8	32.8	32.8	34.7	28.3	28.3	29.2	25.6	23.9	19.3

Source: CIC

V.3.2 Social conditions

The project site is administratively included in Thayetmyo Township, Division of Magwe. The area of Thayetmyo Township is about 6.27 square kilometers and the number of resident families is about 21,800 at the present.
The social conditions prevailing in the Thayet area are discussed below.

(1) Population

The population in Thayetmyo Township is shown in Table 5.4. The average increasing rate of population is about 2.1% which is a little higher than that of the whole country indicating 2.0%.
The density of population in Thayetmyo Township is 16.2 persons per kilometers, whereas that of the whole country is about 52.1 persons per kilometers. However since a large part of resident families live in the area around the existing cement plant, the population density in the project site seems much higher than the average density of Thayetmyo Township.

Table 5-4 Population in Thayetmyo Township

	1983	1984	1985	1986	1987
Population	92,722	94,669	96,657	98,687	100,759

Source: Immigration and Manpower Department

(2) Education system

The education system of Burma is basically divided into three courses as follows:

- Primary education	from 5 years to 10 years age
- Secondary education	from 11 years to 16 years age, inclusive of high school education
- University and college education	from 4 years to 7 years course

Thayetmyo Township has neither college nor university, therefore, students graduated from the high school should leave the Township to be educated in colleges or universities.
For reference, the manpower situation for the rural and urban water supply and sanitation decade activities is shown in the Appendix II.

(3) Manpower requirement for the project

Manpower requirement for the project is estimated to be about 20-30 labors, because the plant is under operation at the present and number of the equipment to be extended is a few. As for labors recruitment for the project, it is easy to fulfill manpower requirement since only unskilled labors are required to be recruited because engineers and skilled labors have already been allocated in the Thayet plant.

(4) Industry

Major industries of the project area are cement and agriculture. There exists some appreciable fishery and forest activities observed in the project area. Many small stores line the shopping district of Thayetmyo town, and small-scale commerce is actively practiced in the town.

(5) Electric power

Electric power is supplied to the site through one overhead line of 66 kV 50 Hz by Electricity Power Corporation (EPC).
The capacity of main transformer in the plant for power receiving is 9,000 kVA which is enough to operate the plant with the rated capacity after the project will be commissioned.

(6) Water supply

Since the Thayet cement plant is located along the Irrawaddy river, water for drinking and industrial uses is supplied from the Irrawaddy river by several sets of water intake pump. The approximate daily water consumption presently is 4,500 tpd in the plant, 140 tpd in the quarry and 860 tpd in the quarters respectively. Water analysis data obtained in the site is shown in the following table.

Table 5-5 Water Quality

(Unit: ppm)

	Quality
Total hardness (as $CaCO_3$)	48.0
Carbonate hardness (as $CaCO_3$)	43.0
Non-carbonate hardness (as $CaCO_3$)	5.0
Chloride (as Cl)	4.2
Sulphate (as SO_4)	21.4
Calcium (as Ca)	11.4
Magnesium (as MgO)	52.9
Turbidity	1,000
pH	7.0

Source: CIC

(7) Fuel supply

The location of Thayet cement plant was selected in 1935 for the reason of the presence of an operating gas field at Pyaye to the southwest of Thayetmyo.

After the Pyaye gas field was once exhausted in 1940s, development plans to reactivate the Pyaye field by further drilling were implemented from 1985.

In August 1987, the Pyaye gas field started to again produce gas thus the Thayet cement plant was again connected to the gas field. The production capacity of the Pyaye gas field is ranging from 2.5 to 2.7 million cubic feets per day with a pressure of more than 70 kg/cm^2.

The average figures of composition of the gas are given in the following table.

Table 5-6 Property of Fuel Gas

(Unit: %)

Component	Average figure
Methane	96.4 - 98.8
Ethane	0 - 0.93
Propane	0 - 0.98
Iso-butane	0 - 0.97
Normal butane	0 - 0.54
Pentane	0 - 0.10
Calorific value	8,120 kcal/m^3

Source: CIC

(8) Transportation

There are two ways available to access the Thayet cement plant, one is by car and the other is by boat. A motorable road under all weather condition runs from Rangoon through Prome to Myede, locating on the east bank of the Irrawaddy river. It takes about 8 hours by car from Rangoon to Thayetmyo, inclusive of transportation time by the plant-owned car-ferry between Myede and Thayetmyo. Traffic of the road is not heavy at present except in Rangoon, indicating considerable surplus capacity for the future increase of traffic. The transportation durations by boat between Rangoon and Thayetmyo are 2 days for downstream and 7 days for upstream respectively. A barge can be also available to transport materials by the Irrawaddy river way, but a suitable capacity of burge seems to be ranging from 400 to 500 tonnes, taking into account the water depth of the river in the dry season.

Another possible way to access the Thayetmyo Township is by train from Rangoon to Prome, from where to Myede by car. The principal distances are as follows:

- Railway	Rangoon - Prome	260 km
- Road	Rangoon - Prome	287 km
	Rangoon - Myede	355 km
- River	Rangoon - Thayetmyo	488 km
	Thayetmyo - Mandalay	474 km

(9) Medical facilities and others

There is one general hospital and one dispensary respectively in the Thayetmyo Township. As for communication facilities, more than 50 sets of telephone and one telegram line are available in the Township. Three (3) guest houses with a maximum accommodation for 14 persons owned by the Thayet cement plant can be available for foreign personnel during erection and commissioning of the equipment of the project.

V.4 Environment Impact

The following discussion is made on the environmental impact expected to the project area.

(1) Increase in employment opportunity

Implementation of the project should increase the employment opportunity. It has, however, a few employment opportunity in comparison with such project as to set up a new cement plant, since the project includes only the scope to set up a new kiln by using as much as possible equipment of the existing plant. The direct increase of employment opportunity is expected to be about 50 persons during the commercial operation period of the project.

(2) Propagating effects on related industries

Propagating effects of the project on related industries may include increased demand for plant construction materials like cement and sand, expansion of the construction sector and increased demand of operating supplies required for the plant operation and product transportation. The uncountable employment opportunity in these related industries is indirectly expected too.

(3) Contribution to regional economy

When the project becomes operational, the increased output of the existing plant may contribute to the regional economy by increasing the business opportunities for materials supply sectors and the transportation sector. No great impact on the regional population and improvement of infrastructure may be expected, because the increased output of product is not so large.

CHAPTER VI PROJECT ENGINEERING

VI.1 Project Layouts

The basic principle of this project conceived by CIC is to set-up a mini-cement plant unit by installing a new 200 tpd gas-fired wet process rotary kiln and using equipment of the old production line 1 as much as possible, and the new kiln is to be located, if possible, on the foundations of the old No.1 kiln.

The result of this study conducted by the Consultant has justified that the above principle can be said most economical and proper for this project from both technical and economical viewpoints, as mentioned hereinafter.

Therefore, in accordance with the principle and the results of the study based on the data obtained during the field survey, the project layout has been prepared.

As suggested by UNIDO project officials in Rangoon and agreed by the Consultant, the production capacity was assumed to be 600 tpd after completion of the project: that is, the total production capacity of the existing No.2 and No.3 kiln lines is 400 tpd and that of the newly installed kiln is 200 tpd.

According to this assumption of the capacity, the project layout has been prepared, and the capacity of each production department has been discussed and evaluated in detail in Chapter VI.2 Scope of the Project.

The project layout is briefly outlined as follows:

- The raw materials quarry is to be operated as it is and the existing equipment in the quarry is assessed to have enough capacity as discussed in Chapter V. Therefore no change is required for the raw materials quarry.

- The crushing department is not to be modified in this project, because the location of the secondary crusher room has been already planned to shift and also a new hammer crusher has been planned to be installed by another project. Accordingly the problems of the existing hammer crusher can be expected to be solved before implementation of this project.

- The ropeway capacity is adequate, and neither modification nor addition is required.

- The raw materials storage hall itself is adequate in capacity and the extension for the project is not necessary. However, minor repair and reinforcement of the storage hall structures are required. Rehabilitation of the existing overhead cranes is to be done and the re-alignment of crane rails also is to be carried out.

- The shell and liner plates of the No.2 raw mill are to be replaced to new ones.

- The minor rehabilitation of other equipment in the raw grinding department is to be carried out.

- The No.1 kiln is to be replaced completely including planetary cooler, feed end hood, slurry feed system and induced draft fan. However, the existing kiln foundations and the burner platform are to be used with minor modifications.

- A new dust collector of cyclone type for the No.1 kiln exhaust gas is to be installed.

- The existing pan conveyor from the No.1 kiln to the clinker storage hall is to be replaced with new one. New kiln gas burner including gas unit is also to be provided.

- A new control room for the No.1 kiln is to be installed on the burner platform and a new operation control panel is to be provided in this room. The other equipment of No.2 and No.3 kiln lines are to be used as they are.

- Two existing cement mills are to be used with minor rehabilitation and modification.

- One existing stationary packer of the No.2 packing plant is to be replaced completely and necessary rehabilitation and modification for the other equipment of No.1 and No.2 packing plants are to be carried out.

- The existing facilities for water, gas and electricity supply are to be used as they are, except minor modification required for the No.1 kiln operation.

- The existing non-production facilities are to be used as they are, except some addition of new laboratory apparatus.

VI.2 Scope of the Project

VI.2.1 General

As already stated in Chapter VI.1, in this project the new 200 tpd gas-fired wet process rotary kiln is to be installed in addition to the existing No.2 and No.3 kiln production lines having the total actual capacity of 400 tpd at present, using equipment of the old No.1 kiln production line as much as possible which was shut-down in October 1983.

For the purpose of clarification of the scope of the project, the results of selection of the process to be applied to the project and of evaluation of the existing equipment are described hereinafter.

VI.2.2 Selection of process

In order to choose the most suitable process for the project, the technical and economical conditions shall be carefully examined and compared with each other.

In general, the cement manufacturing process is divided into two types of the dry process and the wet process, both of which are subdivided into several processes, mainly depending on the type of kiln to be used as follows.

(1) Dry process

- (a) Suspension preheater type kiln
- (b) Suspension preheater with precalciner type kiln
- (c) Long kiln
- (d) Short kiln with waste heat boiler

(e) Shaft kiln
(f) Lepol kiln

(2) Wet process

(a) Short kiln with boiler
(b) Long kiln
(c) Semi-dry suspension preheater type kiln

In order to choose the best process among the above-mentioned processes, the following conditions shall be compared with each other.

(1) Economic factor

(a) Investment cost
(b) Production cost such as consumption of fuel, electricity and water
(c) Manpower requirement
(d) Area to be required for plant

(2) Technical factor

(a) Properties of raw materials
(b) Kind of fuel to be used
(c) Quality of cement to be produced
(d) Easiness of operation
(e) Maintenance cost
(f) Capacity of kiln

In recent years, suspension preheater kiln (SP kiln) and/or suspension preheater with precalciner type kiln (NSP kiln) have been adopted in many plants mainly because of their low fuel consumption, high production capacity of unit volume of kiln and easiness of operation.

However, considering the basic principle and present conditions of this project, the adoption of SP kiln or NSP kiln can be said unsuitable, because the conversion works from the existing wet process to dry process need the complete change of raw materials grinding system including raw mills, transportation equipment, homogenization facilities, raw meal storage silos, etc., and furthermore, the broad modification of the kiln department requires high investment cost. On the other hand, the present fuel cost of the Thayet cement plant is very cheap and the increase of production capacity in the project is decided to be only 200 t/d. Therefore, even if the fuel consumption, maintenance cost, etc. decrease sharply after conversion to SP kiln system, it can be said that the conversion will be at no commercial profit.

The other types of dry process kiln are also considered to be unsuitable for the project due to the same reasons as the above-mentioned. A shaft kiln has been occasionally planned for a mini-cement plant project, however, as it has some technical problems in the flexible operation and cement quality as well as high investment cost for the process conversion, it is also unsuitable for the project.

To the contrary, the Thayet cement plant has extensive experiences of operation and maintenance of a long wet process kiln since 1937. At present the plant has an adequate raw materials grinding system and slurry storage tanks and basins although some rehabilitation of them are required for the project.

The present cost of natural gas as fuel for clinker burning is very cheap. There are no quality problems of cement produced by the existing wet process kilns of the plant.

Considering the above conditions, in order to minimize the investment cost and to get the maximum commercial profit of the project, the most suitable plan is to replace the old No.1 kiln of wet process to a new kiln without any change of the process by using the existing kiln foundation and the equipment of the plant as much as possible as stated in Chapter VI.1.

As an alternative plan, semi-dry suspension preheater type kiln process, which is considered the second recommendable plan from the technical viewpoint because of its low heat consumption, is studied in Chapter VI.4.

VI.2.3 Scope of the project

Considering the present conditions and features of the existing equipment and facilities of the Thayet plant, the scope of the project is decided as briefly explained below.

(1) Raw material quarry

Most of the mobile equipment in the quarry are under good condition as they have been delivered in 1982 by finance of the Asian Development Bank and GTZ. As stated in the feasibility study report by CIC in 1985, the mobile quarry equipment has a sufficient capacity even for 1,200 tpd production of the plant.

The bottleneck of the quarry equipment is in the crushing plant capacity which is 110-120 t/h actually.
The quantity of limestone and marl required for 600 tpd production of the plant is approximately

1,000 tpd, so considering the present capacity of the crushing plant, the quarry operation of 65 hours per week, that is, 13 hours per day, 5 days per week, is necessary.

The deposits of the present limestone and marl are sufficient both in quantity and quality posing no problems for this project.
The capacity of the quarry equipment is also adequate for the project.

Judging from the present conditions of the quarry and its equipment as abovementioned, no renovation, modifi- cation and additional installation of the equipment and facilities is required in this project.

(2) Ropeway

The limestone and marl are transported to the cement plant by 3,637 m long ropeway which was commissioned in 1962 and wholly rehabilitated in 1982 by the finance of West Germany. The design capacity is 134 t/h with 150 backets in total, while the actual capacity is 110 t/h with 135 backets.

The ropeway has, however, such sufficient capacity for the cement production of 600 tpd that no works is required in this project.

(3) Material storage hall

The storage hall has the respective capacities of 15,000 t for raw materials and 10,000 t for clinker and gypsum. This capacity corresponds to about 14 days period of the kiln operation with a capacity of 600 tpd for raw materials, and about 16 days period for clinker and gypsum. The open yard next to the hall can be used to increase the storage capacity for raw materials.

Accordingly, the present storage capacity itself is sufficient. However, the No.1 and No.2 overhead cranes are being operated under bad conditions such as uneven level of crane rails and superannuated and warn-out parts. The structures of hall are so weak that they shake when the cranes are in operation. High dangerous possibility is observed for the cranes during operation. In order to take measures against such bad conditions, in this project the rehabilitation of the No.2 and No.3 cranes is to be done especially for electric control devices and worn-out parts, and the alignment work of crane rails is required to be conducted under the supervision of specialists. The reinforcement of the structures of hall is also necessary to be done in the project.

The receiving equipment and facilities for iron ore, river sand and gypsum presently purchased from outside the plant, have no problem of equipment except the eccentricity of rotor shaft of the gypsum crusher. This eccentricity will be repaired in the project.

(4) Raw grinding mill department

There are four wet type ball mills for raw grinding at present. As for No.1a raw mill with a design capacity of 16 t/h which was built in 1935 and rehabilitated in 1970, since the shell was almost worn-out and cracked, it had been already stopped in operation.

The respective capacities of the other three raw mills are shown in the following table.

Table 6-1 Raw Mill Capacity

Raw mill	Design Capacity		Actual Capacity	
	t/h-dry basis	170 mesh Residue	t/h-dry basis	170 mesh Residue
No.1b	16	-	9	10±2%
No.2	32	7%	19	10±2%
No.3	32	7%	22	10±2%
Total	80	-	50	-

Source: CIC

The total actual capacity of three raw mills is 50 t/h i.e. 1,200 tpd. The required quantity of slurry for clinker production of 600 tpd is about 1,000 tpd on dry basis, which shows that there is a margin capacity of 20% of the required quantity. However, the actual capacity is very low compared with the design figure and the actual slurry fineness is also coarse.
The present conditions of the raw mills and associated equipment are so bad that main problems were pointed out as follows:

- Slurry leaks out from the mill due to cracks of the shell. Especially the crack of the No.2 raw mill shell spreads over so much widely that it seems impossible to repair completely.

- The feed hoppers before the mills suffer from heavy clogging troubles which require hard poking work and reduce the flow rate of materi-als affecting the mill production.

- The bearing and gear box of the NO.2 raw mill are out of order due to serious damage of gears. Since a new gear box has been already purchased for replacement, no additional provision of the gear box will be required in the project.

- Electric power failure occurs about 95 times in one year.

- Main drive motor of the No.3 raw mill often trips due to the abnormal rising of the motor bearing temperature.

- Life of slurry pump blades is short.

- Water content of slurry is presently more than 40% which is so high that it is recommended to decrease it less than 37% for increasing the kiln output and reducing heat consumption.

In order to solve these problems and to increase the present output of the raw mill for keeping more margin capacity than 20% as abovementioned, the following works will be carried out in the project:

- Complete replacement of the No.2 raw mill shell and lining including bearings, shafts and housing

- Modification of mill feed hoppers

- Replacement of slurry pumps and modification of their piping

- Minor modification and rehabilitation of mills and associated equipment, if necessary

(5) Kiln department

There are three long wet process kilns in the plant. The No.1 kiln with the design capacity of 200 tpd was built in 1935 and shut down in 1983 due to a lack of spare parts and high repair cost. The No.2 kiln was built in 1962 and its design capacity is specified as 400 tpd, while the presently achievable capacity is about 280 tpd. The No.2 kiln was under repair work of the girth gear and pinion of the drive unit during the field survey.
The No.3 kiln which is of similar dimension to the No.2 kiln was built in 1968. The design capacity is also same as that of the No.2 kiln while its presently achievable capacity is ranging from 250 tpd to 300 tpd.
For the time being, only the No.3 kiln can be operated. The present conditions of kilns and associated equipment are so bad that main problems were pointed out as follows:

- The No.1 kiln including its associated equipment has been so extremely damaged that it can not be operated.

- The girth gear and pinion of the No.2 kiln drive unit is worn-out.

- There are several cracks and pittings on the tires of the No.3 kiln, and the pittings on the fifth tire are especially severe.

- Several cracks are observed on the No.3 kiln shell.

- Clinker is spilled from the cooler grate of the No.3 kiln due to damaged grate plates and deformed grate frames.
  The clinker spillage has been so much that the quantity of clinker to be fed into the cooler should be controlled within the limited range.

- Although the actual output of the No.3 kiln is about 60-70% of the design capacity, the induced draft fan (IDF) has been operated at full load because water content of the slurry and air leakage from the kiln line are too much.

In order to secure cement production of 600 tpd, the following works will be carried out in this project:

- Complete replacement of the old No.1 kiln with a new kiln including drive unit, planetary cooler, burner, feed end hood, slurry feed system, IDF and other ancillary equipment, provided that the existing kiln foundations and burner platform be used with minor modification.
  The size of a new kiln was planned to be slightly enlarged to ensure the normal output of 200 tpd.

- A dust collector of cyclone type for the new No.1 kiln and conveyors to feed the collected dust to kiln will be newly installed.

- The pan conveyor for clinker transportation from the cooler of the No.1 kiln to the clinker storage will be replaced with a new one.

- A new gas burner for the No.1 kiln will provided together with a gas treatment unit consisting of pressure control valves, flow rate control valve, flow meter, etc.

- A new control room for the No.1 kiln will be installed on the existing burner platform and the operation control panel will be installed in this room.

(6) Cement grinding department

The cement grinding department consists of two ball mills, namely No.2 and No.3 cement mills. The design and actual capacities of each mill are shown respectively as follows:

Table 6-2 Cement Mill Capacity

Cement mill	Design Capacity		Actual Capacity	
	t/h	170 mesh Residue	t/h	170 mesh Residue
No.2	28	8%	20	9.6%
No.3	33	8%	23	7.0%
Total	61	-	43	-

Source: CIC

As shown in the table, the total actual capacity of two cement mills is 43 t/h i.e. 1,032 tpd. The capacity corresponding to the clinker production of 600 tpd is 636 tpd of cement in consideration with gypsum mixing ratio of 6%. The present margin capacity of cement mills is computed to be about 60% which seems sufficient to the kiln output.

However, both mills have to be stopped frequently due to rise in cement temperature at the outlet of mill, troubles of overhead cranes and conveyors, electrical and power failure, defects of mill shell, etc. as stated in the attached Annex III, so the actual margin in the capacity of cement mills seems a little.

The main problems in the cement grinding department were pointed out as follows:

- The airslide conveyor for fine product transport of the No.2 mill has jamming troubles frequently.
- The air separator and the bag filter for the No.2 mill have not been operated normally.
- The bag filter for the No.3 mill has not been operated completely, and air flow rate to be introduced into the mill and air separator is abnormally small.

In order to solve the problems as far as possible and to secure normal operation of the existing cement mills, the following works will be carried out in this project:

- Modification of conveyors having troubles such as jamming
- Renovation of bag filters
- Study on and correction of the condition of grinding media and diaphragm

- Study on and correction of the operating condition of air separators such as air flow rate, circulating ratio, etc.

(7) Packing and loading department

There are the No.1 and No.2 packing plants. The No.1 packing plant has four cement silos with a total capacity of 4,000 t and the No.2 packing plant has also four silos with a total capacity of 6,000 t.
This total capacity of cement silos can cover about 15 days of kiln operation which seems sufficient.
One rotary packer with ten spouts is installed in the No.1 packing plant, however, only two spouts are presently being operated due to a lack of parts and utilization of used paper bags with inferior quality.
There are two stationary packers with four spouts each in the No.2 packing plant, however, one packer has been dismantled due to a lack of spare parts. Therefore, the actual capacity of the packing plants is only 50 t/h in spite that the design capacity is totally 150 t/h by three packers.
For dispatch of bagged cement of 600 tpd, the packing plants should be operated actually with two shifts per day and 6 hours per shift.

In order to secure dispatch of cement of 600 tpd on average under daily fluctuation of shipment, the following works will be carried out in this project:

- A new stationary packer with a capacity of 40 t/h will be installed at the place of the dismantled packer in the No.2 packing plant.

- Renovation of conveyor, bag filters, etc. will be performed as far as possible and essential parts to the work will be supplied.

(8) Utility

The present supply capacity of water, natural gas and electricity for operation of three kilns is judged to be sufficient.
Therefore, only the connection and modification works of pipe and cable for the new No.1 kiln will be carried out in this project.

(9) Spare parts

The Thayet cement plant is being faced with serious problems of maintenance caused by a lack of spare parts. For solution of these problems extending over the whole plant, a huge investment will be required.
However, only the minimum spare parts essential for the plant operation to produce 600 tpd of cement are considered in this project.

VI.3 Technology and Equipment

VI.3.1 General

As mentioned in Chapter VI.2, the new 200 tpd gas-fired wet process rotary kiln will be installed utilizing the equipment of the old production line 1. The total production capacity of the plant is planned to be 600 tpd adding the present capacity of 400 tpd of the No.2 and No.3 kilns.

Considering this basic principle and results discussed in Chapter IV, the specifications of equipment to be installed and renovated in this project are discussed and described in this article together with investment cost.

The project is basically framed:

- to replace the shell of the No.2 raw mill with a new one

- to replace the old No.1 kiln with a new one including ancillary equipment

- to install a new dust collector for kiln exhaust gas

- to make the necessary renovation of the existing equipment and facilities

- to supply the necessary spare parts

According to the above frame, specifications of equipment and investment cost are presented, which have been studied taking into consideration the present conditions of the plant.

However, details of the specifications and investment cost should be studied further prior to the implementation of the project.

VI.3.2 Specifications of equipment

The specifiations of main equipment to be installed and renovated in this project are as follows:

Item No.

1 No.2 Raw Mill Shell 1 set

Type	:	Ball mill type shell
Dimension	:	Diameter inside shell 2,400 mm
		Length between franges 13,000 mm
Material	:	SM41A
Including	:	Liners and diaphragms

2 Slurry Pump 2 sets

Use	:	Slurry transportation to kiln feed system
Capacity	:	25 m^3/h
Pressure	:	4 kg/cm^2
Motor	:	22 kW IM

3 Slurry Scooper 1 set

Use	:	Slurry feed to kiln
Capacity	:	5 - 20 m^3/h
Motor	:	1.5 kW VVVF

4 Rotary Kiln 1 set

Type	:	Wet long kiln
Capacity	:	200 t/d
Dimension	:	Diameter inside shell 2,600 mm
		Length 76,600 mm
Inclination	:	3.99/100 (tan θ)

Speed : 1.2 - 0.12 rpm
Nos. of support: 5
Shell : All welded construction
Motor : 75 kW DCM
1,000 - 100 rpm
Gear box : 75 kW
Reduction ratio 1/148
Auxiliary motor : 15 kW IM
Auxiliary gearbox: 15 kW, 1/12
Materials : Shell SS41
Tire Cr-Mo Cast Steel
Roller SFCM 70R
Refractories:
Sintering zone
High temperature burnt basic bricks
Cooling zone & Calcining zone
High alumina bricks
Preheating zone
Fireclay bricks
Chain for heat exchange:
Weight 28,600 kg
Material, Cr-Ni steel
Accessories: Feed end smoke chamber, burner tunnel with a cooling fan, oil spray device for girth gear and pinion, air seal devices, etc.

5 Planetary Cooler 1 set

Type : Planetary tube type
Capacity : 200 t/d
Dimension : Diameter inside tube: 1,100 mm
Nos. of tube: 10
Accessories: Clinker crusher 1 set
Type: Impact crusher

Capacity: 5 t/h
Motor : 11 kW IM
Chutes, lifters, outlet casing
air seal device, etc.

6 Kiln Burner 1 set

Type	:	Natural gas burning type
Capacity	:	2,000 Nm^3/h-natural gas
Accessories	:	Gas treatment unit consisting of pressure control valve, flow rate control valve, stop valve, flow meter, etc.

7 Primary Air Fan 1 set

Type	:	Turbo fan
Capacity	:	160 m^3/min at 30°C
Pressure	:	1,000 mmAq
Motor	:	40 kW IM

8 Pan Conveyor 1 set

Use	:	Clinker transportation from cooler to clinker storage
Type	:	Pan type chain conveyor
Capacity	:	12.5 t/h
Dimension	:	Width of pan : 400 mm Length of conveyor: 45,200 mm
Motor	:	7.5 kW GM

9 Dust Collector 1 set

Use	:	Dedusting from kiln exhaust gas
Type	:	Cyclone type dust collector
Capacity	:	1,200 m^3/min
Dimension	:	Diameter of cyclone: 2,000 mm

Nos. of cyclone: 4

10 Screw Conveyor 4 sets

Use	:	Conveying collected dust to kiln
Capacity	:	2 t/h
Dimension	:	Diameter : 250 mm
		Total length: 22,000 mm
Motor	:	1.5 kW GM x 4 sets

11 Rotary Valve 3 sets

Use	:	Air seal between screw conveyors
Type	:	Air seal type rotary valve
Capacity	:	2 t/h
Dimension	:	Diameter : 250 mm
Motor	:	0.4 kW GM

12 Bucket Elevator 1 set

Use	:	Conveying the collected dust to kiln
Type	:	Centrifugal discharge type
Capacity	:	2 t/h
Dimension	:	Width : 250 mm
		Height : 11,000 mm
Motor	:	1.5 kW GM

13 Induced Draft Fan (IDF) 1 set

Use	:	Exhaust gas from kiln
Type	:	Turbo-fan
Capacity	:	1,200 m^3/min at 200°C
Pressure	:	300 mmAq
Motor	:	110 kW DC

14 Packer 1 set

Type : Stationary 4 spouts type packer
Capacity : 45 t/h
Bag weight gross: 50 kg

15 Instrument 1 set

System : Analogue signal system
Signal : DC 4 - 20 mA
Measuring points and principle:

- temperature	5 - thermocouple
	1 - pyrometer
- pressure	3 - transmitter
	5 - pressure gauge
- hopper level	3 - paddle switch
- damper position	2 - potentiometer
- machine speed	2 - tacho-generator
- indicator	3 - moving coil type
- recorder	2 - pen type
	1 - multipoint type

16 Electrical Equipment 1 set

(1) Operation panel

Type : Steel-made, self-standing
Dimension : Width 2,000 mm
Depth 600 mm
Height 2,000 mm
Mounting : Graphic board, push buttons, indicators, recorders, annunciators

(2) Motor starter panel

Type : Steel-made, self-standing

Dimension	:	Width	3,000 mm
		Depth	450 mm
		Height	2,100 mm
Mounting	:	Breakers, relays, timers, terminal blocks, etc.	

(3) Cable & wire

Kind	:	Vinyl sheath insulated cable & wire
Size	:	2 mm^2 - 80 mm^2

Note: In order to secure the output of 200 tpd of the new No.1 kiln, the diameter inside the shell was planned to enlarge to 2,600 mm (old one is 2,550 mm), and the shape was also planned to be changed to straight tube type.
Accordingly, the volume inside the shell of new kiln is increased from 361 m^3 (old kiln) to 407 m^3 (new kiln).
Consequently, the specific production capacity of the kiln comes down to 20.5 kg/m^3.h from 23 kg/m^3.h.
Usually, it seems difficult to achieve a high figure of 23.5 kg/m^3.h in long wet process rotary kiln, while a specific production capacity of 20.5 kg/m^3.h of the new kiln can be said quite reasonable and achievable from experiences.

VI.3.3 Standards

As technical standards to be applied to the project, the following standards accepted internationally are recommended:

JIS, JEC, JEM (Japan); DIN, VDE (Germany); BS, IEE (UK), UF, UTE (France); ANSI, NEMA (USA); and standards recommended by IEC.

VI.3.4 Estimate of investment cost

The estimate of investment cost for this project is summarized in Table 6-3. The premises for calculation of the investment cost are basically as follows:

(1) Base of price

The prices and costs are fixed at 1987 price which were investigated and prevailed at the time of the field survey, and no escalation is considered in the calculation.

(2) Foreign portion

The foreign portion includes:

- prices and costs of machinery and equipment

- prices and costs of materials to be supplied from foreign countries such as steel, electric cable, pipe, etc.

- costs of ocean freight and insurance

- commissioning engineers despatching fee

The foreign portion estimated in foreign currency (Japanese Yen) is converted into Kyat using the official exchange rate given by CIC.

(3) Local portion

The local portion includes:

- the tax and customs duty to be imposed in Burma at 45% of C.I.F price.

- cost of inland transportation from Rangoon to the plant site, which is calculated at a rate of 400 Kyats per ton of goods

- cost of erection works, which is calculated at 25% of F.O.B price

Table 6-3 (1) Estimate of Investment Cost (1/2)

(Plant Machinery and Equipment)

Item No.	Q'ty	Item description	Foreign	Local	Cost (in 10^3 Kyats)		
					Foreign	Local	Total
1	1	No.2 Raw Mill Shell	o	o	2,071	1,411	3,482
2	2	Slurry Pump	o	o	215	144	359
3	1	Slurry Scooper	o	o	94	63	157
4	1	Rotary Kiln	o	o	20,158	13,679	33,837
5	1	Planetary Cooler	o	o			
6	1	Kiln Burner	o	o	565	377	942
7	1	Primary Air Fan	o	o	102	69	171
8	1	Pan Conveyor	o	o	823	558	1,381
9	1	Dust Collector	o	o	1,212	820	2,032
10	4	Screw Conveyor	o	o			
11	3	Rotary Valve	o	o			
12	1	Bucket Elevator	o	o			
13	1	Induced Draft Fan (IDF)	o	o	619	414	1,033
-	1	Spare Parts	o		306	0	306
-		Contingency	o	o	2,190	662	2,852
Total					28,355	18,197	46,552

Table 6-3 (2) Estimate of Investment Cost (2/2)

(Auxiliary and Service Equipment)

Item No.	Q'ty	Item description	Foreign	Local	Cost (in 10^3 Kyats)		
					Foreign	Local	Total
14	1	Packer	o	o	269	180	449
15	1	Instrument	o	o	269	179	448
16	1	Electric Equipment	o	o	767	511	1,278
-	1	Water Supply Equipment	o	o	91	61	152
-	1	Laboratory Equipment	o	o	269	180	449
-	1	Renovation of Existing Equipment	o	o	1,615	1,083	2,698
-	1	Spare Parts	o		165	0	165
Total					3,445	2,194	5,639

VI.4 Alternative

VI.4.1 General

For the purpose of finding out another possibility to increase the production of the Thayet cement plant to 600 tpd, an alternative was studied as mentioned hereinafter.
The study was made mainly taking the following points into consideration:

- low investment cost
- utilization of the existing equipment as much as possible
- easiness of operation and maintenance
- technically established process
- less production cost
- security of good cement quality

As the results of the above study on several processes, the semi-dry process with a 2-stage suspension preheater was decided to be adopted in the alternative. The outline of the alternative is as follows:

- The existing equipment from the raw materials quarry to slurry basins will be utilized after the same renovation as the basic plan.

- Filter press machinery and cake dryer will be newly installed.

- Two-stage suspension preheater will be newly installed after the No.3 kiln.

- The No.3 kiln will be shortened by about 20 m in length at the feed end side. The production capacity of the No.3 kiln is planned to be 600 tpd.

- Some modification such as adding a cooling air fan to the grate cooler of the No.3 kiln will be carried out.

- A new dust collector for the suspension preheater will be installed together with conveyors, a fan and a dust tank.

- Other existing equipment and facilities will be utilized after the same renovation as the basic plan.

VI.4.2 Process description

It is referred to the flow sheet and general layout attached hereinafter.
The process from raw materials quarry to slurry basins is the same as the existing one, so the existing equipment and facilities for these departments can be utilized with minor repair.
The slurry will be transported by slurry pumps from the existing slurry basin to slurry feed tanks to be provided before filter presses. The overflow of slurry from these feed tanks will return to the slurry basin. The each feed tank will be equipped with an agitator to prevent precipitation of slurry at the bottom of the tank.
The slurry will be fed from the feed tanks to filter presses where it is dehydrated by compressed air method. The cake, which is obtained in the filter press and consequently has water content of less than 20%, will be conveyed to the box feeder by the cake belt conveyor to be installed under the filter press. Then it will be constantly fed to the cake dryer through a box feeder, a belt weigher and a belt conveyor. The quantity of cake to be fed to the dryer will be automatically controlled to the same quantity as the feed to suspension preheater.

In the cake dryer which is dispersion dryer type, the cake will be dried up to water content of 1% and will become dry raw meal. As the heat source of dryer, the exhaust hot gas from the 1st stage cyclone (C1) of suspension preheater can be fully utilized.

The raw meal will be fed to 2nd-stage cyclone (C2) of suspension preheater together with the exhaust gas from the dryer, and in the C2 cyclone the raw meal will be separated from the gas, and then fed into the 1st-stage cyclone (C1). The heat exchange between the raw meal and hot gas from the kiln will be thus performed in the C1 cyclone, and the raw meal will be fed into the kiln.

The exhaust gas induced by the induced draft fan (IDF) from the C2 cyclone will be emitted to the atmosphere through the dust collector and the chimney. The dust collected by the dust collector will return to the kiln through conveyors and the dust tank.

The existing No.3 kiln will be shortened by about 20 m in length at the feed end side, because the present length is too long to get the high temperature gas from the kiln end for effective heat exchange between the raw meal and gas in the C1 cyclone.

The length of the No.3 kiln after shortening work will be 98 m and the volume inside the shell is calculated to be 838 m^3.

The specific production capacity of semi-dry process kiln with a 2-stage preheater is expected more than 30 $kg/m^3.h$. Therefore, the output of the No.3 kiln after conversion to semi-dry process can be expected to be 600 tpd from the following calculation.

$$30\ kg/m^3.h \times 838\ m^3 \times 24\ h/d = 603.36\ t/d > 600\ t/d$$

As the modification for the cooler, two sets of new cooling air fan will be additionally installed and the existing cooling air fan will be removed since air

compartments under the grate will be increased to three compartments, in order to increase the cooling capacity of the existing cooler.
A dust collector for the exhaust air from the cooler will be expanded.
The processes after the cooler are the same as the existing ones, so the existing equipment and facilities can be utilized with minor repair.

VI.4.3 Materials and inputs

Quality of materials and inputs required for the alternative plan is basically the same as that of the basic plan.
However, consideration should be paid to the difference in consumption of materials and inputs. Namely as described in Chapter 4.3, fuel consumption of 1,200 kcal per ton of clinker in the semi-dry process is usually much less than that of wet process adopted in the basic plan, because effective heat exchange can be expected in the preheater cyclones.
On the other hand, maintenance cost required in the alternative is estimated to increase by about 30% of that of the basic plan, due to the fact that the semi-dry process with the filtration department is much more complex than the wet process and although the new kiln with suspension preheater may consume less quantity of bricks compared to the wet process.

Considering the above matters, production costs in the alternative plan are summarized in Table 6-4.

Table 6-4 Estimate of Variable Production Cost
(Alternative)

Item	Component	Quantity (t/year)	Unit Price (Ks/t)		Unit Cost (Ks/t-cement)		Annual Cost (10^3 Ks/Year)		
			Foreign	Local	Foreign	Local	Foreign	Local	Total
Raw material	Limestone	75,200	-	13.23	-	16.58	-	995	995
	Marl (Clay)	23,800	-	13.23	-	5.24	-	314	314
	Silica	3,800	-	(negligible)	-	0	-	0	0
	Iron ore	980	-	268.0	-	4.38	-	263	263
	Gypsum	3,700	-	328.73	-	20.44	-	1,226	1,226
Utility	Fire brick	108.0	10,100	1,900	18.18	3.42	1,090	205	1,295
	Grinding ball	65.7	3,787	3,257	4.15	3.57	249	214	463
	Mill liner	12.9	13,800	6,350	2.97	1.37	178	82	260
	Lubricating oil	55.74 (kℓ)	-	5.24 Ks/ℓ	-	4.87	-	292	292
	Diesel oil	522 (kℓ)	-	0.55 (Ks/ℓ)	-	4.79	-	287	287
	Paper bag	1.290 (mil.bags)	-	4.14 (Ks/bag)	-	89.01	-	5,341	5,341
	Electric power	7.5 (MWh)	-	0.20 (Ks/kWh)	-	25.00	-	1,500	1,500
Energy	Natural gas	29.43 (mil.ft^3)	-	2.10 (Ks/10^3ft^3)	-	10.30	-	618	618
Total							1,517	11,337	12,854

VI.4.4 Manpower and organization

As already described above, only the No.3 kiln will be operated with 600 tpd production capacity after completion of the project by the alternative plan, then the manning plan for the project may require less manpower than the present one.
However, when considering the present social conditions in Burma, it can be said that the project would be better planned to employ working personnel as many as possible. Accordingly, in this alternative plan, it is not recommended that the present organization and nos. of employees be changed. Consequently, both factory overheads and administrative overheads costs in this alternative plan are the same as the present figures.

VI.4.5 Scope of project

Considering utilization of the existing equipment and facilities as much as possible and the total investment cost, the scope of works in conversion of the No.3 kiln to the semi-dry process kiln is discussed and briefly explained below:

- The works required for the departments from raw materials quarry to raw grinding mill are the same as the basic plan.

- 2 sets of slurry pump and their piping will be provided for transportation of slurry from the slurry basins to the filter press machines.

- 3 sets of filter press machines will be installed to dehydrate slurry and make cake, and ancillary equipment such as slurry feed tank, slurry pump, water pump, compressor belt conveyor, box feeder, belt weigher, etc. will be also provided.

- A cake dryer will be installed together with ancillary equipment such as damper.

- A 2-stage suspension preheater will be installed together with an induced draft fan.

- A dust collector for exhaust gas from the suspension preheater will be installed together with conveyors, fan and dust tank.

- Modification of the kiln will be carried out such as shortening of kiln shell, improvement of air seal, increase of kiln speed, replacement of No.5 tire, drive unit, etc.

- Modification of the clinker cooler will be carried out such as increase of nos. of air compartment, installation of new cooling air fans, expansion of dust collector, renovation of cooler grate and belt conveyors to clinker storage, etc.

- The works required for departments from the clinker storage to the packing plant and the utility department are the same as the basic plan.

VI.4.6 Specifications of equipment

The specifications of main equipment to be installed and renovated in the alternative plan are described as follows:

Item No.

1 No.2 Raw Mill Shell 1 set

Same as the basic plan

2 Slurry Pump 2 sets

Use	:	Slurry transportation from basin to filter press
Capacity	:	60 m^3/h
Pressure	:	4 kg/cm^2
Motor	:	30 kW IM

3 Filter Press 3 set

Use	:	Dehydration of slurry
Capacity	:	8.3 m^3/h (cake)
Accessories	:	Slurry feed tank (20 m^3) and agitator, water pump for bearing seal, water pump for cleaning filter cloth, compressor for valve control and air receiver

4 Slurry Pump 3 sets

Use	:	Low pressure pump for filter press
Capacity	:	90 m^3/h
Pressure	:	7 kg/cm^2
Motor	:	75 kW IM

5 Slurry Pump 3 sets

Use	:	High pressure pump for filter press
Capacity	:	13.5 m^3/h
Pressure	:	15 kg/cm^2
Motor	:	18.5 kW

6 Belt Conveyor 3 sets

Use	:	Conveying cake to box feeder	
Type	:	Flat belt type	
Capacity	:	8.3 Nm^3/h (cake)	
Dimension	:	Belt width	1,800 mm
		Length	15,000 mm
Motor	:	5.5 kW GM	

7 Box Feeder 1 set

Use	:	Feed of cake to dryer
Capacity	:	Max. 65 t/h (wet basis)
Accessories	:	Cake storage bunker (40 m^3)

8 Belt Weigher 1 set

Use	:	Weighing of cake
Type	:	Flat belt type
Capacity	:	20-65 t/h (wet basis)
Motor	:	5.5 kW (Variable speed motor)

9 Belt Conveyor 1 set

Use	:	Conveying cake to dryer	
Type	:	Trough belt type	
Capacity	:	Max. 65 t/h (wet basis)	
Dimension	:	Belt width	700 mm
		Length	20,000 mm
Motor	:	5.5 kW IM	

10 Dryer 1 set

Use	:	Drying of cake
Type	:	Dispersion dryer
Capacity	:	48 t/h (dry basis)
Dimension	:	Diameter 2,250 mm
		Length 6,300 mm
Motor	:	200 kW IM

11 Suspension Preheater 1 set

Use	:	Heat exchange between raw meal and hot gas
Type	:	2-stage suspension preheater
Capacity	:	600 t/d
Dimension	:	

Size of tower

10,000 mm x 10,000 mm x 32,500 mm height

Diameter of cyclone shell

C1	4,160 mm
C2	2,500 mm

12 FAn (IDF) 1 set

Use	:	Preheater
Type	:	Turbo fan
Capacity	:	2,700 m^3/min at 180°C
Pressure	:	550 mmAq
Motor	:	380 kW DCM
Accessories	:	Suction damper with actuator

13 Dust Collector 1 set

Use	:	Preheater exhaust gas
Type	:	Cyclone type dust collector
Capacity	:	2,700 m^3/min at 180°C
Dimension	:	Diameter of cyclone 2,500 mm
Nos. of cyclone	:	8
Accessories	:	Screw conveyors, bucket elevator, rotary valve, dust tank, pneumatic conveyor

14 Fan 1 set

Use	:	Exhaust gas
Type	:	Turbo fan
Capacity	:	3,000 m^3/min at 150°C
Pressure	:	300 mmAq
Motor	:	230 kW IM
Accessories	:	Suction damper with actuator

15 Kiln (No.3 kiln modification) 1 set

Consisting of:
- Shortening of kiln shell by 20 m in length at the feed end side
- Increase of kiln rotation speed from max. 1 rpm to max. 1.5 rpm
- Replacement of No.5 tire with new one
- Brick works and steel works

16 Fan 1 set

Use	:	No.1 air compartment of clinker cooler
Type	:	Turbo fan
Capacity	:	230 m^3/min at 30°C
Pressure	:	400 mmAq
Motor	:	30 kW IM
Accessories	:	Suction damper with actuator

17 Fan 3 sets

Use	:	No.2 and No.3 air compartment of clinker cooler
Type	:	Turbo fan
Capacity	:	1,160 m^3/min at 30°C
Pressure	:	300 mmAq
Motor	:	90 kW IM
Accessories	:	Suction damper with actuator

18 Clinker Cooler (Modification) 1 set

Consisting of:
- Modification of air compartments increase from 1 to 3
- Replacement of a half of grate plates
- Renovation of grate frames

19 Dust Collector 1 set

Use	:	Cooler exhaust air
Type	:	Cyclone type dust collector
Capacity	:	480 m^3/min at 160°C
Dimension	:	Diameter of cyclone 330 mm
Nos. of cyclone	:	12
Accessories	:	Screw conveyor, rotary valve

20 Belt Conveyor 1 set

Use	:	Clinker transportation to clinker storage
Type	:	Trough and heat resisting belt type
Capacity	:	40 t/h
Dimension	:	Width 600 mm
		Length 7,200 mm
Motor	:	1.5 kW GM

21 Belt Conveyor 1 set

Use	:	Clinker transportation to clinker storage
Type	:	Trough and heat resisting belt type
Capacity	:	40 t/h
Dimension	:	Belt width 600 mm
		Length 70,600 mm
Motor	:	7.5 kW GM

22 Packer 1 set

Same as the basic plan

23 Instrument 1 set

System : Analogue signal system
Signal : DC 4 - 20 mA
Measuring points and principle:

- temperature	11 - thermocouple
	1 - pyrometer
- pressure	8 - transmitter
	10 - pressure gauge

- material flow	1 - load cell
	2 - swing time flow switch
- hopper level	1 - paddle switch
	1 - load cell
	2 - ultrasonic monitor
- damper position	2 - potentiometer
- machine speed	3 - tachogenerator
- indicator	7 - moving coil type
- recorder	3 - pen type
	3 - multipoints type

24 Electrical Equipment 1 set

(1) Operational panel

Type	:	Steel-made, self-standing
Dimension	:	Width 2,000 mm x 2 sets
		Depth 600 mm
		Height 2,000 mm
Mounting	:	Graphic board, pushbuttons, indicators, recorders, annunciators

(2) Motor starter panel

Type	:	Steel-made, self-standing
Dimension	:	Width 5,000 mm
		Depth 450 mm
		Height 2,100 mm
Mounting	:	Breakers, relays, timers, terminal blocks

(3) Cable & wire

Kind	:	Vinyl sheath insulated
Size	:	2 - 100 mm^2

VI.4.7 Standards

The technical standards to be applied in this alternative plan are the same as those of the basic plan.

VI.4.8 Estimate of investment cost

The estimate of investment cost for this alternative plan is summarized in Table 6-5 (1) and Table 6-5 (2). The premises for calculation of the investment cost are basically the same as those of the basic plan.

Table 6-5 (1) Estimate of Investment Cost (Alternative 1/2)
(Plant Machinery and Equipment)

Item No.	Q'ty	Item description	Foreign	Local	Cost (in 10^3 Kyats)		
					Foreign	Local	Total
1	1	No.2 Raw Mill Shell	o	o	2,071	1,411	3,482
2	2	Slurry Pump	o	o	242	163	405
3	3	Filter Press	o	o	9,510	6,578	16,088
4	3	Slurry Pump	o	o	387	258	645
5	3	Slurry Pump	o	o	646	430	1,076
6	3	Belt Conveyor	o	o	1,292	879	2,171
7	1	Box Feeder	o	o	1,346	911	2,257
8	1	Weigher	o	o	323	216	539
9	1	Belt Conveyor	o	o	269	181	450
10	1	Dryer	o	o	4,210	2,930	7,140
11	1	Suspension Pre-heater	o	o	5,209	3,586	8,795
12	1	Fan (IDF)	o	o	2,099	1,400	3,499
13	1	Dust Collector	o	o	3,098	2,098	5,196
14	1	Fan	o	o	1,076	717	1,793
15	1	Kiln (No.3 Kiln Modification)	o		1,023	687	1,710
16	1	Fan	o	o	83	57	140
17	1	Fan	o	o	216	145	361
18		Clinker Cooler (Modification)	o	o	286	483	769
19	1	Dust Collector	o	o	205	140	345
20	1	Belt Conveyor	o	o	166	112	278
21	1	Belt Conveyor	o	o	415	281	696
-	1	Spare parts	o		2,153	0	2,153
-		Contingency	o	o	3,798	1,195	4,993
Total					40,123	24,858	64,981

Table 6-5 (2) Estimate of Investment Cost (Alternative 2/2)

(Auxiliary and Service Equipment)

Item No.	Q'ty	Item description	Foreign	Local	Cost (in 10^3 Kyats)		
					Foreign	Local	Total
14	1	Packer	o	o	269	180	449
15	1	Instrument	o	o	1,346	894	2,240
16	1	Electric Equipment	o	o	3,988	2,651	6,639
-	1	Water Supply Equipment	o	o	155	102	257
-	1	Laboratory Equipment	o	o	269	180	449
-	1	Renovation of Existing Equipment	o	o	1,615	1,083	2,698
-	1	Spare Parts	o		392	0	392
Total					8,034	5,090	13,124

CHAPTER VII PLANT ORGANIZATION AND OVERHEAD COST

VII.1 Administration of the Plant

VII.1.1 Present organization

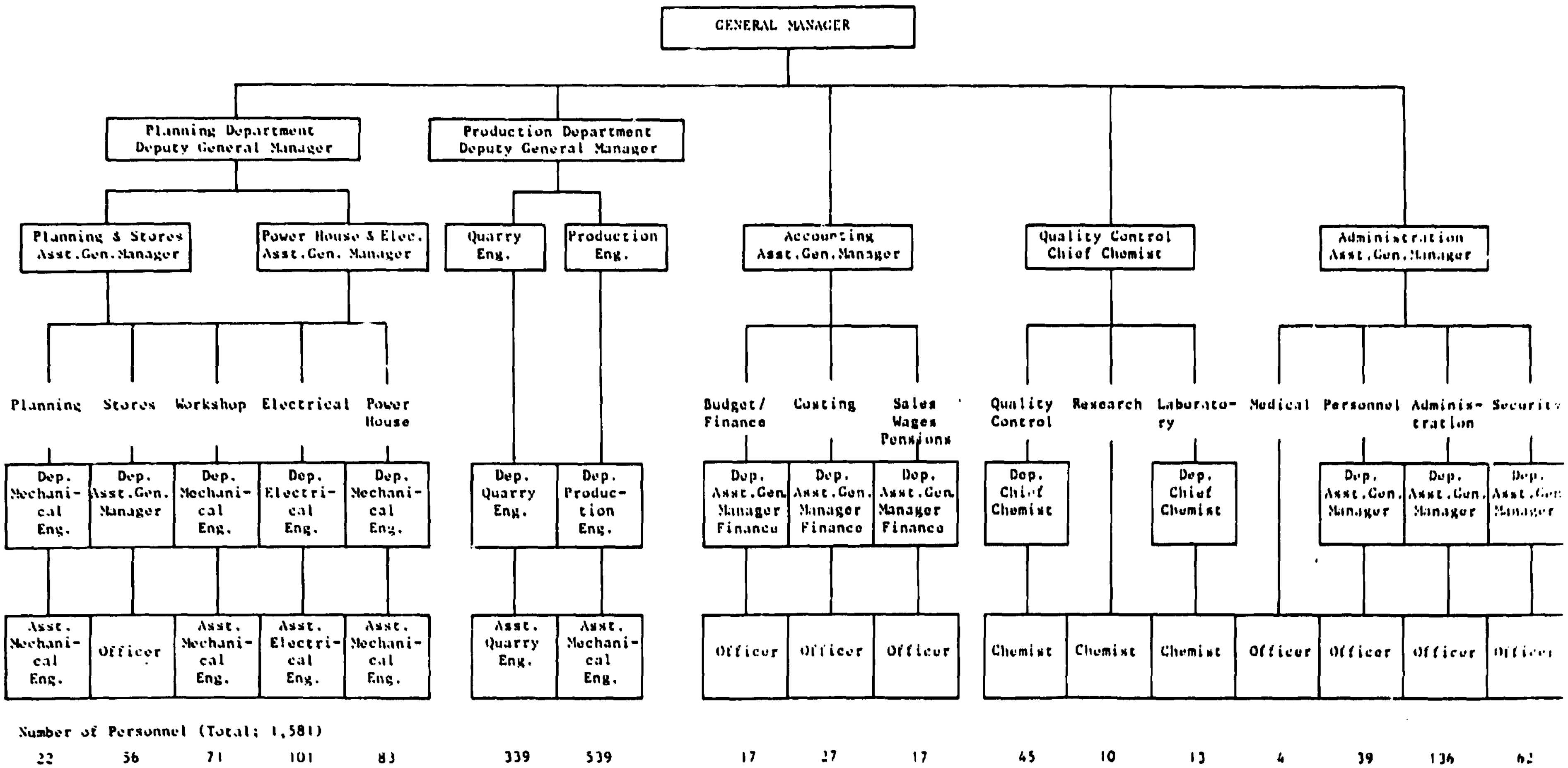
This plant has been planned to operate with a total working personnel of 1,619 under the manning programme shown in Table 7-1 Manning Organization Chart of Thayet Plant. The plant, however, is presently operated actually with a total working personnel of 1,249 under the same organization. From this fact and extremely low productivity per capita of cement, it can be said that the existing plant could be operated by the present number of personnel. Discussion on the present manning programme are made below.

(1) The total number of working personnel can be said to be extremely large, because yearly cement productivity per capita is only 185 tonnes at the rated plant output.

(2) The fact that the administration department has many employees seems due to its many security staff of 62 persons. It seems to be necessary for the plant to have such number of security staff for self defense against the condition surrounding the plant.

(3) As usually applied to many cement plants at present, the routine maintenance is carried out by the planning department staff who are separated from the operation staff. In this point it can be said that the present organization regarding the maintenance work is modernized to ensure such work to be planned and executed by skilled experts.

Table 7-1 THAYETMYO CEMENT PLANT
Organization Chart
(as of 1985)



Source: CIC, Rangoon

However, a number of personnel engaged in the maintenance work seems to be rather small compared with ones in the production department.

VII.1.2 Number of employee by rank

The present number of employee of the plant is classified by rank as shown in the following Table 7-2.

Table 7-2 Number of Employee by Rank
(As of October, 1987)

(Unit: Person)

Category	Nos. of employee		
	Set-up	Appointment	Vacancy
General Manager	1	1	0
Deputy General Manager	2	1	1
Assist. General Manager & Chief Chemist, Accountant	9	9	0
Deputy Assist. General Manager & Deputy Chief	27	24	3
Assist. Manager, Engineer, Accountant, Chemist	33	25	8
Technician (Grade 10) & Clerical (Grade 4)	65	65	0
Technician (Grade 8) & Clerical (Grade 3)	116	110	6
Technician (Grade 6) & Clerical (Grade 2)	209	188	21
Technician (Grade 5)	290	251	39
Technician (Grade 4)	274	253	21
Technician (Grade 3)	42	41	1
Technician (Grade 2)	233	133	100
Technician (Grade 1)	175	105	70
Apprentice	143	43	100
Total	1,619	1,249	370

According to the table, the present number of appointed technicians ranked in the lower grades is much less compared to the set-up number of employees. From the fact that the plant has been practically operated by this large vacancy of employee, it can be said that the plant can be expected to be operated by the present number of employee even after completion of the project.

VII.1.3 Recommendation on administration

According to the project engineering plan (refer to Chapter V), only the old-aged No.1 kiln will be newly replaced together with several auxiliary facilities. The present administration system will, therefore, basically not be required to be changed. However, in order to operate the plant under good and stable condition after completion of the project, the following recommendation is made for improvement of the administration of the plant.

(1) Maintenance management

The purpose of maintenance management is to improve operation efficiency as well as to reduce maintenance and repair costs. The maintenance management should be conducted by fully considering both long term and short term economy.
The basic approach to maintenance management should not be changed regardless whether the project is executed or not, but it will be necessary to provide training for operators, and to prepare maintenance standards and maintenance system incorporating the following points.

. Operation and maintenance personnels must be fully familiar with the construction, characteristics and capacity of all pieces of equipment.

- To understand the life cycle of the spare parts of all machinery and equipment, also prepare an inspection standard (inspection point, period, method, qualified inspector and necessary action) classified into daily inspection and periodical inspection.

- To prepare a lubrication standard (lubrication point, period, amount & type).

- To prepare an inventory standard for spare parts.

- Since coordination and cooperation between operation department and maintenance department is an important point for upgrading operation efficiency, maintenance efficiency and safe operation, the operation standards and maintenance standards must be prepared by fully considering this point.

- For raw material and cement grinding departments maintenance management must be strengthened and necessary repair must be performed to let them show their potential capacities.

(2) Process operation management

When considering the economic condition, labor condition and technical level of the employee, it is believed that a labor intensive type operation is more desirable than a sophisticatedly computerized operation control system. Because when sophisticated control equipment breaks down, it will affect other process department as well as require a high degree of technology to repair the equipment. Furthermore such sophisticated equipment may require a great amount of inventory for spare parts from foreign countries.

Taking account of the above-mentioned condition, in this project it has been planned to use the conventional type control system with which the employee of the plant is familiar. However, for future efficient operation of this plant, the preparation of proper operation manual and technical training of operating staff are necessary and it is recommended to conduct such training by the present engineers with high technique in the plant. In addition, statistic approach is also recommended to analyze and evaluate the operational results of the plant.

On the other hand, the present quality control system can be said to be sufficient and almost the same as in many cement plants. No change is required in the quality control system.

(3) Safety management

It goes without saying that the safety control should be carried out regardless whether the project is implemented or not. It is natural that the aim of safety control is to do away with all the disasters i.e. not only big disasters but also very minute ones, and to keep the health of employees.

It is, therefore, recommended that the following activities should be promoted.

- To keep the present safety and health programme for managing all matters on safety and health.

- To establish a regulation for safety and health as a basic policy of safety control.

- To establish a standard for safety works by reviewing the operation and maintenance works in the plant from a safety control point of view.

- To recheck and improve all operational and maintenance facilities for preventing danger.

VII.2 Overhead Cost

As mentioned above, no change in the present organization of the plant is required for this project, because only No.1 kiln will be replaced together with auxiliary facilities.
Taking into account this condition, the following basis is applied to the calculation of the overhead costs in the project.

(1) Administration labor cost

Since the organization is expected to be the same as the present one, no additional administration cost is estimated.

(2) Maintenance cost of building and equipment

The same unit cost as the present cost per production of 11.2 Kyat/ton-cement will be applied to the maintenance cost of building and equipment after completion of the project.

(3) Technical assistance cost

No technical assistance is required to the project, because production process to be adopted in the project is familiar to the present staff of of the plant.

(4) Training cost

During erection and commissioning of the plant, training of the staffs by the supplier of machinery and equipment will be necessary. Such training cost is included in the pre-production expenditure.

(5) Royalty for patent

Since there is no patent concerning the production process to be adopted in the project, no royalty is included in the overhead costs.

(6) Royality for raw materials

One Kyat per a hundred cubic feet is considered as limestone and marl royalties which are included in the administration non-labor cost.

(7) Land cost

No land cost both for acquisition and rental is considered.

(8) Insurance cost

Yearly insurance cost of 0.25% of the civil engineering works, machinery and equipment is estimated as the factory overhead cost.

(9) Goods and service tax

The goods and service tax will be imposed on the cement at a rate of 67.2 Kyat/ton-cement equivalent to 20% of the exfactory cement price of 336 Kyat/ton-cement, which is included in the marketing non-labor cost.

(10) Distribution cost

The average distribution cost of 44 Kyat per ton of cement is estimated based on the present cost of distribution, which is included in the marketing non-labor cost.

(11) Depreciation and financial cost

Refer to Chapter IX.

CHAPTER VIII MANPOWER

VIII.1 Manpower Requirement

Manpower requirement is usually divided into two categories, i.e. the labor and the staff. Discussion and description are, therefore, made respectively as below.

VIII.1.1 Requirement in each phase

As already described in Chapter V, in this project only machinery and equipment of the No.1 kiln burning department will be replaced as well as auxiliary facilities in other processes. Additional manpower requirement is, therefore, limited to the new project scope. In addition, only unskilled labors are required to be newly recruited, because the manufacturing process is planned to be the same as the present wet process, and engineers and skilled labors for it have been already allocated in the plant.
When considering the above situations, it can be said that both in pre-production phase and operational phase, labors shown in the allocating plan in Chapter VIII.1.3 is only required for the project but no staff is required.

VIII.1.2 Qualification and recruitment

No special skill and experience in the cement manufacturing field is required for labors to be newly recruited for the project due to the afore-mentioned reasons. It is, however, desirable for the project to recruit labors from high school graduates having quick understanding capabilities in industries. Of course it is necessary to conduct the training of labors on many items such as process technology, operation method, maintenance and so on.

On the other hand, it seems easy to recruit necessary number of labors from high school graduates because the Thayet cement plant is the main industry in the Township.

VIII.1.3 Manpower allocating plan

Based on the above consideration on manpower requirement, the manning plan after completion of the project was prepared.
According to this plan, the total number of employee is increased by 50 from present 1,249 to 1,299. However totally set-up number of employee is planned to remain as it is, since the plant has been operated for a long time with a large number of vacancy of employees.

(1) Organization after completion of the project

Basically no change in organization of the plant is required, however, recommendation described in Chapter VII.1.3 should be minded.

(2) Manning plan after completion of the project

The following employees should be newly added to the present production department for No.1 kiln operation.

- Operator 2 persons/shift x 5 crews/shift
- Burner master 1 persons/shift x 5 crews/shift
- Patroller 7 persons/shift x 5 crews/shift
- Total 50 persons

The above figures are considered to be somewhat high in comparison with those of industrialized countries, but are assumed to be reasonable taking into account the non-centralized control system of the existing plant.

The additional employee is classified by rank as follows:

Category	Nos. of employee
° Technician (Grade 8)	5
° Technician (Grade 6 & 5)	45
° Total	50

VIII.1.4 Other staffing plan

Since the scope of the project is limited to only replacement of the existing production line 1, neither special supervisory and managerial staff nor technical assistance by foreign experts is considered for the project. Only supervisory services by the foreign equipment supplier during erection and commissioning are considered, which cost is included in the machinery and equipment cost item.

VIII.2 Cost of Manpower

Wages and salaries including benefits and social security contribution of the present employee are shown in the following table.

Table 8-1 Wages and Salaries

(Unit: Kyat/month)

	Pay scale	Special Allowance
General Manager	1300 - 1400	120 - 130
Deputy General Manager	1000 - 1200	110
Assist. Factory Manager	800 - 1000	100
Deputy Assist. Manager	500 - 800	90
Head of Division	450 - 700	90
Technician (Grade 10)	400 - 520	90
Technician (Grade 9)	360 - 480	85
Technician (Grade 8)	320 - 440	85
Technician (Grade 7)	260 - 380	80
Technician (Grade 6)	210 - 330	80
Technician (Grade 5)	160 - 230	80
Technician (Grade 4)	150 - 220	75
Technician (Grade 3)	130 - 200	75
Technician (Grade 2)	125 - 150	70
Technician (Grade 1)	110 - 125	70
Apprentice	100 - 110	70

Source: Pharmaceutical Industries Corporation

According to the manning plan and the rate of wages and salaries, the additional cost of manpower for the project is calculated and summarized as below. This cost is included in the direct labor cost item.

Table 8-2 Cost of Manpower

Category	Nos. of employee	Wages & Salaries	Annual amount to be paid (Kyat)
Technician (Grade 8)	5	400	24,000
Technician (Grade 6)	10	270	32,400
Technician (Grade 5)	35	200	84,000
Total	50	-	140,400

CHAPTER IX IMPLEMENTATION SCHEDULE

IX.1 Preparation Work

Prior to conclusion of the contract between the equipment suppliers and CIC, the following preparation work is necessary.

(1)	Financing arrangement	3 months
(2)	Preparation of tender documents	2 months
(3)	Preparation of tender by contractor	2 months
(4)	Evaluation of tender	2 months
(5)	Negotiation and award of contract	3 months
	Total	12 months

When the contract can be expected to be awarded to the suppliers having sufficient technology and extensive experiences on cement manufacturing by wet process, it is not necessary that consultants be hired to perform the preparation work and to supervise the construction. Discussion and description on type of the contract are made below.

Various types of contract can be considered, but the scope and conditions of the project should be taken into account.

Since the construction should be carried out considering operation of the existing No.2 and No.3 lines, a turn-key basis contract can be said unsuitable for this project. If equipment is procured from different sources by CIC itself, a large number of persons is required to control and administer the work responsibility, construction schedule and future spare parts management, and this would place an excessive load onto the Thayet plant business management. Under a cost-plus-fee contract, many possible risks would be imposed on CIC in case of work delay or occurrence of unexpected problems.

As a result of the above consideration, a type of contract that the supplier should deliver the equipment on CIF basis, inclusive of supervisory services during construction and commissioning of the plant, is most desirable for this project from the following reasons:

(1) This type of contract is most economical when capable local contractors with sufficient experience can be found.

(2) This type is also effective from the viewpoint of technical transfer to a local partner.

Therefore, in this implementation schedule a local contractor, namely Construction Corporation (CC), is considered to be assigned for construction of the plant. Of course it is necessary for effective execution of the project that roles and responsibilities among the equipment suppliers, CIC and CC must be clearly defined before commencement of the work.

IX.2 Breakdown of Work

In order to implement this project, it is necessary to clarify and breakdown the work to be performed in Burma and the work to be performed in overseas countries.

IX.2.1 Local portion

(1) Civil and building construction

All civil engineering works and building construction works, excluding design and supply of steel construction materials.

(2) Mechanical work

Installation of machinery and equipment, installation of prefabricated equipment (hopper, duct, chute, pipe, etc.) and supply of small parts.

(3) Electrical work

Installation of electrical equipment and execution of cable wiring.

(4) Others

Execution of temporary work, supply of heavy equipment and construction materials (cement, sand, brick, etc.), and management of work and materials as well as installation of materials and equipment necessary for the work which are not included in the overseas portion.

IX.2.2 Overseas portion

(1) Civil and building construction

Design, supply of steel construction materials and supervision.

(2) Mechanical work

Design and supply of machinery and equipment, supply of prefabricating materials (hopper, duct, chute, pipe, etc.) and supervision.

(3) Electrical work

Design and supply of control panel, motors, instruments, lighting facilities, wiring materials, etc. and supervision.

IX.3 Work Schedule

The work schedule may be broken down into the indirect work to be conducted in overseas countries, including design, determination of specification and procurement of machinery and equipment, and the direct construction work to be conducted locally.

(1) Indirect work

The indirect work includes design together with procurement of materials, manufacturing, inspection and shipment of machinery and equipment. The machinery and equipment supplied from overseas countries are expected to be delivered in one shipment to the site 12 months after designing is commenced.

(2) Direct construction work

The direct construction work includes civil engineering work, inland transportation, mechanical and electrical installation work, trial runs and commissioning.
The first work of the direct construction work, after the Construction Corporation staff are mobilized to the site, will be disassembling and removal of No.1 kiln and associated equipment (brick lining, shell, roller, etc.) which is expected to start in the third month after mobilization and to last about 4 months.

Civil construction is expected to take 6 months, and mechanical installation work is expected to start in the 4th month after commencement of civil construction and is expected to be completed in 8 months. Electrical installation work will progress parallel with mechanical work and the last one month will be the testing period for both mechanical and electrical equipment. During this test period, electrical connection for both power and control will be carried out to the existing power source, therefore, both No.2 and No.3 kilns should be shut down during this period.
Commissioning is expected to be completed within 3 months, therefore, the commercial operation can be expected to start in the 24th month after award of contract to the equipment supplier.
In the above schedule, local conditions concerning construction work which is thought to require a little longer time than in industrialized countries is taken into consideration.
The bar chart of project implementation is shown in Fig.9-1.

(3) Construction during operation

As above described, the construction work is planned to be carried out while the existing No.2 and No.3 kilns are in operation. Therefore, in order to prevent troubles between plant employees and construction workers, it is recommended to provide a proper area where temporary equipment for construction be located.
In addition, security work should be provided to protect power supply cables against being damaged during construction period.

IX.4 Responsibilities of Work

It goes without saying that this project should be implemented under the overall responsibility of the CIC personnel assigned. Each work, however, will be carried out practically under the following responsibilities of parties concerned.

(1) Preparation work

CIC is expected to be responsible for the implementation of the preparation work described in Chapter IX.1.

(2) Civil work

It is expected that CC will execute the civil work. The details of the civil engineering drawings and plant layout drawings will be provided on the equipment supplier's responsibility.

(3) Construction work

It is planned that CC will carry out mechanical and electrical installation. The equipment suppliers are, however, considered to be responsible for supervising such installation work and commissioning of machinery and equipment.

(4) Trial runs

The trial runs will be carried out according to the agreement between CIC and CC, then the machinery and equipment will be handed over to the CIC personnel who are responsible for commercial operation of the plant.

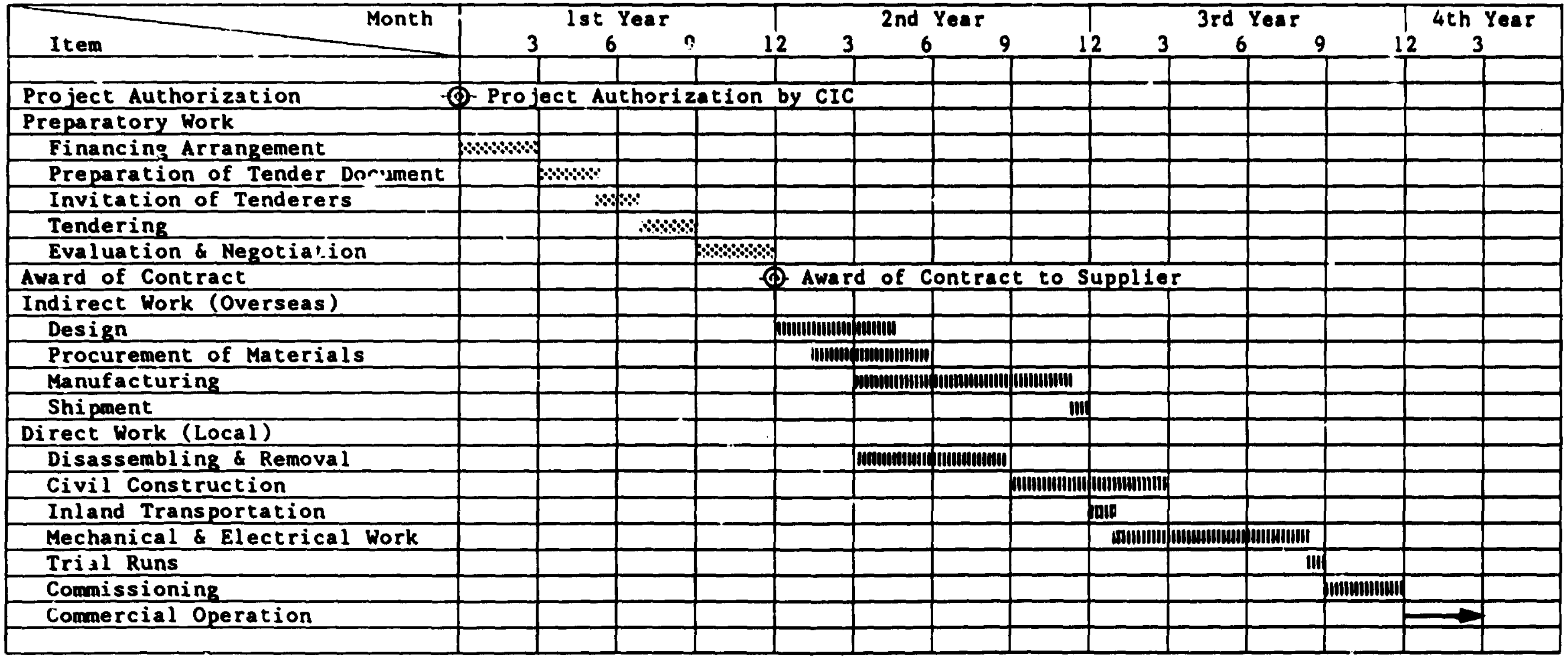
IX.5 Staff Build-up

As described in Chapter VIII, only additional labors of 50 persons will be required for operation of the plant. It is expected that these labors be employed before commencement of the trial runs of machinery and equipment.

IX.6 Payment

It is planned that machinery and equipment cost will be covered by a foreign loan, while construction cost, pre-production expenditure and working capital will be financed by a local loan. Therefore, the civil engineering work and construction will be paid by local currency, whereas machinery and equipment price and supervising fee will be paid by foreign currency. 5% of machinery and equipment price including freightage is added as contingency to the sum of machinery and equipment price. No other contingencies are expected.

Fig. 9-1 Schedule of Project Implementation



CHAPTER X FINANCIAL EVALUATION

X.1 Conditions and Method of the Project Evaluation

The project evaluation was carried out with the following conditions put into the COMFAR computer programme developed by UNIDO. The obtained outputs such as internal rate of return (IRR), income statement, cash-flow table, etc. are attached hereto as an integral part of this report.

X.1.1 Conditions

(1) Investment cost

Only the investment cost newly required for this project was considered, disregarding the values of the existing equipment commonly used in the project, which would be able to be considered as 'hypothetical investment', because such equipment is of little or no value if the project is not implemented.

(2) Production cost

(a) Variable cost

The variable costs shown in Table 4-15 were considered.

(b) Fixed cost

The following fixed costs were considered:

- Direct labor cost required additionally for the project

- Factory overheads consisting of the depreciation of the new assets and the financial cost of the new investment, the insurance premium for the new assets, and the royalty for the limestone extraction

The direct labor cost, factory overheads and administrative overheads of the existing plant operation were not taken into account, because these will remain the same, irrespective of whether the project is implemented or not.

(3) Working capital

Although the existing plant provides a lot of capital for inventory and materials, taking into account the increase of production capacity by 200 tpd, the following additional working capital is considered to be required for the project.

(a) Foreign currency

- Coverage of consumption of fire brick, grinding ball and mill liner planned to be procured from foreign countries for 6 months

(b) Local currency

- Coverage of consumption of raw materials for 10 days

- Coverage of consumption of lubricating and diesel oil for 3 months

(4) Revenue

Calculation was made based on the revenue discussed and shown in Chapter III.5.2 and Table 3.17.

(5) Source of finance for the new investment

(a) Foreign currency

Because of the scarcity of the foreign currency reserves in Burma, no commercial loan was considered. Instead, a soft loan of the following conditions was considered.

- interest rate : 2.5%/annum
- grace period : 10 years
- repayment : in 20 equal yearly installments

(b) Local currency

As instructed by the project office in Rangoon, no equity is considered and the source of finance is from a local loan of the following conditions:

- interest rate : 5%/annum
- grace period : none
- repayment : in 5 equal yearly installments

X.1.2 Summary of the input data to COMFAR

(1) Investment cost

The total investment cost is summarized in the following table.

Table 10-1 Summary of Input Data to COMFAR

(Unit: Thousand Kyats)

			Foreign	Local	Total
Land			0	0	0
Site preparation			0	0	0
Civil work (machine foundations)			83	805	888
Building			0	42	42
Incorporated fixed assets			0	0	0
Plant Machinery & Equipment	FOB price		22,032	0	22,032
	Spare parts		306	0	306
	Freight & insurance		3,827	390	4,210
	Tax & customs duty		0	11,635	11,635
	Erection		0	5,510	5,510
	Contingency		2,190	662	2,852
	Sub-total		28,355	18,197	46,552
Auxiliary and Service Equipment	FOB price		2,806	0	2,806
	Spare parts		165	0	165
	Freight & insurance		474	16	490
	Tax & customs duty		0	1,477	1,477
	Erection		0	701	701
	Sub-total		3,445	2,194	5,639
Pre-production Expenditure	Consultant's fee		0	0	0
	Training		322	34	356
	Test run	Labour	0	69	69
		Material	0	0	0
	Sub-total		322	103	425
Working capital			1,074	248	1,322
Total			33,279	21,589	54,868 (Approx.8.29 Mil.US$)

Table 10-2 Summary of Production and Marketing Cost

No.	Item	Contents	Unit consumption per ton of cement	Unit price (Ks)		Unit cost (Ks/t-cement)		Annual cost for full production (10^3 Ks/annum)		
				Foreign	Local	Foreign	Local	Foreign	Local	Total
1	Raw materials	Limestone	1.2097 t	0	13.23	0	16.58	0	995	
		Clay	0.3722 t	0	13.23	0	5.24	0	314	
		Silica sand	0.0635 t	0	(negligible)	0	0	0	0	
		Iron ore	0.0158 t	0	268.0	0	4.38	0	263	
		Gypsum	0.0600 t	0	328.73	0	20.44	0	1,226	
		Sub-total	1.7212 t	-	-	0	46.64	0	2,798	2,798
2	Utility	Fire brick	2.838 kg	10.1	1.90	28.66	5.39	1,720	323	
		Grinding ball	1.095 kg	3.787	3.257	4.15	3.57	249	214	
		Mill liner	0.215 kg	13.80	6.350	2.97	1.37	178	82	
		Lubricant & diesel oil								
		Lubricant	0.929 l	0	5.24	0	4.87	0	292	
		Diesel oil	8.7 l	0	0.55	0	4.79	0	287	
		Paper bag	21.5 bag	0	4.14	0	89.01	0	5,341	
		Electric power	125 kWh	0	0.20	0	25.00	0	1,500	
		Sub-total	-	15.587		35.78	134.00	2,147	8,039	10,186
3	Energy	Natural gas	6,540 x 10^3 cu.ft	0	2.10	0	13.73	0	824	824
4	Labour (direct)	addition only	50 man	-	233 man month	0	2.33	0	140	140
5	Maintenance	including repair	-	-	-	-	11.20	168	504	672
6	Factory overheads	Insurance premium for the new equipment				-	1.38	0	83	83
		Depreciation of the new assets						to be calculated by COMFAR		
7	Administration labour					-	-	0	0	0
8	Administration non-labour	Royalty for extraction of limestone				0	0.215	0	13	13
		Cost of finance for new investment						to be calculated by COMFAR		
9	Marketing labour					-	-	0	0	0
10	Marketing non-labour	Goods and Service tax				0	67.32	0	4,039	4,039
		Selling and distributing cost				0	44.0	0	2,640	2,640
	Total					35.78	320.82	2,315	19,080	21,395

(2) Revenue

The annual revenue is calculated for each year respectively as shown in the following table.

Table 10-3 Annual Revenue

	1991	1992	1993-2005
Annual sales volume	48,000 t	54,000 t	60,000 t
average selling price at three depots (Ks/t)	492.22	492.22	492.22
annual revenue (10^3Ks)	23,620	26,580	29,533

X.1.3 Result of calculation

Results of calculation for the input data stated in the foregoing is summarized as follows:

(a) IRR: 10.97%

(b) Pay-back period: 7.1 years

(c) Break-even point (in Year 3): 62.1% (37,300 t/y)

Sensitivity analysis was carried out on IRR and the break-even point in the following cases:

Table 10-4 Results of Sensitivity Analysis

Case	Variation	IRR (%)	Break-even point	
			Operation rate (%)	Annual production(t/y)
1	Up production cost by 10%	8.32	74.7	44,800
2	Down production cost by 10%	13.45	52.9	31,700
3	Up investment cost by 10%	9.65	67.5	40,500
4	Down investment cost by 10%	12.52	56.5	33,900
5	Up sales price by 10%	15.79	46.5	27,900
6	Down sales price by 10%	5.42	93.3	56,000
7	Import tax free (equivalent to decrease in total investment cost by 24.8%)	15.40	47.2	28,300

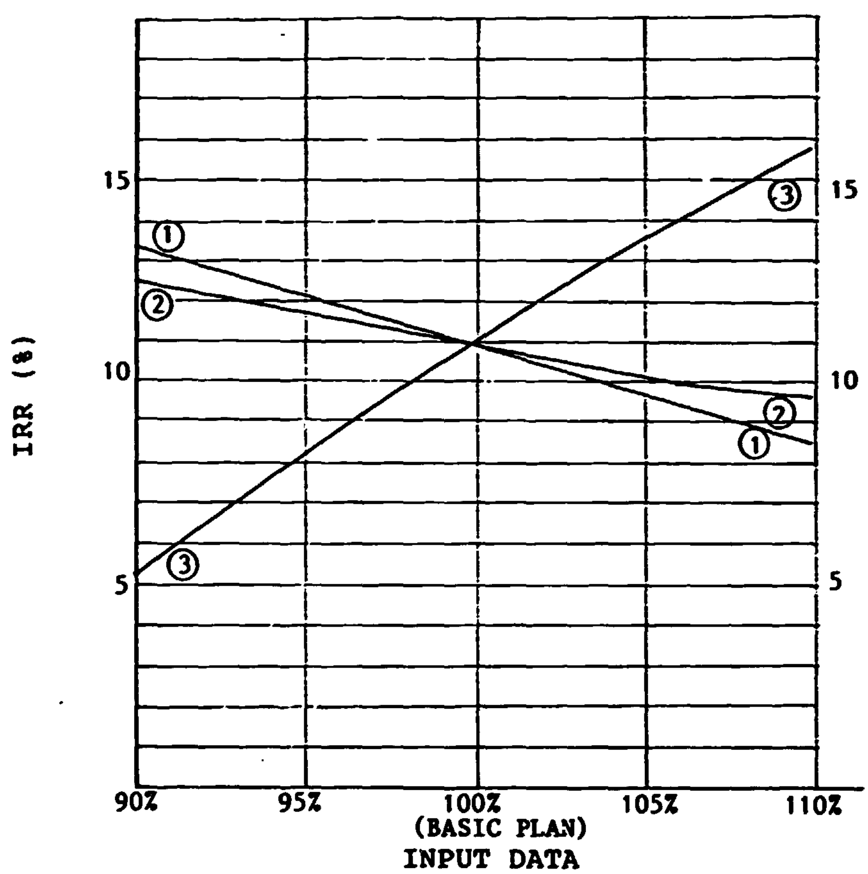
Each case number is corresponding to the index of COMFAR programme as follows:

Table 10-5 Index of COMFAR Programme

Case	Index of COMFAR	Remarks
-	BURMA 0	Basic case
1	BURMA 1	Up production cost by 10%
2	BURMA 2	Down production cost by 10%
3	BURMA 3	Up investment cost by 10%
4	BURMA 4	Down investment cost by 10%
5	BURMA 5	Up sales price by 10%
6	BURMA 6	Down sales price by 10%
7	BURMA 7	Import tax free
8	BURMA 8	Alternative plan
9	BURMA 9	Forecast of existing plant
10	BURMA E	For economic analysis

The COMFAR output summary sheets for all the above cases are attached hereto.
Also shown is a graphic illustration of IRR sensitivity analysis. (See Fig. 10-1.)

Fig. 10-1 Sensitivity Analysis on IRR



Note:

① - Production cost

② - Investment cost

③ - Sales price

X.2 Examination of the Existing Plant's Financial Viability after Implementation of the Project

X.2.1 Necessity of the examination

Even if the project itself is financially viable, it is meaningless unless the Thayet cement plant as a whole is financially viable after implementation of the project. To examine this point, the existing plant's financial status in case of the project being not implemented was forecast for the life of the project. Such forecast was made on the following conditions: No.2 and No.3 kilns (nominal capacity being 400 t/d each) yearly produce 120,000 tons of cement in total without any investment to renovate them.

- Production and marketing unit costs are the same as used for the financial evaluation of the project, except the fuel cost. (The fuel cost for the project was estimated lower than those consumed by these old kilns.)

- Direct labour cost, factory overheads and administrative overheads are almost same as those of F.Y. 1985/86. (Of course, the depreciation and the cost of finance are made different from year to year.)

- The average selling price and the marketing and distribution cost per ton of cement are the same as used for the project evaluation.

- According to the commitment made already, interest of the existing loan will be paid and repayment of the loan made.

From the above forecast made by using COMFAR, it can be found whether the Thayet cement plant is viable or not if the project is not implemented. Furthermore, by adding the project's income statement to that of the said forecast, it can be clearly understood whether the project can improve the financial status of the Thayet cement plant.

X.2.2 Result of the forecast and examination

The result of the forecast of yearly net profit is shown in Fig. 10-2. From this result, it is known that:

(1) The existing plant will suffer from deficit or almost no profit until 1997, but will make profit of 6 to 7 million Kyats per year from 1997, which is about twice as much as that of F.Y. 1985/86.

(2) The project will improve the profitability of the existing plant.

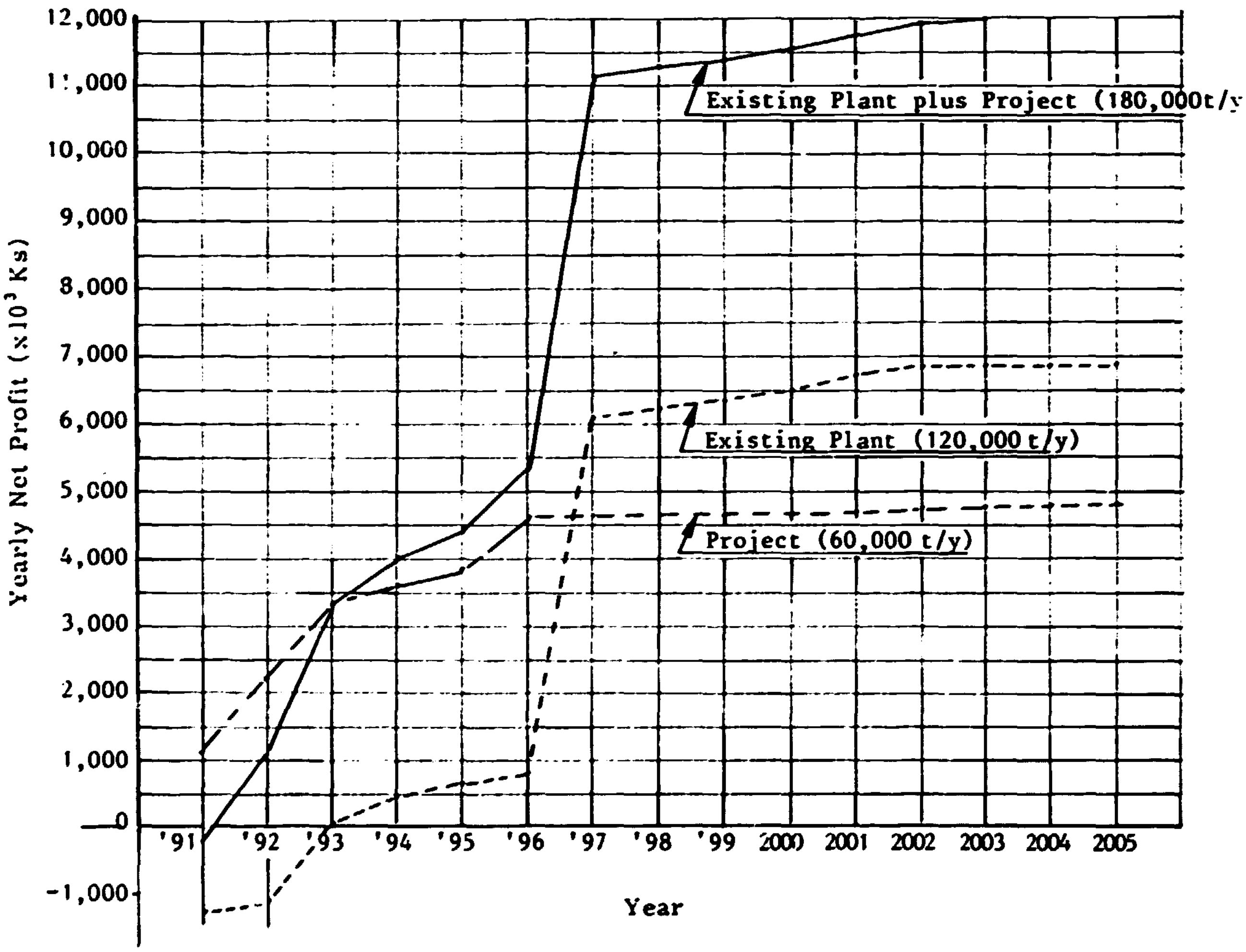
(3) Though not indicated by the graph in Fig. 10-2, the existing plant will suffer from yearly deficit of about 5 million Kyats in 1989 and 1990 respectively, which is considered to be very much likely according to the COMFAR calculation. In addition, it is suggested that the plant will suffer from much deficit in 1988, though the figure is not included in the computer output. But the plant will be able to endure all the said deficit, owing to the accumulated profit (reserves).
A sharp decrease of the depreciation is the reason why the net profit will increase suddenly in 1997.

(4) Furthermore a cost comparison table may better explain the effect of the project to the plant's net profit. (See Table 10-7.)

X.2.3 Evaluation of the result

As seen and explained above, the project is judged to be financially viable.

Fig. 10-2 Forecast of Yearly Net Profit Evolution



X.3 Cement Price in Neighboring Countries

Since the cement price is controlled in Burma as described in Chapter II, profitability of the cement industry may be ensured in a "within Burma" context. Therefore, reference was made to cement prices in several neighboring countries as follows to evaluate the controlled cement price in Burma.

Table 10-6 Cement Price in Neighboring Countries

Country	Cement Price		
	Price Base	Unit Price (per ton cement)	Converted Unit Price (K/t-cement)
India	Market price	Rupee 1,300-1,400	660-711
	'Levy' cement price (cement to be purchased by the government by quota)	Rupee 1,000	508
Thailand	Ex-factory price	Baht/t 1,535	398
Indonesia	Market price	Rupiah 82,300-87,200	330-350
	*1) Do. (in 1986)	Rupiah 78,100 (69.1 US$)	457.4
Hong Kong	Ex-factory price	HK$ 380-400	322-339

Source: Onoda Engineering and Consulting Co., Ltd.

Note:
1. The exchange rate of Indonesian Rupiah to US$ was devalued in 1986 from 1,130 Rp./US$ to 1,645 Rp./US$.
2. Unless otherwise mentioned, the price is of 1987 and of bagged cement.
3. The conversion of the respective prices into Burmese currency was made according to the exchange rates in Table 10-8.

Judging from the above data, the cement price in Burma can be said to be within a reasonable range, and therefore, no adjustment is needed for financial evaluation.

Table 10-7 Comparison of Total Cost of Cement by Case

(Unit: Kyat/t-cement)

Item \ Case \ Year	F.Y. 1985/86	Year 3 (1993)			Year 7 (1997)		
	Actual	Project	Without Project	With Project	Project	Without Project	With Project
Production cost *1)	339.1	245.3	301.5	282.8	245.3	301.5	282.8
Depreciation		53.7	56.5	55.6	44.3	3.0	16.8
Financial cost	32.3	26.2	33.5	31.1	14.5	26.2	22.3
Goods & Service Tax	67.3	67.3	67.3	67.3	67.3	67.3	67.3
Ex-factory cost	438.7	392.5	458.8	436.8	371.4	398.0	389.2
Average selling & distribution cost	44.0	44.0	44.0	44.0	44.0	44.0	44.0
Average cost at depots in Rangoon, Mandalay and Myede	482.7	436.5	502.8	480.8	415.4	442.0	432.2

Note: 1. The figures exclude depreciation, financial cost and goods & service tax.

Table 10-8 Certified Average Exchange Rates
(As of October 1987)

1.	Australian Dollar	A.$	1 = K	4.7710
2.	Austrian Schilling	A.Sch	1 = K	0.5123
3.	Bangladesh Taka	B.Taka	1 = K	0.2144
4.	Belgian Franc B.Fr	B.Fr	1 = K	0.1734
5.	Canadian Dollar	Can $	1 = K	5.0484
6.	Chinese Yuan	RM6	1 = K	1.7843
7.	Czechoslovak Crown	Cze.Cr	1 = K	1.2036
8.	Danish Kroner	D.Kr	1 = K	0.9359
9.	Deutsche Mark	DM	1 = K	3.6500
10.	East German Mark	E.G.M	1 = K	3.6033
11.	Egyptian pound	Egypt £	1 = K	2.9782
12.	English pound	£	1 = K	10.8000
13.	Finland Markka	Finn Mark	1 = K	1.4990
14.	French Franc	F, Fr	1 = K	1.1000
15.	Greek Drachma	G.D	1 = K	0.0471
16.	Hong Kong Dollar	H.K.$	1 = K	0.8478
17.	Indian Rupee	I.Rs	1 = K	0.5075
18.	Israel Shekel (New)	I.S	1 = K	4.1284
19.	Indonesian Rupiah	I.Rupiah	100 = K	0.4012
20.	Italian Lira	I.L	100 = K	0.4992
21.	Japanese yen	J.¥	100 = K	4.6000
22.	Korean won (South)	K.Won	100 = K	0.8215
23.	Kenyan Shilling	K.Sh	1 = K	0.3926
24.	Laosian Kip	L.K	1 = K	0.1891
25.	Malaysian Dollar Ringg;	M.Ring	1 = K	2.6238
26.	Nepalese Rupee	N.Re	1 = K	0.3036
27.	Netherland Guilder Dutch Florin	N.G	1 = K	3.1996
28.	Norwegian Kroner	N.Kr	1 = K	0.9862
29.	New Zealand Dollar	N.Z.$	1 = K	4.3261
30.	Pakistan Rupee	Pak.Re	1 = K	0.3785
31.	Philippine peso	P.Peso	1 = K	0.3213
32.	Singapore Dollar	S.$	1 = K	3.1629
33.	Spanish peseta	S.P	1 = K	0.0543
34.	Sri Lanka Rupee	S.L.Re	1 = K	0.2207
35.	Swedish Kroner	Sw.Kr	1 = K	1.0274
36.	Swiss Franc	S.Fr	1 = K	4.4000
37.	Thai Baht	Th Baht	1 = K	0.2596
38.	U.S.Dollar	US$	1 = K	6.6200
39.	U.S.S.R.Rouble	Rouble	1 = K	10.4896
40.	Vietnam Dong (New)	Dong	1 = K	0.0827
41.	Yugoslav Dinar	Y.D	1 = K	0.0075

Tab: BURMAO : Text Variables

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Project Name: Mini-cement Plant project, Thayet,Burma

Date: December, 1?, 1997, revised

Name of Alternative: DP/BUR/80/015

Accounting currency: Thousand Kyat

Name of Product (A): Portland Cement

(B): Not specified

(C): Not specified

(D): Not specified

(E): Not specified

(F): Not specified

Tab: BURMAO : General Variables

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Multiplier to compute foreign into accounting currency:	1.000
Multiplier to compute local into accounting currency:	1.000
Construction phase: 2 year(s), planned yearly	
Interest rate for computation of future values in % p.a.:	10.000
Percent rate for CF-Discounting:	10.000

Tab: BURMAO : Source of finance - foreign funds

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Equity - O: not specified

Equity - P: not specified

Subsidies : not specified

Loan A: first disbursement in period 1
Amortization: constant principal
lasting for 20 year(s)
paying yearly rates
Period of grace: 10 year(s)
Interests payable: 2.5 % for year 1 through 17

Loan B: not specified

Loan C: not specified

Overdraft: not specified

Tab BURMAO : Source of finance - local funds

COMFAR 2.0 - ECFA. ENGINEERING CONSULTING FIRMS, TOKYO

Equity - O: not specified

Equity - F: not specified

Subsidies : not specified

Loan A: first disbursement in period 1
Amortization: constant principal
lasting for 5 year(s)
paying yearly rates
Period of grace: 1 year(s)
Interests payable: 5.0 % for year 1 through 17

Loan B: not specified

Loan C: not specified

Overdraft: not specified

Tabi BURMAO : Subtable **Initial Fixed Investment - foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 1 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 2 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 3 Structures and civil (a)......	5.00	1.00	0.00	20.00	85.00	0.00	0.00
L 4 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 5 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 6 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 7 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 8 Plant machinery and equipm-(a)	5.00	1.00	0.00	20.00	21452.00	6903.00	0.00
L 9 Plant machinery and equipm-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 10 Auxiliary and service faciliti	5.00	1.00	0.00	20.00	3380.00	165.00	0.00
L 11 Pre-production expenditures...	20.00	1.00	0.00	5.00	0.00	322.00	0.00
L 12 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	1074.00	0.00

Tabi BURMAO : Subtable **Initial Fixed Investment - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 13 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 14 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 15 Structures and civil (a)......	5.00	1.00	0.00	20.00	405.00	400.00	0.00
L 16 Structures and civil (b)......	3.25	1.00	0.00	30.00	42.00	0.00	0.00
L 17 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 18 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 19 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 20 Plant machinery and equipm-(a)	5.00	1.00	0.00	20.00	11635.00	6562.00	0.00
L 21 Plant machinery and equipm-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 22 Auxiliary and service faciliti	5.00	1.00	0.00	20.00	1477.00	717.00	0.00
L 23 Pre-production expenditures...	20.00	1.00	0.00	5.00	0.00	103.00	0.00
L 24 Inventory, working capital....	0.00	1.00	100.00	0.00	0.00	248.00	0.00

Tabi BURMAO : Subtable **Current Fixed Investment - foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Deprec-n %	Depreciati	Scrap - %	Depreciati	Amount- Y1	Amount- Y2	Amount- Y3
L 25 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 26 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 27 Structures and civil (a)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 28 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 29 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 30 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 31 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 32 Plant machinery and equipm-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 33 Plant machinery and equipm-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 34 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 35 Pre-production expenditures...	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 36 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMAO : Subtable **Current Fixed Investment - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Deprec-n %	Depreciati	Scrap - %	Depreciati	Amount- Y1	Amount- Y2	Amount- Y3
L 37 Land..........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 38 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 39 Structures and civil (a)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 40 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 41 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 42 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 43 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 44 Plant machinery and equipm-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 45 Plant machinery and equipm-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 46 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 47 Pre-production expenditures...	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 48 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Initial Fixed Investment - foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Amount- F4	Amount- F5	Amount- F6	Amount- F7	Amount- F8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Initial Fixed Investment - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Amount- F4	Amount- F5	Amount- F6	Amount- F7	Amount- F8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Current Fixed Investment - foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Amount- Y4	Amount- Y5	Amount- Y6	Amount- Y7	Amount- Y8	Amount- Y9	Amount-Y10	Amount-Y11	Amount-Y12	Amount-Y13	Amount-Y14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Current Fixed Investment - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Amount- Y4	Amount- Y5	Amount- Y6	Amount- Y7	Amount- Y8	Amount- Y9	Amount-Y10	Amount-Y11	Amount-Y12	Amount-Y13	Amount-Y14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Production Costs - foreign**

-- COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO -----

Col	1	2	3	4	5	6	7
	Inflator %	Adjust- Y1	Adjust- Y2	Adjust- Y3	Adjust- Y4	Adjust- Y5	Adjust- Y6
L 52 Raw material, annual cost (a).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 53 Raw material, annual cost (b).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 54 Utilities, annual cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 55 Energy, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 56 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 57 Maintenance, annual cost......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 58 Spares, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 59 Factory overheads, annual cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 60 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 61 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 62 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 63 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Standard Production Costs - foreign**

-- COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO -----

Col	1	2	3	4	5	6	7
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 64 Raw material (a)..............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 65 Raw material, unit price (a)..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 66 Raw material (b)..............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 67 Raw material, unit price (b)..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Standa- A	Variat- A	Standa- B	Variat- B	Standa- C	Variat- C	Standa- D
L 68 Utilities, annual cost........	2147.00	100.00	0.00	0.00	0.00	0.00	0.00
L 69 Energy, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 70 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 71 Maintenance, annual cost......	168.00	0.00	0.00	0.00	0.00	0.00	0.00
L 72 Spares, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 73 Factory overheads, annual cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 74 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 75 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 76 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 77 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Foreig- A	Foreig- B	Foreig- C	Foreig- D	Foreig- E	Foreig- F	Local - A
L 78 % of annual depreciation costs	100.00	0.00	0.00	0.00	0.00	0.00	100.00

Tab: BURMAO : Subtable Production Costs - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Adjust- Y7	Adjust- Y8	Adjust- Y9	Adjust-Y10	Adjust-Y11	Adjust-Y12	Adjust-Y13	Adjust-Y14	Adjust-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Standard Production Costs - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Standa- E	Variat- E	Standa- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Local - B	Local - C	Local - D	Local - E	Local - F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Production Costs - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Inflator %	Adjust- Y1	Adjust- Y2	Adjust- Y3	Adjust- Y4	Adjust- Y5	Adjust- Y6
L 82 Raw material, annual cost (a).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 83 Raw material, annual cost (b).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 84 Utilities, annual cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 85 Energy, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 86 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 87 Maintenance, annual cost......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 88 Spares, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 89 Factory overheads, annual cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 90 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 91 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 92 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 93 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable **Standard Production Costs - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 94 Raw material (a)...............	2798.00	100.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 95 Raw material, unit price (a)..	1.00	0.00	0.00	0.00	0.00	0.00	0.00
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 96 Raw material (b)...............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 97 Raw material, unit price (b)..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Standa- A	Variat- A	Standa- B	Variat- B	Standa- C	Variat- C	Standa- D
L 98 Utilities, annual cost........	8039.00	100.00	0.00	0.00	0.00	0.00	0.00
L 99 Energy, annual cost...........	824.00	100.00	0.00	0.00	0.00	0.00	0.00
L 100 Labour (direct), annual cost..	140.00	100.00	0.00	0.00	0.00	0.00	0.00
L 101 Maintenance, annual cost......	504.00	0.00	0.00	0.00	0.00	0.00	0.00
L 102 Spares, annual cost...........	0.00	100.00	0.00	0.00	0.00	0.00	0.00
L 103 Factory overheads, annual cost	83.00	100.00	0.00	0.00	0.00	0.00	0.00
L 104 Administration, labour cost...	0.00	100.00	0.00	0.00	0.00	0.00	0.00
L 105 Administration, non-labour cos	13.00	100.00	0.00	0.00	0.00	0.00	0.00
L 106 Marketing, labour cost........	0.00	100.00	0.00	0.00	0.00	0.00	0.00
L 107 Marketing, non-labour cost....	6679.00	100.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Production Costs - local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Adjust- Y7	Adjust- Y8	Adjust- Y9	Adjust-Y10	Adjust-Y11	Adjust-Y12	Adjust-Y13	Adjust-Y14	Adjust-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Standard Production Costs - local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Standa- E	Variat- E	Standa- F	Variat- F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab BURMAO : Subtable Production Program and Sales - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 110 Yearly production, export - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 111 Unit price, export product A.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 112 Sales tax, export product A..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 113 Other direct variable cost- A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 114 Direct non-variable cost, - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 115 Labour included in direct - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 116 Yearly production, export - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 117 Unit price, export product B.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 118 Sales tax, export product B..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 119 Other direct variable cost- B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 120 Direct non-variable cost, - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 121 Labour included in direct - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 122 Yearly production, export - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 123 Unit price, export product C.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 124 Sales tax, export product C..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 125 Other direct variable cost- C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 126 Direct non-variable cost, - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 127 Labour included in direct - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 128 Yearly production, export - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 129 Unit price, export product D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 130 Sales tax, export product D..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 131 Other direct variable cost- D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 132 Direct non-variable cost, - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 133 Labour included in direct - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 134 Yearly production, export - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 135 Unit price, export product E.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 136 Sales tax, export product E..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 137 Other direct variable cost- E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 138 Direct non-variable cost, - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 139 Labour included in direct - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 140 Yearly production, export - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 141 Unit price, export product F.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 142 Sales tax, export product F..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 143 Other direct variable cost- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 144 Direct non-variable cost, - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 145 Labour included in direct - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Production Program and Sales - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab. BURMAO : Suitable Production Program and Sales - local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 146 Yearly production, local p- A	29533.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 147 Unit price, local product A..	0.00	1.00	1.00	1.00	1.00	1.00	1.00
L 148 Sales tax, local product A...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 149 Other direct variable cost- A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 150 Direct non-variable cost, - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 151 Labour included in direct - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 152 Yearly production, local p- B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 153 Unit price, local product B..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 154 Sales tax, local product B...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 155 Other direct variable cost- B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 156 Direct non-variable cost, - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 157 Labour included in direct - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 158 Yearly production, local p- C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 159 Unit price, local product C..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 160 Sales tax, local product C...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 161 Other direct variable cost- C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 162 Direct non-variable cost, - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 163 Labour included in direct - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 164 Yearly production, local p- D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 165 Unit price, local product D..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 166 Sales tax, local product D...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 167 Other direct variable cost- D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 168 Direct non-variable cost, - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 169 Labour included in direct - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 170 Yearly production, local p- E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 171 Unit price, local product E..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 172 Sales tax, local product E...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 173 Other direct variable cost- E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 174 Direct non-variable cost, - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 175 Labour included in direct - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 176 Yearly production, local p- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 177 Unit price, local product F..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 178 Sales tax, local product F...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 179 Other direct variable cost- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 180 Direct non-variable cost, - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 181 Labour included in direct - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tit: BURMAO : Suitable Production Program and Sales - local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	^.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMAO : Subtable **Working Capital Requirements - f/1**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Covera- F	Covera- L	Covera- F	Covera- L	Not used	Not used	Not used
L 182 Accounts receivable C1/C2: cas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Covera- F	Covera- L	not used	not used	Not used	Not used	Not used
L 183 Inventory, raw material (a)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 184 Inventory, raw material (b)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 185 Inventory, utilities..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 186 Inventory, energy.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 187 Inventory, spare parts	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 188 Inventory, work-in-progress...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 189 Inventory, finished products..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 190 Accounts payable..............	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMAO : Subtable **Source of Finance - foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	1st disbu	2nd disbu	3rd disbu	4th disbu	5th disbu	6th disbu	7th disbu
L 191 Equity-O (ordinary shares)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 192 Equity-P (preference shares).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 193 Subsidies, grants.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 194 Loan A, foreign (AF)..........	26075.00	8679.00	0.00	0.00	0.00	0.00	0.00
L 195 Loan B, foreign (BF)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 196 Loan C, foreign (CF)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 197 Overdraft during production...	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMAO : Subtable **Source of Finance - local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	1st disbu	2nd disbu	3rd disbu	4th disbu	5th disbu	6th disbu	7th disbu
L 198 Equity-O (ordinary shares)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 199 Equity-P (preference shares).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 200 Subsidies, grants.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 201 Loan A, local (AL)............	14959.00	8443.00	0.00	0.00	0.00	0.00	0.00
L 202 Loan B, local (BL)............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 203 Loan C, local (CL)............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 204 Overdraft during production...	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMAO : Subtable **Income, Tax, Cashflow**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7
	Variab- ?	Yearly- %	Tax ho-(y)	Years loss	Tax credit	Differ- F	Differ- L
L 205 Income tax....................	0.00	0.00	0.00	1.00	0.00	0.00	0.00
	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
L 206 Investment allowance (deducted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 207 Depreciation allowance (initia	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 208 Adjustment of income tax......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 209 Tax rate in % (if defined var	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 210 Profit distributed Equity--PF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 211 Profit distributed Equity--PL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 212 Profit distributed Equity--OF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 213 Profit distributed Equity--OL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Working Capital Requirements - f/1

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Source of Finance - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
8th disbu	9th disbu	10th disbu	11th disbu	12th disbu	13th disbu	14th disbu	15th disbu	16th disbu	17th disbu	18th disbu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Source of Finance - local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
8th disbu	9th disbu	10th disbu	11th disbu	12th disbu	13th disbu	14th disbu	15th disbu	16th disbu	17th disbu	18th disbu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tab: BURMAO : Subtable Income, Tax, Cashflow

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

8	9	10	11	12	13	14	15	16	17	18
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMAO : Subtable Working capital req., foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	adc	coto	required Y1	required Y2	required Y3	required Y4	required Y5	required Y6
L 1 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 2 raw material 1st..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 3 raw material other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 4 utilities.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 5 energy............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 6 spare-parts.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 7 work-in-progress..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 8 finished products.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 9 liabilities.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 10 cash in hand......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 11 current assets....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 12 net work'g capital	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 13 NWC increase......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMAO : Subtable Working capital req., local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	adc	coto	required Y1	required Y2	required Y3	required Y4	required Y5	required Y6
L 14 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 15 raw material 1st..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 16 raw material other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 17 utilities.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 18 energy............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 19 spare-parts.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 20 work-in-progress..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 21 finished products.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 22 liabilities.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 23 cash in hand......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 24 current assets....	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 25 net work'g capital	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 26 NWC increase......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMAO : Subtable Working capital req., consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	adc	coto	required Y1	required Y2	required Y3	required Y4	required Y5	required Y6
L 27 NWC,consol........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 28 increase consol...	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabw BURMAO : Subtable **Working capital req., foreign**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17		
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	3
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	4
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	5
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	6
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	7
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	8
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	9
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	11
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	13

Tabw BURMAO : Subtable **Working capital req., local**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17		
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	17
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	18
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	19
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	21
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	22
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	23
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	24
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	26

Tabw BURMAO : Subtable **Working capital req., consolidated**

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17		
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L	28

Tabo BURMAO : Subtable initial fixed investment - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	sum foreig	sum fval/f			invest- P1	invest- P2	invest- P3	invest- P4
L 1 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 2 civil A+B.........	83.00	91.30	0.00	0.00	83.00	0.00	0.00	0.00
L 3 equipment A+B.....	28355.00	30500.20	0.00	0.00	21452.00	6903.00	0.00	0.00
L 4 equipment C......	3445.00	3773.00	0.00	0.00	3280.00	165.00	0.00	0.00
L 5 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 6 pp-expenses.......	1408.30	322.00	0.00	0.00	325.94	1082.36	0.00	0.00
L 7 total fixed.......	33291.30	34686.50	0.00	0.00	25140.94	8150.36	0.00	0.00
L 8 inventory.........	1074.00	1074.00	0.00	0.00	0.00	1074.00	0.00	0.00
L 9 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 10 t o t a l.........	34365.30	35760.50	0.00	0.00	25140.94	9224.36	0.00	0.00

Tabo BURMAO : Subtable initial fixed investment - local, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	sum local	sum fval/l	sum consol	sum fval/c	invest- P1	invest- P2	invest- P3	invest- P4
L 11 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 12 civil A+B.........	847.00	891.70	930.00	983.00	530.00	400.00	0.00	0.00
L 13 equipment A+B.....	18197.00	19360.50	46552.00	49860.70	33087.00	13465.00	0.00	0.00
L 14 equipment C......	2194.00	2341.70	5639.00	6114.70	4757.00	882.00	0.00	0.00
L 15 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 16 pp-expenses.......	1436.00	103.00	2844.30	425.00	699.91	2144.39	0.00	0.00
L 17 total fixed.......	22674.00	22696.90	55965.30	57383.40	39073.91	16891.39	0.00	0.00
L 18 inventory.........	248.00	248.00	1322.00	1322.00	0.00	1322.00	0.00	0.00
L 19 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 20 t o t a l.........	22922.00	22944.90	57287.30	58705.40	39073.91	18213.39	0.00	0.00

Tabo BURMAO : Subtable initial fixed investment - consolidated, foreign, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	grant tota	FVAL	sum nval	sum fval	sum P1	sum P2	sum P3	sum P4
L 21 sum, cons/f.......	57287.30	61194.69	34365.30	36879.39	25140.94	9224.36	0.00	0.00
L 22 sum, local........	10.00	-2.00	22922.00	24315.30	13932.97	8989.03	0.00	0.00

Tabo BURMAO : Subtable initial fixed investment - foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
invest- P5	invest- P6	invest- P7	invest- P8	Not used	Not used	Not used	Not used	Not used	scrap valu	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	1
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.75 L	2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7088.75 L	3
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	861.25 L	4
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	5
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	6
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7970.75 L	7
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1074.00 L	8
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	9
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9044.75 L	10

Tabo BURMAO : Subtable initial fixed investment - local, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
invest- P5	invest- P6	invest- P7	invest- P8	Not used	Not used	Not used	Not used	Not used	scrap valu	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	11
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	243.52 L	12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11638.00 L	13
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1409.75 L	14
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13291.27 L	17
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1322.00 L	18
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	19
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14613.27 L	20

Tabo BURMAO : Subtable initial fixed investment - consolidated, foreign, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
sum P5	sum P6	sum P7	sum P8	Not used	Not used	Not used	Not used	Not used	scrap valu	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9044.75 L	21
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5568.52 L	22

Tabo BURMAO : Subtable investment during production, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 151 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 152 civil A+B.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 153 equipmt A+B.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 154 equipment C.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 155 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 156 pp-expenses.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 157 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 158 in progress.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 159 inventory.........	1074.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 160 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 161 cash, bank........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 162 tot.current.......	1074.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 164 total asset.......	1074.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 165 depreciation......	0.00	1875.81	1875.81	1875.81	1875.81	1875.81	1594.15	1594.15

Tabo BURMAO : Subtable investment during production, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 166 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 167 civil A+B.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 168 equipmt A+B.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 169 equipment C.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 170 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 171 pp-expenses.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 172 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 173 in progress.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 174 inventory.........	1322.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 175 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 176 cash, bank........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 177 tot.current.......	1322.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 178 loss c/f..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 179 total asset.......	1322.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 180 depreciation......	0.00	3224.17	3224.17	3224.17	3224.17	3224.17	2655.31	2655.31

Tabo BURMAO : Subtable investment during production, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 181 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 182 tot.current.......	248.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable production costs, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 106 raw material......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 107 other RM..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 108 utilities.........	0.00	1717.57	1932.32	2147.00	2147.00	2147.00	2147.00	2147.00
L 109 energy............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 110 labour............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 111 maintenance.......	0.00	168.00	168.00	168.00	168.00	168.00	168.00	168.00
L 112 spares............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 113 factory ovh.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 114 sub-total.........	0.00	1885.57	2100.32	2315.00	2315.00	2315.00	2315.00	2315.00
L 115 (variable)........	0.00	1717.57	1932.32	2147.00	2147.00	2147.00	2147.00	2147.00
L 116 admin. ovh........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 117 M+distrib.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 118 operating c.......	0.00	1885.57	2100.32	2315.00	2315.00	2315.00	2315.00	2315.00
L 119 depreciation......	0.00	1875.81	1875.81	1875.81	1875.81	1875.81	1594.15	1594.15
L 120 sub-total.........	0.00	3761.38	3976.13	4190.81	4190.81	4190.81	3909.15	3909.15
L 121 interest..........	0.00	868.85	868.85	868.85	868.85	868.85	868.85	868.85
L 122 total FCost.......	0.00	4630.23	4844.98	5059.66	5059.66	5059.66	4778.00	4778.00
L 123 (variable)........	0.00	1717.57	1932.32	2147.00	2147.00	2147.00	2147.00	2147.00
L 124 (labour)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable investment during production, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 151
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 152
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 153
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 154
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 155
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 156
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 157
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 158
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 159
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 160
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 161
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 162
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L .63
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 164
1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	0.00	7970.75 L 165

Tabo BURMAO : Subtable investment during production, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 166
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 167
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 168
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 169
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 170
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 171
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 172
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 173
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 174
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 175
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 176
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 177
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 178
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 179
2655.31	2655.31	2655.31	2655.31	2655.31	2655.31	2655.31	2655.32	0.00	13291.27 L 180

Tabo BURMAO : Subtable investment during production, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 181
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 182

Tabo BURMAO : Subtable production costs, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 106
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 107
2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	0.00	0.00 L 108
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 109
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 110
168.00	168.00	168.00	168.00	168.00	168.00	168.00	168.00	0.00	0.00 L 111
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 112
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 113
2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	0.00	0.00 L 114
2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	0.00	0.00 L 115
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 116
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 117
2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	2315.00	0.00	0.00 L 118
1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	1594.15	0.00	0.00 L 119
3909.15	3909.15	3909.15	3909.15	3909.15	3909.15	3909.15	3909.15	0.00	0.00 L 120
868.85	868.85	868.85	825.41	781.97	738.52	695.08	651.64	0.00	0.00 L 121
4778.00	4778.00	4778.00	4734.56	4691.11	4647.67	4604.23	4560.79	0.00	0.00 L 122
2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	2147.00	0.00	0.00 L 123
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 124

Tabo BURMAO : Subtable production costs, consolidated

-- COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO -----

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 126 raw material......	0.00	2238.36	2518.23	2798.00	2798.00	2798.00	2798.00	2798.00
L 127 other RM..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 128 utilities.........	0.00	8148.66	9167.50	10185.00	10186.00	10186.00	10186.00	10185.00
L 129 energy............	0.00	659.19	741.61	824.00	824.00	824.00	824.00	824.00
L 130 labour............	0.00	112.00	126.00	140.00	140.00	140.00	140.00	140.00
L 131 maintenance.......	0.00	672.00	672.00	672.00	672.00	672.00	672.00	672.00
L 132 spares............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 133 factory o.h.......	0.00	66.40	74.70	83.00	83.00	83.00	83.00	83.00
L 134 sub-total.........	0.00	11896.61	13360.04	14703.00	14703.00	14703.00	14703.00	14703.00
L 135 (variable)........	0.00	11224.61	12528.04	14031.00	14031.00	14031.00	14031.00	14031.00
L 136 admin. o.h........	0.00	10.40	11.70	13.00	13.00	13.00	13.00	13.00
L 137 Medistrib.........	0.00	5343.11	6011.17	6679.00	6679.00	6679.00	6679.00	6679.00
L 138 operating c.......	0.00	17250.12	19322.91	21395.00	21395.00	21395.00	21395.00	21395.00
L 139 depreciation......	0.00	3224.17	3224.17	3224.17	3224.17	3224.17	2655.31	2655.31
L 140 sub-total.........	0.00	20474.29	22547.09	24619.18	24619.18	24619.18	24050.31	24050.31
L 141 interest..........	2419.30	2038.95	1804.95	1570.91	1336.89	1102.87	868.85	868.85
L 142 total PCost.......	0.00	22513.24	24352.02	26190.09	25956.06	25722.04	24919.16	24919.16
L 143 (variable)........	0.00	16578.12	18650.91	20723.00	20723.00	20723.00	20723.00	20723.00
L 144 (labour)..........	0.00	112.00	126.00	140.00	140.00	140.00	140.00	140.00
L 145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable local costs; marketing distribution foreign, consolidated

-- COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO -----

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 146 variable..........	0.00	14860.55	16718.59	18576.60	18576.00	18576.00	18576.00	18576.00
L 147 labour............	0.00	112.00	126.00	140.00	140.00	140.00	140.00	140.00
L 148 total PCost.......	0.00	17883.01	19507.04	21130.43	2[illegible]96.40	20662.38	20141.16	20141.16

Tabo BURMAO : Subtable sales (= production programme) foreign

-- COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO -----

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 56 A.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 57 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 58 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 59 B.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 60 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 61 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 62 C.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 63 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 64 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 65 D.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 66 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 67 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 68 E.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 69 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 70 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 71 F.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 72 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 73 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 74 total sales.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable production costs, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used	
2798.00	2798.00	2798.00	2798.00	2798.00	2798.00	2798.00	2798.00	0.00	0.00	L 126
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 127
10186.00	10186.00	10186.00	10186.00	10186.00	10186.00	10186.00	10186.00	0.00	0.00	L 128
824.00	824.00	824.00	824.00	824.00	824.00	824.00	824.00	0.00	0.00	L 129
140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	0.00	0.00	L 130
672.00	672.00	672.00	672.00	672.00	672.00	672.00	672.00	0.00	0.00	L 131
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 132
83.00	83.00	83.00	83.00	83.00	83.00	83.00	83.00	0.00	0.00	L 133
14703.00	14703.00	14703.00	14703.00	14703.00	14703.00	14703.00	14703.00	0.00	0.00	L 134
14031.00	14031.00	14031.00	14031.00	14031.00	14031.00	14031.00	14031.00	0.00	0.00	L 135
13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	0.00	0.00	L 136
6679.00	6679.00	6679.00	6679.00	6679.00	6679.00	6679.00	6679.00	0.00	0.00	L 137
21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	0.00	0.00	L 138
2655.31	2655.31	2655.31	2655.31	2655.31	2655.31	2655.31	2655.32	0.00	0.00	L 139
24050.31	24050.31	24050.31	24050.31	24050.31	24050.31	24050.31	24050.32	0.00	0.00	L 140
868.85	868.85	868.85	825.41	781.96	738.52	695.08	651.64	0.00	0.00	L 141
24919.16	24919.16	24919.16	24875.72	24832.28	24788.84	24745.39	24701.96	0.00	0.00	L 142
20723.00	20723.00	20723.00	20723.00	20723.00	20723.00	20723.00	20723.00	0.00	0.00	L 143
140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	0.00	0.00	L 144
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 145

Tabo BURMAO : Subtable local costs; marketing distribution foreign, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used	
18576.00	18576.00	18576.00	18576.00	18576.00	18576.00	18576.00	18576.00	0.00	0.00	L 146
140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00	0.00	0.00	L 147
20141.16	20141.16	20141.16	20141.16	20141.16	20141.16	20141.16	20141.17	0.00	0.00	L 148

Tabo BURMAO : Subtable sales (= production programme) foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 58
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 59
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 60
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 61
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 62
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 63
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 64
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 65
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 66
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 67
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 68
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 69
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 71
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 72
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 73
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 74

Tabo BURMAO : Subtable sales (= production programme) local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 77 A.sales pa........	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 78 -net of tax.......	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 79 -net dir.c........	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 80 B.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 81 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 82 -net dir.c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 83 C.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 84 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 85 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 86 D.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 87 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 88 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 89 E.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 90 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 91 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 92 F.sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 93 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 94 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 95 total sales.......	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 96 -net of tax.......	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 97 -net dir.c........	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00

Tabo BURMAO : Subtable sales (= production programme) consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 98 total sales.......	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 99 -net of tax.......	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 100 -net dir.c........	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 101 tax foreign.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 102 tax cons..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 103 labour, fgn.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 104 labour, loc.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 105 labour.cons.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable sales (= production programme) local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used	
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	77
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	78
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	79
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	80
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	81
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	82
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	83
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	85
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	86
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	87
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	88
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	89
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	91
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	92
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	93
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	94
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	95
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	96
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	97

Tabo BURMAO : Subtable sales (= production programme) consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used	
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	98
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	99
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L	100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	101
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	102
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	103
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	104
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	105

Tabo BURMAO : Subtable finance - initial investment = foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL			funds P1	funds P2	funds P3	funds P4
L 23 equ.O. paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 24 equ.F. paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 25 subsidies..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 26 loan A paid........	34754.00	35840.30	0.00	0.00	26075.00	8679.00	0.00	0.00
L 27 loan B paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 28 loan C paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 29 total loan.........	34754.00	35840.30	0.00	0.00	26075.00	8679.00	0.00	0.00
L 30 debt A.............	0.00	0.00	0.00	0.00	26075.00	34754.00	0.00	0.00
L 31 debt B.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 32 debt C.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 33 total debt.........	0.00	0.00	0.00	0.00	26075.00	34754.00	0.00	0.00
L 34 debt/funds%........	0.00	0.00	0.00	0.00	100.00	100.00	0.00	0.00

Tabo BURMAO : Subtable finance - initial investment = local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL	local+forg	total FVAL	funds P1	funds P2	funds P3	funds P4
L 35 equ.O paid.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 36 equ.F paid.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 37 subsidies..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 38 loan A paid........	23402.00	24735.00	34754.00	35840.30	14959.00	8443.00	0.00	0.00
L 39 loan B paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 40 loan C paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 41 total loan.........	23402.00	24735.00	34754.00	35840.30	14959.00	8443.00	0.00	0.00
L 42 debt A.............	0.00	0.00	0.00	0.00	14959.00	23402.00	0.00	0.00
L 43 debt B.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 44 debt C.............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 45 total debt.........	0.00	0.00	0.00	0.00	14959.00	23402.00	0.00	0.00
L 46 debt/funds%........	0.00	0.00	0.00	0.00	100.00	100.00	0.00	0.00

Tabo BURMAO : Subtable finance - initial investment = consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL			funds P1	funds P2	funds P3	funds P4
L 47 sum equity.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 48 sum loan CF........	58156.00	60575.30	34754.00	35840.30	41034.00	17122.00	0.00	0.00
L 49 total funds........	58156.00	0.00	34754.00	0.00	41034.00	17122.00	0.00	0.00
L 50 debt/funds%........	0.00	0.00	0.00	0.00	100.00	100.00	0.00	0.00
L 51 interest f........	1086.30	0.00	0.00	0.00	325.94	760.36	0.00	0.00
L 52 interest l........	1333.00	0.00	0.00	0.00	373.98	959.03	0.00	0.00
L 53 interest c........	2419.30	0.00	0.00	0.00	699.91	1719.39	0.00	0.00

Tabo BURMAO : Subtable finance - initial investment = foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
funds F5	funds F6	funds F7	funds F8	Not used	Not used	Not used	Not used	Not used	Not used	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 23
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 24
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 26
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 28
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 29
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 30
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 31
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 32
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 33
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 34

Tabo BURMAO : Subtable finance - initial investment = local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	1	17	18	
funds F5	funds F6	funds F7	funds F8	Not used	Not used	Not used	Not used	Not used	Not used	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 35
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 36
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 37
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 38
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 39
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 41
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 42
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 44
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 45
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 46

Tabo BURMAO : Subtable finance - initial investment = consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
funds F5	funds F6	funds F7	funds F8	Not used	Not used	Not used	Not used	Not used	Not used	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 47
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 48
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 49
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 51
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 52
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 53

Tabo BURMAO : Subtable funds during production, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 185 equ.O paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 186 equ.P paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 187 balance ret.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 188 profit dist.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 189 loanA.cflow.......	34754.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 190 loanB.cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 191 loanC.cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 192 debt A............	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00
L 193 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 194 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 195 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 196 net worth.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 197 total loan........	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00	34754.00
L 198 s.term.bank.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 199 total funds.......	34754.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMAO : Subtable funds during production, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 200 equ.O paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 201 equ.P paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 202 balance ret.......	0.00	4336.93	5452.16	6567.09	6801.11	7035.13	7269.15	7269.15
L 203 profit dist.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 204 loanA.cflow.......	23402.00	-4680.40	-4680.40	-4680.40	-4680.40	-4680.40	0.00	0.00
L 205 loanB.cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 206 loanC.cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 207 debt A............	23402.00	18721.60	14041.20	9360.80	4680.40	-0.00	-0.00	-0.00
L 208 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 209 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 210 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 211 net worth.........	0.00	4336.93	5452.16	6567.09	6801.11	7035.13	7269.15	7269.15
L 212 total loan........	23402.00	18721.60	14041.20	9360.80	4680.40	-0.00	-0.00	-0.00
L 213 s.term.bank.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 214 total funds.......	23402.00	-343.47	771.76	1886.69	2120.71	2354.73	7269.15	7269.15

Tabo BURMAO : Subtable funds during production, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 215 equity paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 216 net worth.........	0.00	4336.93	5452.16	6567.09	6801.11	7035.13	7269.15	7269.15
L 217 long term.........	58156.00	-4680.40	-4680.40	-4680.40	-4680.40	-4680.40	0.00	0.00
L 218 short term........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 219 total funds.......	58156.00	-343.47	771.76	1886.69	2120.71	2354.73	7269.15	7269.15
L 220 loan repay........	58156.00	4680.40	4680.40	4680.40	4680.40	4680.40	0.00	0.00

Tabo BURMAO : Subtable funds during production, foreign

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 185
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 186
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 187
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 188
0.00	0.00	-1737.70	-1737.70	-1737.70	-1737.70	-1737.70	-26065.50	0.00	0.00	L 189
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 190
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 191
34754.00	34754.00	33016.30	31278.60	29540.90	27803.20	26065.50	0.00	0.00	34754.00	L 192
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 193
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 194
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 195
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 196
34754.00	34754.00	33016.30	31278.60	29540.90	27803.20	26065.50	0.00	0.00	0.00	L 197
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 198
0.00	0.00	-1737.70	-1737.70	-1737.70	-1737.70	-1737.70	-26065.50	0.00	0.00	L 199

Tabo BURMAO : Subtable funds during production, local

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 200
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 201
7269.15	7269.15	7269.15	7312.59	7356.04	7399.48	7442.92	7486.36	0.00	13291.27	L 202
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 203
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 204
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 205
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 206
-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	23402.00	L 207
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 208
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 209
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 210
7269.15	7269.15	7269.15	7312.59	7356.04	7399.48	7442.92	7486.36	0.00	0.00	L 211
-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	L 212
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 213
7269.15	7269.15	7269.15	7312.59	7356.04	7399.48	7442.92	7486.36	0.00	0.00	L 214

Tabo BURMAO : Subtable funds during production, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18	
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 215
7269.15	7269.15	7269.15	7312.59	7356.04	7399.48	7442.92	7486.36	0.00	0.00	L 216
0.00	0.00	-1737.70	-1737.70	-1737.70	-1737.70	-1737.70	-26065.50	0.00	0.00	L 217
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	L 218
7269.15	7269.15	5531.45	5574.89	5618.34	5661.78	5705.22	-18579.14	0.00	0.00	L 219
0.00	0.00	1737.70	1737.70	1737.70	1737.70	1737.70	26065.50	0.00	0.00	L 220

Tabo BURMAO : Subtable funds income, cashflows, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Col	1	2	3	4	5	6	7	8
	cflow. c/f	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 221 gross profit......	0.00	1112.76	2227.98	3342.91	3576.94	3810.96	4613.84	4613.84
L 222 foreign inc.......	0.00	-4530.23	-4844.98	-5059.66	-5059.66	-5059.66	-4778.00	-4778.00
L 223 allowances........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 224 taxable inc.......	0.00	1112.76	2227.98	3342.91	3576.94	3810.96	4613.84	4613.84
L 225 income tax........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 226 net income........	0.00	1112.76	2227.98	3342.91	3576.94	3810.96	4613.84	4613.84
L 227 tx/dividend.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 228 net divident......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 229 acc. income.......	0.00	1112.76	3340.74	6683.65	10260.59	14071.54	18685.38	23299.22
L 230 incl interest.....	0.00	3151.71	7184.62	12098.44	17012.27	21926.09	27408.78	32891.46
L 231 CF-out.prod.......	54858.00	17250.12	19322.91	21395.00	21395.00	21395.00	21395.00	21395.00
L 232 CF-in.prod........	0.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 233 net CF.prod.......	-54858.00	6375.88	7257.09	8138.00	8138.00	8138.00	8138.00	8138.00
L 234 acc. net-CF.......	-54858.00	-48492.12	-41235.03	-33097.03	-24959.03	-16821.03	-8683.03	-545.03
L 235 equ. NPV/IRR......	0.00	25414.03	-100.00	24284.32	-100.00	0.00	0.00	0.00
L 236 NCF/sales %.......	0.00	26.99	27.30	27.56	27.56	27.56	27.56	27.56
L 237 NCF/invest %......	0.00	11.62	13.23	14.83	14.83	14.83	14.83	14.83
L 238 net income ROE1...	0.00	1112.76	2227.98	3342.91	3576.94	3810.96	4613.84	4613.84
L 239 NPV, IRR..........	0.00	3575.61	10.97	0.00	0.00	0.00	0.00	0.00
L 240 netCF (ROE2)......	0.00	-343.47	771.76	1886.69	2120.71	2354.73	7269.15	7269.15
L 241 total CF,out......	57287.30	23969.47	25808.24	27646.31	27412.29	27178.27	22263.85	22263.85
L 242 total CF, in......	58156.00	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00	29533.00
L 243 total netCF.......	868.70	-343.47	771.76	1886.69	2120.71	2354.73	7269.15	7269.15
L 244 acc. netCF........	868.70	525.23	1296.99	3183.68	5304.39	7659.12	14928.27	22197.42
L 245 depr. allow.......	0.00	3224.17	3224.17	3224.17	3224.17	3224.17	2655.31	2655.31
L 246 tax% if var.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 247 tax due...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 248 acc. investa......	54858.00	54858.00	54858.00	54868.00	54858.00	54858.00	54868.00	54858.00

Tabo BURMAO : Subtable funds income, cashflows, consolidated

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	salvage va	for Calcul
4613.84	4613.84	4613.84	4657.28	4700.72	4744.16	4787.61	4831.04	0.00	0.00 L 221
-4778.00	-4778.00	-4778.00	-4734.56	-4691.11	-4647.67	-4604.23	-4560.79	0.00	0.00 L 222
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 223
4613.84	4613.84	4613.84	4657.28	4700.72	4744.16	4787.61	4831.04	0.00	0.00 L 224
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 225
4613.84	4613.84	4613.84	4657.28	4700.72	4744.16	4787.61	4831.04	0.00	0.00 L 226
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 227
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 228
27913.05	32526.89	37140.73	41798.00	46498.73	51242.89	56030.50	60861.54	0.00	0.00 L 229
38374.15	43856.84	49339.53	54822.21	60304.90	65787.59	71270.27	76752.95	0.00	0.00 L 230
21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	21395.00	0.00	0.00 L 231
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L 232
8138.00	8138.00	8138.00	8138.00	8138.00	8138.00	8138.00	8138.00	14613.27	0.00 L 233
7592.97	15730.97	23868.97	32006.97	40144.97	48282.97	56420.97	64558.97	79172.24	0.00 L 234
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 235
27.56	27.56	27.56	27.56	27.56	27.56	27.56	27.56	0.00	0.00 L 236
14.83	14.83	14.83	14.83	14.83	14.83	14.83	14.83	0.00	0.00 L 237
4613.84	4613.84	4613.84	4657.28	4700.72	4744.16	4787.61	4831.04	0.00	0.00 L 238
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 239
7269.15	7269.15	5531.45	5574.89	5618.33	5661.78	5705.22	-18579.14	14613.27	0.00 L 240
22263.85	22263.85	24001.55	23958.11	23914.66	23871.22	23827.78	48112.14	0.00	0.00 L 241
29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00	0.00	0.00 L 242
7269.15	7269.15	5531.45	5574.89	5618.34	5661.78	5705.22	-18579.14	0.00	0.00 L 243
29466.57	36735.72	42267.17	47842.06	53460.40	59122.18	64827.40	46248.26	0.00	0.00 L 244
2655.31	2655.31	2655.31	2655.31	2655.31	2655.31	2635.31	2655.32	0.00	0.00 L 245
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 246
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L 247
54868.00	54868.00	54868.00	54868.00	54868.00	54868.00	54868.00	54868.00	0.00	0.00 L 248

Mini-cement Plant project, Thayet,Burma
December. 19. 1987. revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	55965.30	59.486 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	57287.30	59.988 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	23402.00	
total funds :	58156.00	59.760 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17250.12	19322.91	21395.00
depreciation :	3224.17	3224.17	3224.17
interest :	2038.95	1804.93	1570.91
production costs	22513.24	24352.02	26190.09
thereof foreign	20.57 %	19.90 %	19.32 %
total sales :	23626.00	26580.00	29533.00
gross income :	1112.76	2227.98	3342.91
net income :	1112.76	2227.98	3342.91
cash balance :	-343.47	771.76	1886.69
net cashflow :	6375.88	7257.09	8138.00

Net Present Value at: 10.00 % = 3675.61
Internal Rate of Return: 10.97 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

Total Initial Investment in Thousand Kyat

Year	1989	1990
Fixed investment costs		
Land, site preparation, development	0.00	0.00
Buildings and civil works	530.00	400.00
Auxiliary and service facilities	4757.00	882.00
Incorporated fixed assets	0.00	0.00
Plant machinery and equipment	33087.00	13465.00
Total fixed investment costs	38374.00	14747.00
Pre-production capital expenditures	699.91	2144.39
Net working capital	0.00	1322.00
Total initial investment costs	39073.91	18213.39
Of it foreign, in %	64.34	59.65

Total Production Costs in Thousand Kyat

Year	1991	1992	1993	1994	1995	1996-2000
% of nom. capacity (single product)	80.00	90.00	100.00	100.00	100.00	100.00
Raw material 1	2238.36	2518.23	2798.00	2798.00	2798.00	2798.00
Other raw materials	0.00	0.00	0.00	0.00	0.00	0.00
Utilities	8148.66	9167.50	10186.00	10186.00	10186.00	10186.00
Energy	659.19	741.61	824.00	824.00	824.00	824.00
Labour, direct	112.00	126.00	140.00	140.00	140.00	140.00
Repair, maintenance	672.00	672.00	672.00	672.00	672.00	672.00
Spares	0.00	0.00	0.00	0.00	0.00	0.00
Factory overheads	66.40	74.70	83.00	83.00	83.00	83.00
Factory costs	11896.61	13300.04	14703.00	14703.00	14703.00	14703.00
Administrative overheads	10.40	11.70	13.00	13.00	13.00	13.00
Indir. costs, sales and distribution	5343.11	6011.17	6679.00	6679.00	6679.00	6679.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	3224.17	3224.17	3224.17	3224.17	3224.17	2655.31
Financial costs	2038.95	1804.93	1570.91	1336.89	1102.87	868.85
Total production costs	22513.24	24352.02	26190.09	25956.07	25722.04	24919.16
Costs per unit (single product)	0.95	0.92	0.89	0.88	0.87	0.84
Of it foreign, %	20.57	19.90	19.32	19.49	19.67	19.17
Of it variable,%	73.64	76.59	79.13	79.84	80.57	83.16
Total labour	112.00	126.00	140.00	140.00	140.00	140.00

Total Production Costs in Thousand Kyat

Year	2001	2002	2003	2004	2005
% of nom. capacity (single product).	100.00	100.00	100.00	100.00	100.00
Raw material 1	2798.00	2798.00	2798.00	2798.00	2798.00
Other raw materials	0.00	0.00	0.00	0.00	0.00
Utilities	10186.00	10186.00	10186.00	10186.00	10186.00
Energy	824.00	824.00	824.00	824.00	824.00
Labour, direct	140.00	140.00	140.00	140.00	140.00
Repair, maintenance	672.00	672.00	672.00	672.00	672.00
Spares	0.00	0.00	0.00	0.00	0.00
Factory overheads	83.00	83.00	83.00	83.00	83.00
Factory costs	14703.00	14703.00	14703.00	14703.00	14703.00
Administrative overheads	13.00	13.00	13.00	13.00	13.00
Indir. costs, sales and distribution	6679.00	6679.00	6679.00	6679.00	6679.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Depreciation	2655.31	2655.31	2655.31	2655.31	2655.32
Financial costs	825.41	781.96	738.52	695.08	651.64
Total production costs	24875.72	24832.28	24788.84	24745.39	24701.96
Costs per unit (single product)	0.84	0.84	0.84	0.84	0.84
Of it foreign, %	19.03	18.89	18.75	18.61	18.46
Of it variable,%	83.31	83.45	83.60	83.74	83.89
Total labour	140.00	140.00	140.00	140.00	140.00

Net Working Capital in Thousand Kyat

	adc	coto	1991-2005
Year			1991-2005
Coverage	adc	coto	
Current assets &			
Accounts receivable . . .	0	—	0.00
Inventory and materials .	0	—	1322.00
Energy	0	—	0.00
Spares	0	—	0.00
Work in progress	0	—	0.00
Finished products . . .	0	—	0.00
Cash in hand	0	—	0.00
Total current assets			1322.00
Current liabilities and			
Accounts payable	0	—	0.00
Net working capital			1322.00
Increase in working capital			0.00
Net working capital, local			248.00
Net working capital, foreign			1074.00

Note: adc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in Thousand Kyat

Year	1989	1990
Equity, ordinary ..	0.00	0.00
Equity, preference.	0.00	0.00
Subsidies, grants .	0.00	0.00
Loan A, foreign .	26075.00	8679.00
Loan B, foreign..	0.00	0.00
Loan C, foreign .	0.00	0.00
Loan A, local....	14959.00	8443.00
Loan B, local....	0.00	0.00
Loan C, local....	0.00	0.00
Total loan	41034.00	17122.00
Current liabilities	0.00	0.00
Bank overdraft	0.00	0.00
Total funds	41034.00	17122.00

Source of Finance, production in Thousand Kyat

Year	1991-95	1996-99	2000- 4	2005
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	0.00	0.00	-1737.70	-26065.50
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	-4580.40	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan	-4580.40	0.00	-1737.70	-26065.50
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft	0.00	0.00	0.00	0.00
Total funds	-4580.40	0.00	-1737.70	-26065.50

Cashflow Tables, construction in Thousand Kyat

Year	1989	1990
Total cash inflow . .	41034.00	17122.00
Financial resources .	41034.00	17122.00
Sales, net of tax . .	0.00	0.00
Total cash outflow . .	39073.91	18213.39
Total assets	38374.00	16494.00
Operating costs . . .	0.00	0.00
Cost of finance . . .	699.91	1719.39
Repayment	0.00	0.00
Corporate tax . . .	0.00	0.00
Dividends paid . . .	0.00	0.00
Surplus (deficit) .	1960.09	-1091.39
Cumulated cash balance	1960.09	868.70
Inflow, local	14959.00	8443.00
Outflow, local	13932.97	8989.03
Surplus (deficit) .	1026.03	-546.03
Inflow, foreign . . .	26075.00	8679.00
Outflow, foreign . . .	25140.94	9224.36
Surplus (deficit) .	934.06	-545.36
Net cashflow	-38374.00	-16494.00
Cumulated net cashflow	-38374.00	-54868.00

Cashflow tables, production in Thousand Kyat

Year	1991	1992	1993	1994	1995	1996
Total cash inflow . .	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax . .	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00
Total cash outflow . .	23969.47	25808.25	27646.31	27412.29	27178.27	22263.85
Total assets	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs . . .	17250.12	19322.92	21395.00	21395.00	21395.00	21395.00
Cost of finance . . .	2038.95	1804.93	1570.91	1336.89	1102.87	868.85
Repayment	4680.40	4680.40	4680.40	4680.40	4680.40	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	-343.47	771.75	1886.69	2120.71	2354.73	7269.15
Cumulated cash balance	525.25	1296.99	3183.68	5304.38	7659.12	14928.27
Inflow, local	23626.00	26580.00	29533.00	29533.00	29533.00	29533.00
Outflow, local	21215.05	22839.07	24462.46	24228.44	23994.42	19080.00
Surplus (deficit) .	2410.95	3740.93	5070.54	5304.56	5538.58	10453.00
Inflow, foreign . . .	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign . . .	2754.42	2969.17	3183.85	3183.85	3183.85	3183.85
Surplus (deficit) .	-2754.42	-2969.17	-3183.85	-3183.85	-3183.85	-3183.85
Net cashflow	6375.88	7257.08	8138.00	8138.00	8138.00	8138.00
Cumulated net cashflow	-46492.12	-41235.03	-33097.03	-24959.03	-16821.03	-8683.03

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

Cashflow tables, production in Thousand Kyat

Year	1997	1998	1999	2000	2001	2002
Total cash inflow ..	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00
Financial resources .	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax ..	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00
Total cash outflow ..	22263.85	22263.85	22263.85	24001.55	23958.11	23914.66
Total assets	0.00	0.00	0.00	0.00	0.00	0.00
Operating costs ...	21395.00	21395.00	21395.00	21395.00	21395.00	21395.00
Cost of finance ...	868.85	868.85	868.85	868.85	825.41	781.96
Repayment	0.00	0.00	0.00	1737.70	1737.70	1737.70
Corporate tax ...	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid ...	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	7269.15	7269.15	7269.15	5531.45	5574.89	5618.34
Cumulated cash balance	22197.42	29466.57	36735.72	42267.17	47842.06	53460.40
Inflow, local	29533.00	29533.00	29533.00	29533.00	29533.00	29533.00
Outflow, local	19080.00	19080.00	19080.00	19080.00	19080.00	19080.00
Surplus (deficit) .	10453.00	10453.00	10453.00	10453.00	10453.00	10453.00
Inflow, foreign ...	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign ...	3183.85	3183.85	3183.85	4921.55	4878.11	4834.67
Surplus (deficit) .	-3183.85	-3183.85	-3183.85	-4921.55	-4878.11	-4834.67
Net cashflow	8138.00	8138.00	8138.00	8138.00	8138.00	8138.00
Cumulated net cashflow	-545.03	7592.97	15730.97	23868.97	32006.97	40144.97

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

Cashflow tables, production in Thousand Kyat

Year	2003	2004	2005
Total cash inflow ..	29533.00	29533.00	29533.00
Financial resources .	0.00	0.00	0.00
Sales, net of tax ..	29533.00	29533.00	29533.00
Total cash outflow ..	23871.22	23827.78	48112.14
Total assets	0.00	0.00	0.00
Operating costs ...	21395.00	21395.00	21395.00
Cost of finance ...	738.52	695.08	651.64
Repayment	1737.70	1737.70	26065.50
Corporate tax ...	0.00	0.00	0.00
Dividends paid ...	0.00	0.00	0.00
Surplus (deficit) .	5661.78	5705.22	-18579.14
Cumulated cash balance	59122.18	64827.40	46248.26
Inflow, local	29533.00	29533.00	29533.00
Outflow, local	19080.00	19080.00	19080.00
Surplus (deficit) .	10453.00	10453.00	10453.00
Inflow, foreign ...	0.00	0.00	0.00
Outflow, foreign ...	4791.22	4747.78	29032.14
Surplus (deficit) .	-4791.22	-4747.78	-29032.14
Net cashflow	8138.00	8138.00	8138.00
Cumulated net cashflow	48282.97	56420.97	64558.97

COMFAR 2.0 UNIDO
COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Cashflow Discounting:

a) Return on Equity 1:
Net present value .... 25414.03 at 10.00 %
Internal Rate of Return (IRRE1) .. not found

b) Return on Equity 2:
Net present value .... 24284.32 at 10.00 %
Internal Rate of Return (IRRE2) .. not found

c) Internal Rate of Return on total investment:
Net present value .... 3675.61 at 10.00 %
Internal Rate of Return (IRR) .. 10.97 %

Equity 1 = Total equity paid : Net income
Equity 2 = Initial equity paid : Net cash return

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987, revised

Net Income Statement in Thousand Kyat

Year	1991	1992	1993	1994	1995
Total sales, incl. sales tax	23626.00	26580.00	29533.00	29533.00	29533.00
Less: variable costs, incl. sales tax.	16578.12	18550.91	20723.00	20723.00	20723.00
Variable margin	7047.88	7929.09	8810.00	8810.00	8810.00
As % of total sales	29.83	29.83	29.83	29.83	29.83
Non-variable costs, incl. depreciation	3896.17	3896.18	3896.18	3896.17	3896.18
Operational margin	3151.71	4032.91	4913.82	4913.83	4913.83
As % of total sales	13.34	15.17	16.64	16.64	16.64
Cost of finance	2038.95	1804.93	1570.91	1336.89	1102.87
Gross profit	1112.76	2227.98	3342.91	3576.94	3810.96
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	1112.76	2227.98	3342.91	3576.94	3810.96
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	1112.76	2227.98	3342.91	3576.94	3810.96
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	1112.76	2227.98	3342.91	3576.94	3810.96
Accumulated undistributed profit	1112.76	3340.74	6683.65	10260.59	14071.54
Gross profit, % of total sales	4.71	8.38	11.32	12.11	12.90
Net profit, % of total sales	4.71	8.38	11.32	12.11	12.90
ROE, Net profit, % of equity	0.00	0.00	0.00	0.00	0.00
ROI, Net profit+interest, % of invest.	5.74	7.35	8.96	8.96	8.96

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987, revised

Net Income Statement in Thousand Kyat

Year	1996	1997	1998	1999	2000
Total sales, incl. sales tax	29533.00	29533.00	29533.00	29533.00	29533.00
Less: variable costs, incl. sales tax.	20723.00	20723.00	20723.00	20723.00	20723.00
Variable margin	8810.00	8810.00	8810.00	8810.00	8810.00
As % of total sales	29.83	29.83	29.83	29.83	29.83
Non-variable costs, incl. depreciation	3327.31	3327.31	3327.31	3327.31	3327.31
Operational margin	5482.69	5482.69	5482.69	5482.69	5482.69
As % of total sales	18.56	18.56	18.56	18.56	18.56
Cost of finance	868.85	868.85	868.85	868.85	868.85
Gross profit	4613.84	4613.84	4613.84	4613.84	4613.84
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	4613.84	4613.84	4613.84	4613.84	4613.84
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	4613.84	4613.84	4613.84	4613.84	4613.84
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	4613.84	4613.84	4613.84	4613.84	4613.84
Accumulated undistributed profit	18585.38	23299.22	27913.05	32526.85	37140.73
Gross profit, % of total sales	15.62	15.62	15.62	15.62	15.62
Net profit, % of total sales	15.62	15.62	15.62	15.62	15.62
ROE, Net profit, % of equity	0.00	0.00	0.00	0.00	0.00
ROI, Net profit+interest, % of invest.	9.99	9.99	9.99	9.99	9.99

Mini-cement Plant project, Thayet,Burma — December, 19, 1987. revised

Net Income Statement in Thousand Kyat

Year	2001	2002	2003	2004	2005
Total sales, incl. sales tax	29533.00	29533.00	29533.00	29533.00	29533.00
Less: variable costs, incl. sales tax.	20723.00	20723.00	20723.00	20723.00	20723.00
Variable margin	8810.00	8810.00	8810.00	8810.00	8810.00
As % of total sales	29.83	29.83	29.83	29.83	29.83
Non-variable costs, incl. depreciation	3327.32	3327.31	3327.31	3327.31	3327.32
Operational margin	5482.68	5482.69	5482.69	5482.69	5482.68
As % of total sales	18.56	18.56	18.56	18.56	18.56
Cost of finance	825.41	781.96	738.52	695.08	651.64
Gross profit	4657.28	4700.72	4744.16	4787.61	4831.04
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	4657.28	4700.72	4744.16	4787.61	4831.04
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	4657.28	4700.72	4744.16	4787.61	4831.04
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	4657.28	4700.72	4744.16	4787.61	4831.04
Accumulated undistributed profit	41798.00	46498.73	51242.89	56030.50	60861.54
Gross profit, % of total sales	15.77	15.92	16.06	16.21	16.36
Net profit, % of total sales	15.77	15.92	16.06	16.21	16.36
ROE, Net profit, % of equity	0.00	0.00	0.00	0.00	0.00
ROI, Net profit+interest, % of invest.	9.99	9.99	9.99	9.99	9.99

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

Projected Balance Sheets, construction in Thousand Kyat

Year	1989	1990
Total assets	41034.00	58156.00
Fixed assets, net of depreciation	0.00	39073.91
Construction in progress	39073.91	16891.39
Current assets	0.00	1322.00
Cash, bank	0.00	0.00
Cash surplus, finance available	1960.09	868.70
Loss carried forward	0.00	0.00
Loss	0.00	0.00
Total liabilities	41034.00	58156.00
Equity capital	0.00	0.00
Reserves, retained profit	0.00	0.00
Profit	0.00	0.00
Long and medium term debt	41034.00	58156.00
Current liabilities	0.00	0.00
Bank overdraft, finance required.	0.00	0.00
Total debt	41034.00	58156.00
Equity, % of liabilities	0.00	0.00

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

Projected Balance Sheets, Production in Thousand Kyat

Year	1991	1992	1993	1994	1995	1996
Total assets	54588.36	52135.94	50798.45	49694.99	48825.55	53439.38
Fixed assets, net of depreciation	52741.13	49516.95	46292.77	43068.60	39844.42	37189.11
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	1322.00	1322.00	1322.00	1322.00	1322.00	1322.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	525.23	1296.99	3183.68	5304.39	7659.13	14928.28
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	54588.36	52135.94	50798.45	49694.99	48825.55	53439.38
Equity capital	0.00	0.00	0.00	0.00	0.00	0.00
Reserves, retained profit	0.00	1112.76	3340.74	6683.65	10260.59	14071.54
Profit	1112.75	2227.98	3342.91	3576.94	3810.96	4613.84
Long and medium term debt	53475.60	48795.20	44114.80	39434.40	34754.00	34754.00
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	53475.60	48795.20	44114.80	39434.40	34754.00	34754.00
Equity, % of liabilities	0.00	0.00	0.00	0.00	0.00	0.00

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Projected Balance Sheets, Production in Thousand Kyat

Year	1997	1998	1999	2000	2001	2002
Total assets	58053.22	62667.05	67280.89	70157.03	73076.60	76039.63
Fixed assets, net of depreciation	34533.79	31878.47	29223.16	26567.85	23912.53	21257.22
Construction in progress	0.00	0.00	0.00	0.00	0.00	0.00
Current assets	1322.00	1322.00	1322.00	1322.00	1322.00	1322.00
Cash, bank	0.00	0.00	0.00	0.00	0.00	0.00
Cash surplus, finance available	22197.43	29466.58	36735.73	42267.19	47842.07	53460.41
Loss carried forward	0.00	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00	0.00
Total liabilities	58053.22	62667.05	67280.89	70157.03	73076.60	76039.63
Equity capital	0.00	0.00	0.00	0.00	0.00	0.00
Reserves, retained profit	18685.38	23299.22	27913.05	32526.89	37140.73	41798.00
Profit	4613.84	4613.84	4613.84	4613.84	4657.28	4700.72
Long and medium term debt	34754.00	34754.00	34754.00	33016.30	31278.60	29540.90
Current liabilities	0.00	0.00	0.00	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00	0.00
Total debt	34754.[illegible]	34754.00	34754.00	33016.30	31278.60	29540.90
Equity, % of liabilities	[illegible]	0.00	0.00	0.00	0.00	0.00

Mini-cement Plant project, Thayet,Burma --- December, 19, 1987. revised

Projected Balance Sheets, Production in Thousand Kyat

Year	2003	2004	2005
Total assets	79946.09	82095.00	60861.54
Fixed assets, net of depreciation	18601.90	15946.59	13291.27
Construction in progress	0.00	0.00	0.00
Current assets	1322.00	1322.00	1322.00
Cash, bank	0.00	0.00	0.00
Cash surplus, finance available	59122.19	64827.41	46248.27
Loss carried forward	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total liabilities	79946.09	82096.00	60861.54
Equity capital	0.00	0.00	0.00
Reserves, retained profit	46498.73	51242.89	56030.50
Profit	4744.16	4787.61	4831.04
Long and medium term d . *	27803.20	26065.50	0.00
Current liabilities	0.00	0.00	0.00
Bank overdraft, finance required.	0.00	0.00	0.00
Total debt	27803.20	26065.50	0.00
Equity, % of liabilities	0.00	0.00	0.00

Mini-cement Plant project, Thayet,Burma — December, 19, 1987. revised

CASE 1 (BURMA 1)

UP PRODUCTION COST BY 10%

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA. ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987, revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	55965.30	59.486 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	57287.30	59.988 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	23402.00	
total funds :	58156.00	59.760 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	18439.50	20652.63	22865.00
depreciation :	3224.17	3224.17	3224.17
interest :	2038.95	1804.93	1570.91
production costs	23702.63	25681.73	27660.09
thereof foreign	20.33 %	19.69 %	19.13 %
total sales :	23626.00	26580.00	29533.00
gross income :	-76.63	898.27	1872.91
net income :	-76.63	898.27	1872.91
cash balance :	-1532.85	-557.96	416.69
net cashflow :	5186.50	5927.38	6668.00

Net Present Value at: 10.00 % = -6151.55
Internal Rate of Return: 8.32 %
Return on equity1: not found
Return on equity2: 59.25 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 2 (BURMA 2)

DOWN PRODUCTION COST BY 10%

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA. ENGINEERING CONSULTING FIRMS. TOKYO

Mini-cement Plant project. Thayet,Burma
December. 19. 1987 . revised
DP/BUR/80/015

2 year(s) of construction. 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	55965.30	59.486 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	57287.30	59.988 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	23402.00	
total funds :	58156.00	59.760 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	16059.94	17992.30	19924.00
depreciation :	3224.17	3224.17	3224.17
interest :	2038.95	1804.93	1570.91
production costs	21323.06	23021.40	24719.09
thereof foreign	20.83 %	20.13 %	19.53 %
total sales :	23626.00	26580.00	29533.00
gross income :	2302.94	3558.60	4813.91
net income :	2302.94	3558.60	4813.91
cash balance :	845.71	2102.37	3357.69
net cashflow :	7566.06	8587.70	9609.00

Net Present Value at: 10.00 % = 13509.46
Internal Rate of Return: 13.45 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 3 (BURMA 3)

UP INVESTMENT COST BY 10%

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987 . revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	61562.00	59.481 % foreign
current assets:	1454.00	81.224 % foreign
total assets:	63016.00	59.982 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	38120.00	
local loans :	25743.00	
total funds :	63863.00	59.690 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17256.52	19330.11	21403.00
depreciation :	3546.65	3546.65	3546.65
interest :	2240.15	1982.72	1725.29
production costs	23043.31	24859.48	26674.93
thereof foreign	21.27 %	20.58 %	19.99 %
total sales :	23626.00	26580.00	29533.00
gross income :	582.69	1720.52	2858.07
net income :	582.69	1720.52	2858.07
cash balance :	-1019.27	118.57	1256.11
net cashflow :	6369.48	7249.89	8130.00

Net Present Value at: 10.00 % = -1428.71
Internal Rate of Return: 9.65 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 4 (BURMA 4)

DOWN INVESTMENT COST BY 10%

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19. 1987. revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	50367.21	59.486 % foreign
current assets:	1190.00	81.261 % foreign
total assets:	51557.21	59.989 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	31189.00	
local loans :	21052.00	
total funds :	52241.00	59.702 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17243.72	19315.71	21387.00
depreciation :	2901.28	2901.28	2901.28
interest :	1832.32	1621.80	1411.28
production costs	21977.32	23838.79	25699.56
thereof foreign	19.81 %	19.16 %	18.61 %
total sales :	23626.00	26580.00	29533.00
gross income :	1648.68	2741.21	3833.44
net income :	1648.68	2741.21	3833.44
cash balance :	339.56	1432.08	2524.31
net cashflow :	6382.28	7264.29	8146.00

Net Present Value at: 10.00 % = 8776.55
Internal Rate of Return: 12.52 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 5 (BURMA 5)

UP SALES PRICE BY 10%

COMFAR © 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987, revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	55965.30	59.486 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	57287.30	59.988 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	23402.00	
total funds :	58156.00	59.760 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17250.53	19322.45	21395.00
depreciation :	3224.17	3224.17	3224.17
interest :	2038.95	1804.93	1570.91
production costs	22513.65	24351.55	26190.09
thereof foreign	20.57 %	19.90 %	19.32 %
total sales :	25989.00	29237.00	32486.00
gross income :	3475.35	4885.45	6295.91
net income :	3475.35	4885.45	6295.91
cash balance :	2019.12	3429.22	4839.69
net cashflow :	8738.47	9914.55	11091.00

Net Present Value at: 10.00 % = 23384.50
Internal Rate of Return: 15.79 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 6 (BURMA 6)

DOWN SALES PRICE BY 10%

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987, revised
DP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	55965.30	59.486 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	57287.30	59.988 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	23402.00	
total funds :	58156.00	59.760 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17250.40	19322.70	21395.00
depreciation :	3224.17	3224.17	3224.17
interest :	2038.95	1804.93	1570.91
production costs	22513.53	24351.80	26190.09
thereof foreign	20.57 %	19.90 %	19.32 %
total sales :	21264.00	23922.00	26580.00
gross income :	-1249.53	-429.80	389.91
net income :	-1249.53	-429.80	389.91
cash balance :	-2705.75	-1886.03	-1066.31
net cashflow :	4013.60	4599.30	5185.00

Net Present Value at: 10.00 % = -16033.25
Internal Rate of Return: 5.42 %
Return on equity1: 42.38 %
Return on equity2: 22.43 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 7 (BURMA 7)

IMPORT TAX FEE

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987. revised
DP/BUR/84/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	41768.52	79.704 % foreign
current assets:	1322.00	81.241 % foreign
total assets:	43090.52	79.751 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	34754.00	
local loans :	8935.00	
total funds :	43689.00	79.549 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17250.12	19322.91	21395.00
depreciation :	2351.62	2351.62	2351.62
interest :	1315.60	1226.25	1136.90
production costs	20917.34	22900.78	24883.52
thereof foreign	22.14 %	21.16 %	20.33 %
total sales :	23626.00	26580.00	29533.00
gross income :	2708.66	3679.22	4649.48
net income :	2708.66	3679.22	4649.48
cash balance :	3273.28	4243.84	5214.10
net cashflow :	6375.88	7257.09	8138.00

Net Present Value at: 10.00 % = 16139.07
Internal Rate of Return: 15.40 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CASE 8 (BURMA 8)

ALTERNATIVE PLAN

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987. revised
DP/BUR/80/015

3 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	94712.53	54.446 % foreign
current assets:	977.00	77.687 % foreign
total assets:	95689.53	54.683 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	52907.00	
local loans :	44202.00	
total funds :	97109.00	54.482 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	14816.56	16556.58	18296.00
depreciation :	5614.98	5614.98	5614.98
interest :	3532.78	3090.75	2648.74
production costs	23964.32	25262.31	26559.71
thereof foreign	24.88 %	24.21 %	23.59 %
total sales :	23626.00	26580.00	29533.00
gross income :	-338.32	1317.69	2973.29
net income :	-338.32	1317.69	2973.29
cash balance :	-3563.74	-1907.73	-252.13
net cashflow :	8809.44	10023.42	11237.00

Net Present Value at: 10.00 % = -8669.69
Internal Rate of Return: 8.46 %
Return on equity1: not found
Return on equity2: 43.60 %

Index of Schedules produced by COMFAR

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987
DP/BUR/80/015

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	64160.00	84.319 % foreign
current assets:	0.00	0.000 % foreign
total assets:	64160.00	84.319 % foreign

Source of funds during construction phase

equity & grants:	84086.00	0.000 % foreign
foreign loans :	21429.00	
local loans :	30000.00	
total funds :	135515.00	15.813 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	49533.00	49533.00	49533.00
depreciation :	10565.93	10565.93	6781.93
interest :	4328.61	4180.26	4031.90
production costs	64427.54	64279.19	60346.83
thereof foreign	25.50 %	25.33 %	20.46 %
total sales :	59066.00	59066.00	59066.00
gross income :	-5361.54	-5213.19	-1280.83
net income :	-5361.54	-5213.19	-1280.83
cash balance :	-42209.74	3704.36	3852.71
net cashflow :	-36232.75	9533.00	9533.00

Net Present Value at: 10.00 % = -22279.48
Internal Rate of Return: 6.61 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

CHAPTER XI ECONOMIC EVALUATION

XI.1 Price Adjustment

For the economic evaluation purpose, the price adjustment was made to the following inputs:

(1) Foreign currency expenditure such as investment and imported materials

The adjustment was made using the following shadow foreign exchange rate given by the project office in Rangoon.

- Official foreign exchange rate: 6.62
- Conversion factor : 1.15
- Shadow foreign exchange rate: 1.15 x 6.62 = 7.61

On the other hand, goods & service tax and the import duty which is locally levied on the imported equipment were omitted.

(2) Labour cost

The adjustment was made using the conversion factor of 0.5 which was given together with the aforementioned data.

As seen in Chapter X, no apparent distortion is found in the market price of cement. Therefore, the same price of cement as the market price was used for the economic evaluation.

XI.2 Economic Rate of Return (ERR)

The following result on ERR of the project was obtained using COMFAR.

ERR : 12.97%

XI.3 Absolute Efficiency Test

Since the labour cost for the project is very little, the absolute efficiency test was made using simple formula, which is,

$$E_s = O - (MI + D) > W$$

where

E_s = absolute efficiency test of the project in terms of value added surplus over the wages on the basis of data for a normal year;

O = expected value of normal annual output (usually annual sales revenue);

MI = expected value of normal annual current material inputs and services purchased from outside the project;

D = expected depreciation of fixed capital in a normal year;

W = expected wages in a normal year.

When taking year 3 as a normal year, the following figures can be obtained from the COMFAR calculation for ERR.

O = 29,533 (x 10^3Kyats)
MI = 17,550 (x 10^3Kyats)
D = 2,633 (x 10^3Kyats)
W = 70 (x 10^3Kyats)

Therefore, $E_s = O - (MI + D) = 9,350 > 70$.
Thus, the project passed the absolute efficiency test.

XI.4 Net National Value Added

Table 11-1 was prepared to compute the net national value added of this project. The net national value added thus obtained is 69,461 x 10^3Ks after being discounted at the Social Discount Ratio (SDR) of 6.5% which was given together with the aforementioned data.

XI.5 Import Substitution Effect

No cement has long been imported to Burma. But, it is possible to compute the foreign currency saving effect of the project, supposing that cement would be imported as much as the output of the project if the project is not implemented.

The attached Table 11-2 shows the net saving amount both in current price and present value discounted at 10% for the life of the project plus foreign loan repayment period.

To start with this calculation, CIF Burma price of cement was assumed to be 40 US$/ton (bagged cement), considering the world market price in the vicinity of Burma, for instance, China where CIF price of imported cement is 37-40 US$/ton (bagged cement).

The ratio of the net present value of the saving to the foreign loan is calculated from the results of Table 11-2 as follows:

$$\frac{\text{NPV of Saving}}{\text{Foreign Loan}} = \frac{13{,}086\ (\times 10^3 \text{US\$})}{5{,}262\ (\times 10^3 \text{US\$})} = 2.5$$

Table 11-1 Net National Value Added

(in Thousand Kyat)

Item \ Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
1. Value of output (O)	0	0	23,626	26,580	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	29,533	
2. Value of material inputs (MI+I)	497	8,443	14,179	15,865	17,550	17,550	17,550	17,550	17,550	17,550	17,550	19,549	19,549	19,549	19,549	19,549	47,530	
3. Net domestic value added(1-2)	-497	-8,443	9,447	10,715	11,983	11,983	11,983	11,983	11,983	11,983	11,983	9,984	9,984	9,984	9,984	9,984	-17,997	
4. Repatriated payments (R)	0	0	999	999	999	999	999	999	999	999	999	999	950	899	849	799	750	
5. Net national value added(3-4)	-497	-8,443	8,448	9,716	10,984	10,984	10,984	10,984	10,984	10,984	10,984	8,985	9,034	9,085	9,135	9,185	-18,747	
5.1 Wages (W)	0	0	56	63	70	70	70	70	70	70	70	70	70	70	70	70	70	
5.2 Social surplus (SS)	0	0	8,392	9,653	10,914	10,914	10,914	10,914	10,914	10,914	10,914	8,915	8,964	9,015	9,065	9,115	-18,817	
6. Discount factors at 6.5% discount rate	1.00	0.94	0.88	0.83	0.78	0.73	0.69	0.64	0.60	0.57	0.53	0.50	0.47	0.44	0.41	0.39	0.37	
7. Discounted values of net national value added (5 x 6)	-497	-7,936	7,385	8,012	8,513	7,967	7,531	6,985	6,548	6,221	5,784	4,458	4,213	3,967	3,717	3,555	-6,962	69,461
7.1 Discounted values of wages (5.1 x 6)	0	0	49	52	55	51	48	45	42	40	37	35	33	31	29	27	26	600
7.2 Discounted values of social surplus (5.2 x 6)	0	0	7,336	7,960	8,458	7,916	7,483	6,940	6,506	6,181	5,747	4,423	4,180	3,936	3,688	3,528	-6,988	

Note: 1) In the row 2, investment financed by a foreign loan is included in the inputs value of year 2000 and onward, because actual disbursement by the nation of Burma is considered to be 'repayment' of the loan. Therefore, only the investment financed by local currency is input in 1989 and 1990.

2) In the row 4, interest for the foreign loan is input.

3) In the row 6, Social Discount Ratio (SDR) of 6.5% is applied, which was given by the proejct office in Rangoon.

Table 11-2 Import Substitution Effect

(in Thousand US$)

Year	Gross saving	Foreign currency outflow			Net saving	NPV (at 10%)
		Material	Interest	Repayment		
1991	1,920	285	131	0	1,504	1,367
1992	2,160	317	131	0	1,712	1,415
1993	2,400	350	131	0	1,919	1,442
1994	2,400	350	131	0	1,919	1,311
1995	2,400	350	131	0	1,919	1,192
1996	2,400	350	131	0	1,919	1,083
1997	2,400	350	131	0	1,919	985
1998	2,400	350	131	0	1,919	895
1999	2,400	350	131	0	1,919	814
2000	2,400	350	131	0	1,919	740
2001	2,400	350	131	263	1,656	580
2002	2,400	350	125	263	1,662	530
2003	2,400	350	118	263	1,669	483
2004	2,400	350	111	263	1,676	441
2005	2,400	350	105	263	1,682	403
2006	0	0	98	263	-361	-79
2007	0	0	92	263	-355	-70
2008	0	0	85	263	-348	-63
2009	0	0	79	263	-342	-56
2010	0	0	72	263	-335	-50
2011	0	0	66	263	-329	-44
2012	0	0	59	263	-322	-40
2013	0	0	52	263	-315	-35
2014	0	0	46	263	-309	-31
2015	0	0	39	263	-302	-28
2016	0	0	33	263	-296	-25
2017	0	0	26	263	-289	-22
2018	0	0	20	263	-283	-20
2019	0	0	13	263	-276	-17
2020	0	0	7	263	-270	-15
Total	35,280	5,152	2,687	5,260	22,181	13,086

XI.6 Other Impact to the National Economy

XI.6.1 Promotion of IDWSSD Programme

As can be understood from the fact that this project is a part of the IDWSSD Programme, when this project is not implemented, the IDWSSD Programme may be hindered because of the long-lasting and severe scarcity of cement in Burma. Adversely, it can be said that this project will promote the said Programme much more than the case without the project.

XI.6.2 Contribution to increase of employment & income distribution

The direct effect on employment increase of the project is very little; i.e., 50 men in the Thayet cement plant. But, as is well known, cement is one of the most basic construction materials. Consequently, increase of employment will be generated in the following industries by this project, and the income will be distributed accordingly:

(1) Concrete products industry

- concrete products & pile
- concrete pipe
- concrete block & tile

(2) Concrete aggregate industry

Gravel and sand are needed to produce concrete, and therefore more demand of gravel and sand is generated by the output of the project. It should be noted that extraction of gravel and sand can be carried out by unskilled or semi-skilled labour if labour-intensive method is applied.

(3) Construction industry

Construction industry will be much active to almost the same extent as increase of cement supply, and demand for construction labour will be increased consequently.

CASE 10 (BURMA E)

ECONOMIC ANALYSIS

COMFAR 2.0 UNIDO

COMFAR 2.0 - ECFA, ENGINEERING CONSULTING FIRMS, TOKYO

Mini-cement Plant project, Thayet,Burma
December, 19, 1987. revised
EP/BUR/80/015

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: Thousand Kyat

Total initial investment during construction phase

fixed assets:	46761.84	81.871 % foreign
current assets:	1483.00	83.277 % foreign
total assets:	48244.84	81.914 % foreign

Source of funds during construction phase

equity & grants:	0.00	0.000 % foreign
foreign loans :	39973.00	
local loans :	8940.00	
total funds :	48913.00	81.723 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	17476.71	19574.71	21672.00
depreciation :	2632.98	2632.98	2632.98
interest :	1446.32	1356.93	1267.53
production costs	21556.02	23564.62	25572.51
thereof foreign	24.70 %	23.64 %	22.75 %
total sales :	23626.00	26580.00	29533.00
gross income :	2069.98	3015.38	3960.49
net income :	2069.98	3015.38	3960.49
cash balance :	2914.96	3860.36	4805.47
net cashflow :	6149.29	7005.29	7961.00

Net Present Value at: 10.00 % = 9677.06
Internal Rate of Return: 12.97 %
Return on equity1: not found
Return on equity2: not found

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

ANNEX I DEVELOPMENT OF THE ECONOMY IN BURMA

In 1948, Burma gained independence and proceeded to introduce the Burmese way to Socialism. The Burma Socialist Programme Party has adopted a Twenty-Year Long Term Plan in which the guidelines are laid down to double the national standard of living by the end of the plan period (F.Y. 1974/75 to F.Y. 1993/94), and to transfer the Burmese economy from an agricultural economy to an agro-based industrial one, by developing more industries. This Long Term Plan consists of five Four-Year Plans which targets and results are roughly described below.

1. Implementation of the Second Four-Year Plan (F.Y. 1974/75 - F.Y. 1977/78)

The Second Four-Year Plan was implemented from April 1, 1974 and completed on March 31, 1978. Proper course was taken to follow the general guidelines and due to the coordinated efforts of all the sectors of the economy, there was a general progress in all sectors. In the production sector of the economy there was an annual average growth rate of 4.7 per cent, in the services sector 6.4 per cent and in the trade sector 4.7 per cent, and the Gross Domestic Product (GDP) growth rate 5.1 per cent.

		Predetermined Target (%)	Actual Achievement (%)	Difference (%)
1.	**Production**	**4.6**	**4.7**	**+0.1**
	- Agriculture	4.0	3.2	-0.8
	- Fishery and Livestock	3.4	3.3	-0.1
	- Forest	3.1	8.5	+5.4
	- Mining	2.4	12.2	+9.8
	- Industry	7.5	7.4	-0.1
	- Electricity	9.1	8.6	-0.5
	- Construction	1.0	5.9	+4.9
2.	**Services**	**3.8**	**6.4**	**+2.6**
3.	**Trade**	**4.9**	**4.7**	**-0.2**
4.	**Gross Domestic Product**	**4.5**	**5.1**	**+0.6**

Source: Second Four-Year Development Plan

Although there was short performances in some sectors of the economy, there was also more achievement than the predetermined targets for the production sector as a whole by 0.1 per cent, 2.6 per cent in services sector and 0.6 per cent in gross domestic product value. Only the trade sector fell short of the target by 0.2 per cent. The implementation of the Second Four-Year Plan as a whole was considered a success.

2. Implementation of the Third Four-Year Plan (F.Y. 1978/79 - 1981/82)

With the experience gained and the momentum of economic progress achieved from the Second Four-Year Plan, the Third Four-Year Plan was launched with effect from April 1, 1978 and was completed in March 31, 1982.

The Third Four-Year Plan did not envisage any significant change in the structure of the economy. The policy was to emphasize more at increasing the aggregate output than changing the economic structure although initial steps were taken during the plan period for the establishment of certain large scale industries which would use domestic raw material and which would give support to agricultural development. The principal objective of the Third Four-Year Plan was that at the end of the plan period, the path of the original Twenty-Year Long Term Plan was to be regained.

During the Third Four-Year Plan period, commodity production sector had made considerable development. It was laid down that GDP should rise by 6.6 per cent per year and actual increase during that period had been on the average 6.6 per cent.

The following is the comparison of the actual achievement with the predetermined targets of the Third Four-Year Plan:

		Predetermined Target (%)	Actual Achievement (%)	Difference (%)
1.	Production	7.7	8.1	+0.4
	- Agriculture	5.8	8.6	+2.8
	- Fishery and Livestock	5.0	5.0	-
	- Forest	5.8	7.9	+2.1
	- Mining	12.2	8.2	-4.0
	- Industry	12.2	6.0	-6.2
	- Electricity	14.3	13.0	-1.3
	- Construction	11.8	18.7	+6.9
2.	Services	5.5	6.2	+0.7
3.	Trade	5.4	3.6	-1.8
4.	Gross Domestic Product	6.6	6.6	-

Source: Third Four-Year Development Plan

Apart from the Trade sector which fell short of the target by 1.8 per cent, the implementation of the Third Four-Year Plan as a whole had created good economic foundations.

3. Implementation of the Fourth Four-Year Plan (F.Y. 1982/83 - 1985/86)

The Fourth Four-Year Plan, formulated within the frame work of the plan guidelines laid down by the Fourth Party Congress was adopted by the second session of the Third Pyithu Hluttaw.

A review of plan performance over the Fourth Four-Year Plan period indicates that 99.8 per cent of the plan targets was achieved in 1982/83, 98.0 per cent in 1983/84, 97.9 per cent in 1984/85 and 98.0 per cent in 1985/86. Thus, the average annual performance achieved over the 4 year period was 98.4 per cent.

A review of growth performance during the plan period reveals that GDP rose by 5.6 per cent in 1982/83, 4.4 per cent in 1983/84, 5.6 per cent in 1984/85 and 6.2 per cent in 1985/86. The average annual rate of growth achieved was 5.5 per cent. The rising trend of economic growth rate is attributable to a number of factors such as improvement in the planning process, and active participation of the people in plan implementation.

The sectoral performance of Annual Plans during the Fourth Four-Year Plan period are as shown below:

Sectoral Economic Growth Rates during the Fourth Four-Year Plan Period (At 1969/70 Constant Producers' Prices)

Particulars	1982/83 (Actual)	1983/84 (Actual)	1984/85 (Actual)	1985/86 Provisional (Actual)
1. Goods	6.2	4.6	5.9	3.2
Agriculture	6.8	4.9	3.0	2.6
Livestock and Fishery	3.5	7.0	9.7	1.9
Forestry	3.4	(-)1.5	6.9	4.0
Mining	8.1	3.2	14.8	4.8
Processing and Manufacturing	5.3	3.3	8.2	4.5
Power	16.9	8.0	15.3	9.9
Construction	6.3	4.8	8.2	2.5
2. Services	6.1	4.2	5.5	7.4
Transportation	9.5	5.8	6.0	3.5
Communications	26.0	13.4	4.5	11.3
Financial Institutions	3.3	5.3	6.9	6.1
Social and Administrative Services	6.8	1.9	5.6	12.6
Rentals and Other Services	2.2	4.9	4.2	2.7
3. Trade	3.5	4.1	4.9	3.4
Total Net Output	5.6	4.4	5.6	4.3

The following is the comparison of the actual achievement with the predetermined targets of the Fourth Four-Year Plan:

		Predetermined Target (%)	Actual Achievement (%)	Difference (%)
1.	Production	7.4	5.7	-1.7
	- Agriculture	5.6	4.7	-0.9
	- Fishery and Livestock	8.1	6.4	-1.7
	- Forest	4.9	4.1	-0.8
	- Mining	13.6	12.7	-0.9
	- Industry	8.2	6.1	-2.1
	- Electricity	17.3	14.6	-2.7
	- Construction	5.4	5.4	-
2.	Services	5.8	5.8	-
3.	Trade	7.2	4.5	-2.7
4.	Gross Domestic Product	7.0	5.5	-1.5

Source: Fourth Four-Year Development Plan

Only the services sector has achieved its performances in accordance with planned target. Production and Trade sectors fell short of the targets by 1.7 per cent and 2.7 per cent respectively. But during the plan period the average annual rate of growth achieved was 5.5 per cent.

4. Fifth Four-Year Plan
(F.Y. 1986/87 - 1989/90)

The Fifth Four-Year Plan is being implemented from April 1, 1986 and scheduled to be completed on March 31, 1990. The targets of the Fifth Four-Year Plan were drawn up in accordance with the Fifth Four-Year Plan guidelines laid down by the Party Congress. The main objective was to strive dynamically towards the attainment of the objectives of the Twenty-Year Long Term Plan.

Planned targets are as shown below:

	1985/86 (Base Year) (Kyat in millions)	1989/90 (Kyat in millions)	Average Annual Growth rates(%)	Average Annual Growth Rates of the Guidelines
At 1969/70 Prices				
1.Gross Domestic Product	21,106	25,218	4.5	6.0
2.Gross Investment	2,711	2,864	1.4	13.5
3.Exports	1,286	1,722	7.6	16.1
4.Imports	1,231	1,491	4.9	12.5
At 1985/86 Prices				
5.Gross Domestic Product	58,118	70,788	5.1	-
6.Gross Investment	9,847	10,449	1.5	-
7.Public Investment	9,674	7,842	(-)2.9	-
8.Exports	4,438	5,573	5.9	-
9.Imports	5,760	7,020	5.1	-

Source: Fifth Four-Year Plan Guideline

Sectoral distribution of public investment at 1985/86 prices for the fifth four-year is shown below:

	Amount (Kyat in millions)	Per cent
1. Agriculture	4,539	13.6
2. Livestock & Fishery	866	2.6
3. Forestry	1,135	3.4
4. Mining	2,326	6.9
5. Processing and Manufacturing	9,679	29.1
a. Agro-related	1,023	3.1
b. Agro-base	1,219	3.6
c. Other-industry	7,521	22.4
6. Power	3,206	9.6
7. Construction	1,307	3.9
8. Transport & Communications	4,700	14.0
9. Others	5,661	16.9
	33,504	100.0

Source: Fifth Four-Year Plan Guidelines

Predetermined plan targets (average annual growth rates) were drawn up as shown below:

	Average annual growth rate (%)
1. Production	4.7
- Agriculture	3.9
- Fishery & Livestock	6.1
- Forestry	3.8
- Mining	9.9
- Processing & Manufacturing	5.1
- Power	9.3
- Construction	2.4
2. Services	4.7
- Transportation	5.8
- Communication	3.4
- Financial	5.0
- Social & Administration	4.2
- Rentals and other services	3.0
3. Trade	4.0
4. Gross Domestic Products	4.5

Source: Fifth Four-Year Plan Guideline

The sectional performance of the First Year (1986/87) of Fifth Four-Year Plan
(Value of Net output and services at 1969/70 constant producers' prices)

Particulars	1986/87		
	Annual Plan	Pro-visional	Per-centage
1. Goods	11,776	11,180	95
Agriculture	6,048	5,866	97
Livestock and Fishery	1,489	1,413	95
Forestry	463	441	95
Mining	362	316	87
Processing and Manufacturing	2,457	2,243	91
Power	396	364	92
Construction	562	537	96
2. Services	5,627	5,576	99
Transportation	1,146	1,124	98
Communications	172	171	99
Financial Institutions	845	866	102.4
Social and Administrative Services	2,286	2,240	98
Rentals and other Services	1,178	1,176	99.8
3. Trade	4,458	4,282	96
Total Net Output	21,861	21,038	96

Source: Report to Pyithu Hluttaw

5. Structural Changes

Structural changes are planned to be 54.4 per cent in commodity production, 25.6 percent in services and 20.0 percent in trade out of the total production value of goods and services in the final year of the plan.

The economic ownership pattern at the end of plan period is envisaged as 40.9 percent in State Sector, 9.2 percent in Co-operative Sector and 49.9 percent in private sector.

Value of Goods and Services, Consumption and Investment for 1986/87 and Targets for 1987/88 Annual Plan (At Current Producers' Prices)

Particulars	1986/87 (Provisional Actual)	1987/88 (Annual Plan)	
		Value	Growth rate
	Kyat in Millions		Percentage
1. Goods	68,758 (US$ 9,893)	78,603 (US$11,310)	5.2
Agriculture	25,533	27,493	4.2
Livestock & Fishery	6,520	7,489	5.5
Forestry	1,094	1,354	4.3
Mining	920	1,557	12.1
Manufacturing & Processing	31,131 (US$ 4,479)	36,516 (US$ 5,254)	4.6
Power	422	597	12.7
Construction	3,139	3,598	14.5
2. Services	13,592	15,093	5.2
Transportation	3,449	3,876	6.3
Communications	245	324	16.1
Financial Institutions	2,167	2,364	7.5
Social & Administrative Services	5,167	5,770	4.1
Rentals & Other Services	2,583	2,758	3.2
3. Trade	18,140	20,360	1.0
Total	100,491	114,056	5.0
(Total Inter-industry use)	(44,410)	(50,047)	(5.1)

Source: Ministry of No.1 Industry

Production of Selected Commodities of Processing and Manufacturing Sector for 1986/87 and Production Targets for 1987/88.

Commodity	A/U	1986/87 Provisional	1987/88 Targets
Sugar	Thousand Ton	63	73.25
Salt	"	340	360.90
Cigarette	Million No.	2,100	3,020
Cotton Yarn	Thousand Ton	15.94	18.57
Shirting	Million Yard	15.087	23.118
Poplin	"	5.014	6.575
Gents' Longyis	Million No.	10.327	11.396
Ladies' Longyis	Thousand No.	232	261
Children's Longyis	"	179	209
Vest	Million No.	3.5	4.7
Towel	Thousand No.	1,516	2,003
Blanket	"	1,415	1,817
Mosquito Netting	Million Yard	3.243	4.619
Gunny Bag	Million No.	30.833	34.9
Umbrella	Dozen in Thousand	8.17	64.78
Soap	Thousand Ton	39.91	55.00
Matches	Thousand Case (Each contains 1,200 match boxes)	110	150

Commodity	A/U	1986/87 Provisional	1987/88 Targets
Paper	Thousand Ton	16.65	23.9
Pulp	"	5.50	6.60
Candle	"	2.69	2.70
Bricks and Tiles	Million No.	138.4	155.79
Cement	Thousand Ton	570.6	672.00
Sheet Glass	"	7.0	8.40
Wire Nail	"	2.1	4.2
Aluminium Ware	Million Pound	1.267	2.047
Motor Spirit	Million Gallon	76.9	72.27
Kerosene	"	2.02	1.77
Diesel Oil	"	108.72	98.64
Furnace Oil	"	50.38	44.57
Incandenscent Lamp	Thousand No.	3,000	1,000
Fluorescent Lamp	"	440	440
Dry-cell Battery	"	20,750	20,750
Television Receiver	No.	2,288	3,000
Motor Car	"	2,671	2,289
Bicycle	"	18,200	18,230
Water Pump	Set	5,160	5,290
Tractor	No.	898	800
Power Tiller	"	600	500
Fertilizer	Thousand Ton	366.5	376.2

Source: Minitry of No.1 Industry

Production of Main Crops

(Thousand Tons)

Crops	1986/87 (Provisional)
Paddy (ton)	15,219
(Basket in Million)	(729)
Wheat	246
Maize	323
Millet	191
Matpe	116
Pedisein	38
Butter bean	106
Sultapya	26
Soya bean	23
Gram	236
Pesingon	32
Other Pulses	22
Groundnut	586
Sesamum	187
Sunflower	327
Cotton	92
Jute	45
Rubber	15
Sugar Cane	3,282
Virginia tobacco (green)	57

Source: Ministry of No.1 Industry

Production of Crude Oil, Natural Gas and Selected Minerals

Particulars	A/U	1986/87 (Provisional)
1. Crude oil and natural gas		
Crude oil	Thousand US barrels	10,103
Natural gas	Million Cuft	38,290
2. Minerals		
Tin concentrates (65%)	Ton	1,323
Tungsten concentrates (65%)	"	476
Tin, tungsten mixed concentrates (65%)	"	966
Tin, tungsten, scheelite mixed concentrates	"	2,285
Tin concentrates (74%)	"	1,571
Tungsten concentrates (67%)	"	947
Refined tin metal (99.9%)	"	600
Lead sulphide ore	"	399,000
Refined gold	Fine Oz.	95
Refined silver	Thousand fine Oz.	600
Refined lead	Ton	8,128
Zinc concentrates	"	10,160
Copper matte	"	203
Nickel speiss	"	86
Antimonial lead	"	305
Copper ore	"	2,088
Copper concentrates	Metric Ton	48,768
Pig iron	"	-

Particulars	A/U	1986/87 (Provisional)
Steel billets	Metric Ton	21,000
Steel balls	"	3,000
3. Non metallic minerals		
Jade	Kilo	12,804
Barytes	Ton	11,000
Gypsum	"	43,275
Manganese dioxide	"	50
Graphite	"	-
Graphite concentrates	"	100
Industrial/white clay	"	600
Ball clay	"	200
Fire clay	"	1,050
Fire clay powder	"	350
Calcium carbonate	"	800
Feldspar	"	3,005
Soap stone/talc	"	150
Bentonite	"	700
Dolomite	"	3,660
Coal	"	51,000
Limestone	Thousand Ton	1,472
Stone quarrying	Thousand Sudrum	523
River shingle	"	187

Source: Ministry of No.1 Industry

ANNEX II MANPOWER SITUATION FOR DECADE ACTIVITIES

1. Urban Water Supply and Sanitation

Category	Estimated for Decade Activities		
	Proposed	Existing	Shortage
Managers	8	4	4
Professionals			
- Accountant/Financial analysts	12	-	12
- Chemists/Bacteriologists	3	-	3
- Water Resources specialists (Hydrogeologists/Geologist)	12	2	10
- Engineers:			
Civil	67	28	39
Mechanical	13	-	13
Electrical	14	-	14
Sanitary	106	65	41
- Procurement and stores personnel	6	2	4
Technicians			
- Accountants	34	2	32
- Laboratory technicians	16	1	15
- Water resources technicians	13	3	10
- Drafting and surveying	96	33	63
- Well drillers (foremen)	13	-	13
- Engineering design and construction	279	159	120
- Operation and maintenance	11	0	11
- Sanitarians	4	6	-
- Training staff	15	4	11
- Store keepers	16	2	14
- Junior engineers	185	102	83
- Chairmen	30	7	23
Supervisors			
- Work charge	30	2	28
Craftsmen			
- Plumbers	880	341	539
- Mechanics	88	11	77
- Well drillers	100	32	68
- Pump repair	63	17	46
- General maintenance	529	238	291
Others			
- Drivers	59	3	56
Operators			
- Water works	466	276	188
- Sewage	85	18	67

Source: Report to National Meeting, January 1982

2. Rural Water Supply and Sanitation

Category	Estimated for Decade Activities		
	Proposed	Existing	Shortage
Managers	2	2	-
Professionals			
- Chemists/Bacteriologists	2	0	2
- Water Resources specialists (Hydrogeologists/Geologist)	9	5	4
- Engineers:			
Civil	1	1	0
Mechanical	48	18	30
Sanitary	27	6	21
Technicians			
- Accountants	12	0	12
- Laboratory technicians	2	1	1
- Water resources technicians (Sub. Assistant engineers	153	6	147
- Drafting and surveying	24	4	20
- Well drillers	322	132	190
- Engineering design and construction (SAE)	51	12	39
- Training staff	12	0	12
- Store keepers	42	8	34
- Junior engineers	188	0	188
- Chairmen	16	0	16
- Workshop technicians	296	0	298
Craftsmen			
- Plumbers	304	131	173
- Mechanics	362	60	302
- Meter repairs	12	0	12
Others			
- Drivers	150	40	110
- Electricians	12	5	7
- Masons	35	7	28
- Welders	18	5	13
- Carpenters	27	9	18
- Technical clerks	29	8	21

Source: Report to National Meeting, January 1982

PREFACE

In response to the request of the Government of the Socialist Republic of the Union of Burma, United Nations Industrial Development Organization (UNIDO) decided to conduct a feasibility study in support of International Drinking Water Supply and Sanitation Decade (IDWSSD) on a mini-cement plant at Thayet, Magwe Division and subcontracted it to a consulting firm named Onoda Engineering and Consulting Company (OEC), Tokyo, Japan. OEC sent to the Socialist Republic of the Union of Burma a field survey team headed by Mr. Taro Kojima from October 12 to November 2, 1987.

The survey team exchanged views with the staff concerned of the Government of Burma and UNIDO, Rangoon, and conducted a field survey in the project areas. Upon returning to Japan, the team promoted analytical and design work based on the data collected in Burma, and prepared the draft final report. According to the conclusion of discussion meeting held on March 11th, 1988 in Rangoon among the staff concerned of Burma, UNIDO and us, the team reviewed several points of the draft final report and has prepared this final report. We hope that this report will serve for the development of the project and contribute to the promotion of the IDWSSD Programme.

In conclusion, I wish to express my deep appreciation to the officials concerned of the Government of Burma and UNIDO, Rangoon for their close cooperation and hospitality extended to our team, without which our task couldn't have been completed so successfully.

Tokyo, March 1988

K. Hyakutake

Kengo Hyakutake
President
Onoda Engineering and
Consulting Co., Ltd.

ANNEX-III

THE TECHNICAL ASSESSMENT REPORT

ON

THAYETMYO CEMENT PLANT, MAGWE DIVISION

THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

(PROJECT NO. DP/BUR/80/015)

DECEMBER 1987

PREPARED BY

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
VIENNA, AUSTRIA

AND

ONODA ENGINEERING AND CONSULTING CO., LTD.
TOKYO, JAPAN

INTRODUCTION

This technical assessment report is made on the existing cement plant and associated facilities in the Thayetmyo cement plant, Magwe Division, based on the findings obtained by the field survey team during a period from October 12 to November 2, 1987.

Description and discussion are limited to the technical points in this report. On the other hand, financial operation conditions of the existing plant is described in the feasibility study on a mini-cement plant project. The outline of findings and the results of discussion are summarized below. As for the results of discussion on each major equipment, refer to Section II. Results of Diagnosis on Cement plant and Associated Facilities.

I. Summary of Diagnosis on the Existing Plant

I.1 Operation of the entire plant

The operation of this plant is being suffered from a lack of spare parts, and only No.3 kiln was being operated during the field survey. The output of the entire plant shows only about 25-30% of the normal capacity of 1,000 tpd at present. In addition, owing to difficulty of purchasing materials for paper bags, the plant is faced to the conditions to urgently plan and implement bulk cement shipment.

I.2 Raw materials

1) Raw material quarries

As for the main raw materials for the cement manufacture in the Thayetmyo plant, the following materials are supplied from the quarry about 3.5 km far from the plant.

- limestone
- marl

As corrective/additive materials, iron ore, river sand and gypsum are supplied from other suppliers. During the field survey, exploitation and supply conditions of limestone and marl were investigated. Since quarries of other raw materials have not been investigated by the field survey team, local conditions of these quarries are briefly described below according to the information given by IPD people.

2) Limestone

The limestone exploited for the cement plant is usually light-gray to pinkish and fine- to medium-grained. They can be locally coarse-grained and cut by a large amount of thin calcite-veins. The fossile content is highly variable. The limestone contains stringers and lenses of shale with variable thickness. A thicker zone of shales in the middle portion of the limestone horizon has been observed in places.
A nozzle feature of the limestone is that freshly broken pieces of the limestone give off a strong petroliferous smell, indicative of a small amount of organogenic compounds in the rock.
A lower grade of limestone is extracted from the overburden where the thickness of the intercalated limestone bands allows this. The $CaCO_3$-content of the lower grade limestone is ranging from 70 to 80%, whereas the average figure of $CaCO_3$-content of the limestone ranges from 85 to 90%.
The moisture of the limestone is reported to be 0.5-1.5% with a maximum of 3% during the rainy season. Since the plant has presently adopted the wet process, it can be said that variation of moisture content of raw materials has not so big effect on efficiency of the plant operation.

3) Marl

Marl is produced from the overburden zone overlying the main limestone bed. It is not a well-defined rock type but rather consists of a mixture of the various rock-types alternating in the overburden in highly variable proportions. Consequently the quality varies rapidly over short periods between about 30-70% $CaCO_3$ with an average around 50-55%.

During the rainy season, the maximum moisture content of marl is reported to be 8%.

4) Clay

The clay is only utilized in case the slurry has an excessive $CaCO_3$-content. The clay is extracted from the deposit at the foot of the limestone quarry along the existing ropeway. The clay is usually friable during the dry season, however, it becomes so sticky during the rainy season that difficulty in clay handling greatly increases. The maximum moisture content of the clay is reported to be about 2% in the dry season and about 10% in the rainy season.

5) Iron ore

In order to increase the amount of liquid phase and thereby improve the burnability of the raw mixture, the iron ore of about 1% is presently added to the raw mixture. The iron ore is supplied from the deposit which consists of a slightly hematitic to lateritic cavernous gossan.
Before added to the raw mixture, the iron ore is hand-crushed to less than 50 mm in the cement plant. The maximum moisture content during the dry season is reported to be about 1.5% and 5% during the rainy season.

6) River sand

In order to keep the silica content in the raw mixture at the desirable level, the river sand of about 4% is added to the mixture. The river sand is produced in a sand pit about 4.5 km to the north of the plant alongside the Irrawaddy River. Taking into account the mining difficulty during the rainy season, a large stock of about 5,000 t is always kept at the existing raw material storage yard.

7) Gypsum

The gypsum is delivered to the plant by barge from three deposits, namely Hsi Paw in the northern part of the country, Pakokku about 480 km north of the plant and Phaung Lin Gyi about 300 km far from the plant. The quality of each deposit is above 80% in purity for Hsi Paw and Pakokku, and 50-80% for Phaung Lin Gyi respectively.

8) Quantity of reserves

The total quantity of limestone reserves in the present quarry have been calculated from the latest information available on core logs, surface outcrops, etc. and reported to reach 14.4 million tonnes as a conservative estimate for the main limestone horizon.
The material included in two thinner layers above the main body in the present quarry would increase the quantity of reserves by about 10%. The quantity of limestone reserves exceed the expected consumption for more than 50 years by the plant with a capacity of 1,000 tpd.

I.3 Conditions of the processing facilities

1) Raw material crushing

A hammer crusher is installed at the quarry to break down the limestone to less than 25 mm, but the actual maximum grain size of discharge limestone reaches about 40-50 mm, because the gap between hammer heads and crusher inside liners exceeds the designed figures owing to hammer heads being worn-out.

These large-sized limestone have caused the clogging troubles at the raw mill feeding chute. A new hammer crusher was already purchased to replace by CIC from the supplier in Thailand, however it has not been replaced yet due to unproper design and manufacturing.

2) Raw material receiving

The limestone and marl are transported by ropeway from the quarry to the storage yard in the plant. The capacity of the ropeway is 150 t/h in design, and the actual capacity is reported to be about 135 t/h which exceeds the quantitative requirement on the raw material transportation after completion of a mini-cement plant project.
Gypsum and iron ore are received by barge and conveyed by truck to the storage after being crushed in the plant.
Clay and river sand are also received by truck and stored in the raw materials storage.
There are three sets of overhead crane in the storage yard. They have been utilized commonly for the raw materials receiving, discharging and clinker feeding to cement mill hoppers,
No.1 and No.2 overhead cranes are being operated under much serious conditions of uneven level of rails, superannuated and worn-out parts. It is necessary to urgently carry out further diagnosis on all parts of cranes by a specialist for accident prevention.

3) Raw material grinding

Each raw material is picked up by cranes and fed to its respective hopper from where it is discharged to the mill through the table feeder for the No.1b and No.2 mills and the belt feeder for the No.3 mill, located under the hopper respectively.

Water is added to the mixed materials at the mill inlet and the mixed raw materials are ground by the wet system. The slurry is pumped to six slurry tanks and after blending, pumped into the slurry basin from where it is fed to the kiln.

The flow of material is a normal process for a wet type kiln, and the water content of the slurry is usually controlled at 33-35% from the viewpoint of heat consumption and handling. At this plant, however, water content of the slurry is 40±2% which causes jamming troubles in the slurry pipes.

From the viewpoint of quality and operation, it is important that composition and water content of the slurry should be controlled constantly. However, the present raw material mixing facility and water adding facility are not satisfactory. The feeder of each raw material is a constant speed type feeder with a manually adjustable open-gate, so if the condition of raw materials changes, the amount of discharge will change. If an accurate mixing is to be performed with this equipment, the gate opening should be frequently adjusted to assure a good control. At present such adjustment is not performed so water content seems to be influenced by their error in mix control.

As for the detailed discussion on defects found during the field survey, refer to Section II.

4) Clinker burning

Slurry stored in the slurry basins is pumped to the kiln feed tank located on the top stage of the kiln end tower. A bucket scoop type feeder is installed in the tank and the feed amount is controlled by regularly the rotation of the bucket. In order to raise the accuracy of feeding, the slurry in the tank is controlled to a prefixed level and if the slurry comes higher than this level, it overflows back into the slurry basin.

The No.1 kiln diameter inside the shell is 2,550 mm at inlet and discharge ends and 2,250 mm at center, while the length is 76.6 m. The calculated amount of output per unit inner volume is 23 kg/m^3h (200 t/d base) which is a little high for this type of kiln.
The produced clinker is transported by a pan conveyor to the storage yard separated by a wall from the raw materials storage yard.
The problems are as described in Section II. Main reasons of decrease in daily average clinker production are considered to be as follows:

- Increase of false air from the clinker cooler and the induced fan periphery
- Increase of water content of the slurry
- Unproper maintenance due to a lack of spare parts and poor operation control

5) Cement grinding

Clinker and gypsum are picked up by overhead cranes used commonly for raw materials in the storage yard, and charged into respective hoppers from where the materials are fed to two mills by respective table feeders and belt feeders located under the hopper.
The present average output of cement mills is about 43 t/h, but the mills totally have a potential capacity of 61 t/h. They are independently equipped with a Sturtevant type separator and a bagfilter for dust collection. The cement is pumped to the cement silo with a kniyon pump so power cost is high.
Since cement temperature at the outlet of the mill easily exceeds the standard limit, operation of the mill is frequently forced to be stopped in order to keep good quality of cement. The main reason of this stoppage seems a shortage of the circulating air volume for

the air separator, owing to impossibility of increasing the air volume for the reason of non-availability of the existing bagfilter.
Details of findings and discussion results are as described in Section II.

6) Packing and shipping

There are two lines of packing system, which design capacity is 60 t/h and 90 t/h respectively. Both lines have four cement silos with a totalling capacity of 4,000 tonnes and 6,000 tonnes respectively. The cement discharged from the cement silos is conveyed by a chain conveyor to the packer. One rotary type cement packer is provided in the No.1 line and two stationary type packers are in the No.2 line.
Almost all bagged cement is shipped by barge from the plant to the demand areas and depots.
The loading facilities for each line are independent with separate route, so it is difficult to change the line when a packer breaks down during operation, which will cause trouble during busy shipping hours.
Furthermore, due to a lack of paper bags and spare parts, the present packing capacity decreases to about 50 t/h in total.
The packing room is dusty with dust piled up everywhere creating a very bad environment. There are several sets of bagfilter type dust collector, but it can not be seen that they are operating effectively.

II. Results of Diagnosis on Cement Plant and Associated Facilities

Item	Present Situation	Comments
1) Limestone crusher to ropeway	° Design capacity of the crushing plant and the ropeway is each 150 t/h respectively, but due to the working condition at quarry, the actual capacity is decreased as follows: - crushing plant : 110 - 120 t/h - ropeway : 130 - 135 t/h	
• Ropeway	° Regarding the capacity for the project of a mini-cement plant, the existing ropeway is considered to have a enough capacity because the rehabilitation was completed in 1982.	
• Hammer crusher	° On the other hand, the crushing plant, especially the hammer crusher, shows low capacity a bit and has problems below-mentioned. - Hammer and liner are worn-out and lacking in spare parts. - Hammer crusher is operated with somewhat big amplitude of vibration. - Max. grain size of discharge limestone is about 40 - 50 mm, which exceeds the designed size (25 mm) for the raw mill feed.	- CIC has already purchased the new hammer crusher made in Thailand and a chain conveyor, which are not installed yet due to unproper design and manufacturing. - It is better to install the new hammer crusher before start of a mini-cement plant project.
2) Raw material and clinker storage hall	° No.1 and No.2 overhead cranes are operated under much serious conditions of uneven level of rails, superannuated and worn-out parts.	- It is necessary to carry out the detailed diagnosis about all parts by a specialist urgently for accident prevention and a mini-cement plant project.
• Gypsum crusher	° Gypsum crusher has eccentricity of rotor shaft.	

Item	Present Situation	Comments
3) Raw mills	° Raw mill 1A - Shell is almost completely worn-out and cracked, therefore, it has been already stopped because of coming life.	
° Productivity	° Present grinding capacity is as follows: (see table below)	- It is recommended to check the feed material size distribution and the following conditions of the raw mill inside. . Actual ball charge . Actual ball size . Opening ratio of slit plates . Process control items

Raw mill	Designed		Present		Availa-bility
	t-Dry/n	170 mesh Residue	t-Dry/h	170 mesh Residue	
1B	16	-	9	10%±2	56.3%
2	32	7%	19	10%±2	59.4
3	32	7%	22	10%±2	68.8
Total	80		50		62.5

- Even though present fineness of slurry is coarse than the designed one, availability of each raw mill capacity is very low, which is 56 - 69% only.

- After completion of the project of a mini-cement plant, surplus ratio of the raw mill capacity is calculated as follows:

  . Raw mill capacity : 50 t/h x 24 h = 1,200 t/d
  . Necessary amount of raw meal to kiln No.1, 2, and 3 : (200+400)t/d x 1.660 = 1,000 t/d
  . Surplus ratio : 20%

Comments: - Feasibility study should be carried out with 20% surplus ratio of raw mill capacity.

Item	Present Situation	Comments
	- This surplus ratio seems to be enough, but actual production capacity of kiln No.2 and No.3 in the dry season will increase to about 250 t/day each. Then a surplus ratio in the dry season is computed as follows: . Raw mill capacity: 50 t/h x 24 h = 1,200 t/d . Necessary amount of raw meal for kiln No.1, 2, and 3 : (200+250x2)t/d x 1.660 = 1,160 t/d . Surplus ratio : 3.4% - This surplus ratio is considered to be very tight for operation and maintenance.	
° Major troubles (refer to Table-1)	° According to Table-1 and the field survey results in October 1987, the raw mill department has been suffered from the following persist and chronic troubles resulting in 60-70% of grand total stoppage hours. - Common troubles	
	(1) Mechanical and electrical defects of overhead cranes	- Refer to item (2) in page 10.
	(2) Power failure Power failure frequency: 95 times (Oct. 1986 - Sep. 1987)	
	(3) Mill shell crack and slurry leakage - Especially shell cracks of raw mill No.2 are found almost over whole areas.	- It is recommended to use the rubber liner for wearing prevention.
	- Raw mill No.2 (1) Defects of mill bearing and reducer gear	- CIC has already purchased a new reducer, but it is not installed yet.

Item	Present Situation	Comments
	- Raw mill No.3 (1) Life of slurry pump blade is short. (2) Hopper and mill inlet chute make clogging troubles very often. (3) Main drive motor often trips due to abnormal rising of bearing temperature.	- Lining plate of high molecular polyethylene is useful to hopper.
4) Slurry	° There are two slurry basins, but one is out of order. ° High water content and slurry pipe jamming occur very often.	- Under repair by CIC. - It is recommended to increase the diameter of slurry pipe and decrease a target of water content from 40%±2 to 37%±2 step by step.

Table 1 Major and Chronic Troubles

(Unit: hours of stoppage)

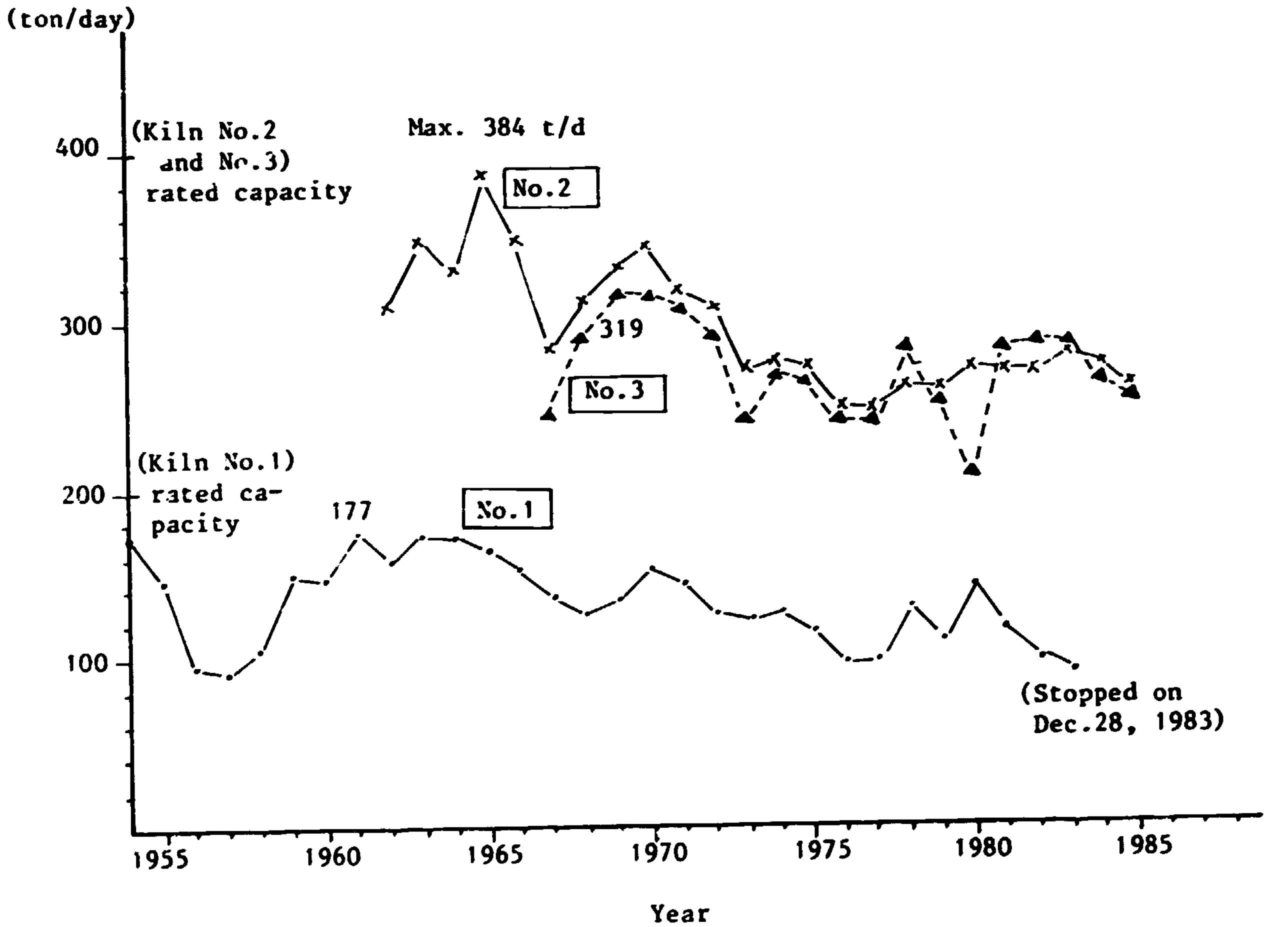
Troubles	Raw mill No.2					Raw mill No.3				
	1979/80	1980/81	1981/82	1982/83	1983/84	1979/80	1980/81	1981/82	1982/83	1983/84
Crane (including electrical troubles)	233.10	358.15	213.10	291.30	275.55	343.10	400.05	374.20	796.45	630.35
Raw material shortage	2330.00	140.55	0	0	0	1040.20	0	0	94.25	0
				Almost solved				Almost solved		
Power failure	380.05	238.20	294.35	727.35	746.50	358.10	321.50	341.00	298.20	887.00
Mill shell	364.25	847.30	341.55	2,404.10	1,000.25	130.05	264.20	198.15	394.05	547.30
Mill bearing and reducer gear	607.50	134.00	732.00	133.05	1,071.40	6.20	1.00	0	0	1.15
Slurry pump	0	99.30	110.55	87.40	134.45	80.25	147.30	140.25	331.15	339.05
Total stoppage hours	3,915.30	1,818.30	1,692.45	3,644.00	3,229.35	1,958.30	1,134.45	2,054.00	2,014.50	2,405.25
Total stoppage (ratio)	(76.3)	(40.4)	(29.9)	(70.1)	(60.3)	(70.1)	(43.7)	(24.9)	(57.4)	(72.8)
Grand total stoppage hours	5,129.30	4,506.35	5,653.10	5,197.25	5,352.25	2,792.00	2,598.50	4,226.35	3,508.35	3,302.50

Source: CIC

Note: Grand total stoppage hours include stoppage due to full-loaded silo and other minor troubles.

Item	Present Situation	Comments
5) Kilns ° Actual clinker Production	° Table 2 shows the annual average result of daily clinker production. ° According to the table 2, the average daily production of kiln No.2 and No.3 is coming down by about 8 t/day a year (1.5 t/day for kiln No.1). ° Causes of decrease in daily average production are considered as follows: (1) Increase of false air from the clinker cooler and the induced fan periphery. (2) Increase of slurry water content. (3) Lack of optimum and periodical maintenance and unproper operation control.	- Procedure for improvement to increase daily production. (1) Arrangement of measuring instrument. (2) Confirmation of the present operating condition such as gas balance, heat balance, etc. (3) Planning of improvement and action for countermeasures.

Table 2 Actual Clinker Product Record
Thayetmyo-Plant, Burma



Item	Present Situation	Comments
° Major troubles	° Common troubles - According to "Stoppage analysis record" made by CIC, there are the following common troubles: (1) Electrical and Power failure (2) Slurry shortage (3) Sudden brick lining trouble of kiln Most of serious troubles in kiln department of Thayetmyo cement plant is poor maintenance for important mechanical elements of kiln itself, which is discussed below. Furthermore, the present instrumentation for stable and effective operation and maintenance is poor and some of the existing instruments are out of order.	
	° Kiln No.1 - Clearance between type and liner plate seems to be big due to being worn-out. - Cracks and deformation on kiln shell are found at several areas. - Almost all supporting rollers have problems in shaft scratching, worn-out plane bearings, roller cracks etc. - Driving parts have problems in girth gear (breakage of gear rim and abnormal worn-out gear surface), spring plate for girth gear (bended), torsion shaft (breakage), etc. Refer to photo-1 and 2.	- In case of a mini-cement plant project by using the present kiln 1 line, (1) Concrete foundation of kiln supporting roller and drive unit seems to be available to the new kiln after minor modification. (2) Whole kiln, ID fan and planetary cooler are not available due to the major mechanical troubles mentioned below.

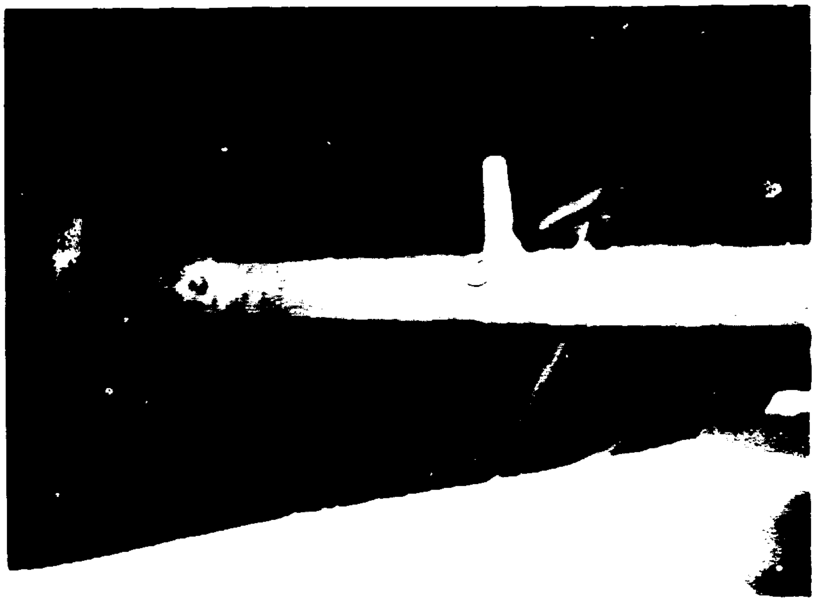


Photo 1 Breakage of girth gear rim of kiln No.1

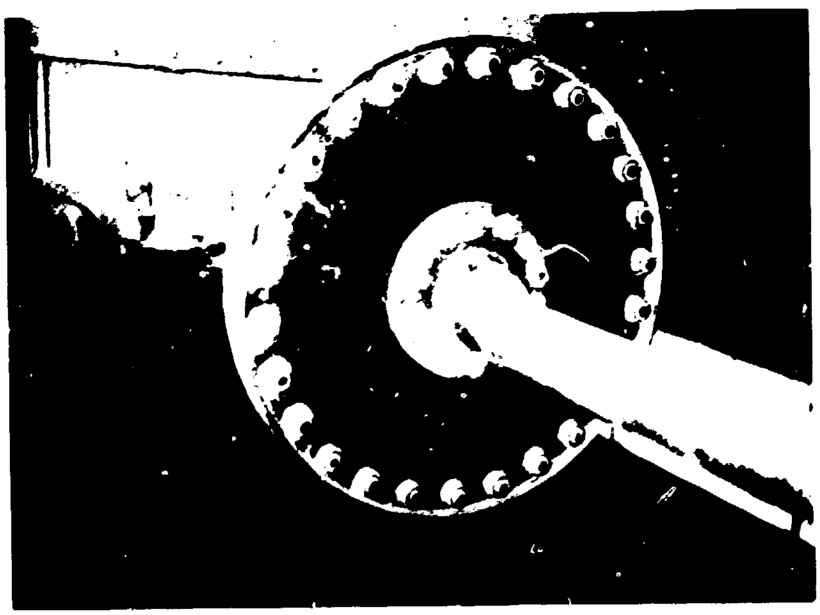


Photo 2 Breakage cf torsion shaft of kiln No.1

Item	Present Situation	Comments
	° Kiln No.2 - Pinion for girth gear is so completely damaged that it is impossible to use again. - Girth gear is abnormally worn-out, and under reversing work of girth gear position by CIC. ° Kiln No.3 - Tyre itself is completely damaged due to heavy crack and pittings at 5th tire station (chain part zone). Refer to photo-3 and 4. - Coupling of torsion shaft has crack. - Many cracks are found at 2nd and 3rd tire rims. - Kiln shell crack with a completely perforated hole is found between 5th and 6th tire station. Refer to photo-5. - Kiln shell is badly and widely deformed at the area near 5th tire station. Refer to photo-6. - Pinion and girth gear are damaged and abnormal gear working is found.	(3) Slurry feeding unit is not available. (4) Clinker conveyor seems to be available after repair. ° Main reason of damage of pinion and girth gear is misalignment (backlash and top clearance) of gear working. ° In total, kiln No.3 has been operated under very serious situation due to unexecution of major and proper mechanical maintenance.

Item	Present Situation	Comments
	- Track and wheel of grate cooler are worn-out exceeding the limit. - A lot of high temperature clinker are spilled from damaged grate plates. This is a reason why cement temperature at the outlet of cement mill rises higher. - The ID fan has no adjustable surplus capacity under around 60% of rated output due to a lot of air leakage, high water content of slurry, etc. - Lubrication oil gauge for supporting rollers are almost broken.	- No spare grate plates is stored. Urgent procurement of spare grate plates is strongly recommended. - Damper opening ratio of the ID fan is about 76% resulting in nearly full flow rate of the ID fan.

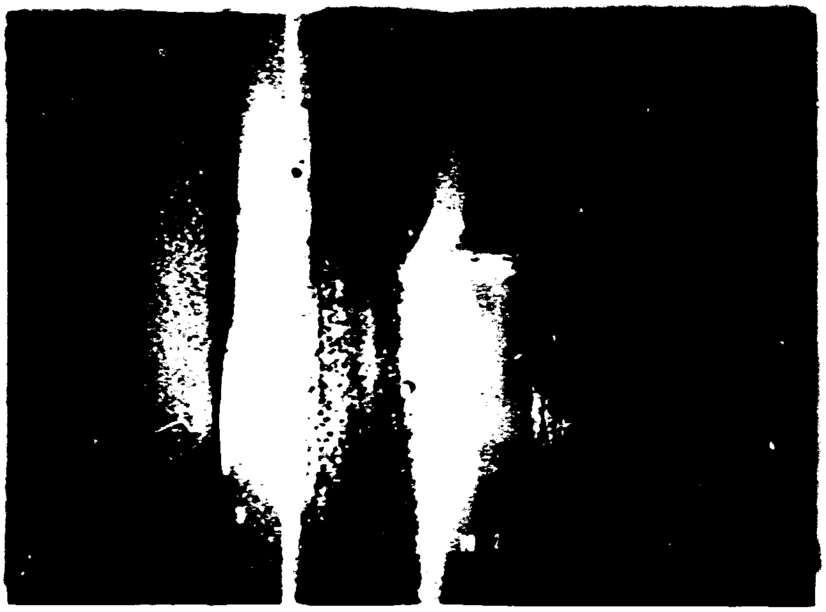


Photo 3 Crack at 5th tyre station of kiln No.3

Photo 4 Deep pilling at 5th tyre station of kiln No.3

Photo 5 Perforated shell crack of kiln No.3

Photo 6 Shell deformation of kiln No.3

Item	Present Situation	Comments
6) Cement mills		
• Productivity	• Present grinding capacity is as follows.	The following data is not available, which has a close relation to efficiency of grinding mills. . Actual ball charge . Actual ball size distribution . Separator circulating ratio . Opening ratio of diaphragm slit plate

Cement mill	Designed		Present		Availability
	t/h	170 mesh Residue	t/h	170 mesh Residue	
2	28	8%R	20	* 9.6%R	71.4%
3	33	8%R	23	* 7.0%R	69.7
Total	61		43		70.0%

Note: The figures were measured on 31, March 1987.

- Cement fineness (170 mesh) is nearly the same as the designed value, but availability of both mills is very low, which is only 70%.

- The surplus ratio of cement mill capacity after the project of a mini-cement plant is expected as follows:

  . Clinker production : (200+400)t/d x 1.06(including gypsum) = 636 t/d
  . Cement mill : 43 t/h x 24 h = 1,032 t/d
  . Surplus ratio : 61.6%

- An expected ratio of cement mill capacity seems to be reasonable, however, the below consideration should be taken to practically obtain this expected figure for a long period.

Comments: In case clinker production is expected to be 200 t/d + 250 t/d x 2 = 700 t/d, the computed surplus ratio comes to be: 39.1%.

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Item	Present Situation	Comments
° Major troubles (Refer to Table-3)	° According to Table-3 and the field survey results in October 1987, the cemen mill department is suffered from the following persist and chronic troubles resulting in 50-60% of grand total stoppage hours. - Common troubles (1) Overhead crane (2) Mill stoppage by laboratory instruction The cement mill department has to be stopped in order to keep good cement quality, because the cement temperature at the mill outlet exceeds the standard limit.	- Refer to item (2) in page 10. - Standard limit of temperature is lower than 110°C.

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Table 3. Major and Chronic Troubles Hours

Cement mill Dept.

(Unit: hours of stoppage)

Troubles		Cement mill No.2 1979/80	Cement mill No.2 1980/81	Cement mill No.2 1981/82	Cement mill No.2 1982/83	Cement mill No.2 1983/84	Cement mill No.3 1979/80	Cement mill No.3 1980/81	Cement mill No.3 1981/82	Cement mill No.3 1982/83	Cement mill No.3 1983/84
Crane		124.20	130.55	40.15	383.45	150.25	247.00	192.30	137.00	393.10	165.00
Laboratory (Cement temperature, etc.)		366.10	333.15	0 *2)	323.15	722.40	547.15	824.45	0 *2)	550.20	1,423.25
Electrical and power failure		633.15	330.05	331.25	275.55	587.05	416.05	268.00	436.25	279.10	596.50
Mill shell		655.55	301.50	340.15	638.20	723.50	178.05	431.45	173.20	698.40	170.15
Air separator		144.15	251.15	563.45	70.10	77.45	202.40	282.55	21.50	63.20	44.50
Bucket elevator & screw conveyor		123.30	328.05	193.10	763.40	249.25	10.00	63.35	33.15	18.00	34.20
Total stoppage	hours	2,047.25	1,675.25	1,468.50	2,445.05	2,511.10	1,601.05	2,063.30	801.50	2,012.40	2,534.40
	(ratio)	(43.5)	(44.5)	(25.5)	(54.1)	(64.8)	(50.7)	(56.1)	(20.2	(54.6)	(58.5)
Grand total stoppage hours *1)		4,710.45	3,767.25	5,760.35	4,539.05	3,876.30	3,160.50	3,676.35	3,967.30	3,667.00	4,335.00

Source: CIC

Note: 1) Grand total stoppage hours include stoppage due to clinker shortage and other minor troubles.
2) The figures are questionable.

<table>
<tr><th>Item</th><th>Present Situation</th><th>Comments</th></tr>
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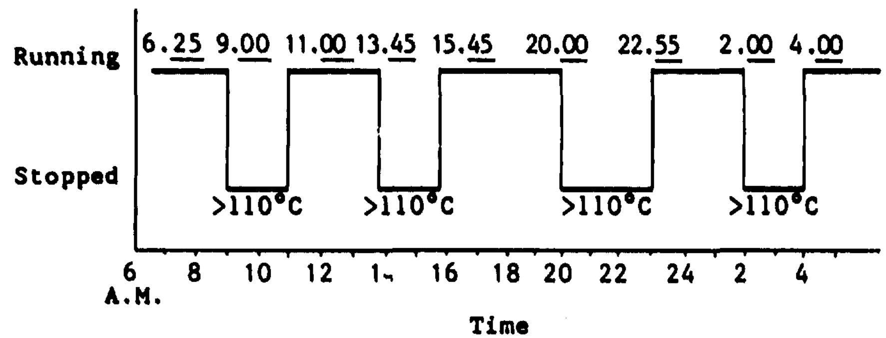
A typical record of cement temperature at the No.3 mill outlet is shown below.



- The data measured on 31, March 1987 show that the cement mill department is hampered the normal operation due to rising of cement temperature very often.

(3) Electrical and power failure

(4) Defects of mill shell

(5) Troubles of separator and transportation machinery

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- If the problem concerning cement temperature is not solved before completion of a mini-cement plant project, the expected surplus ratio of cement mill capacity will drop down from 61.6% to approx. 30%.
- In case of clinker production of (200+250x2)t/d, surplus ratio: approx. 20%

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Item	Present Situation	Comments
	- Cement mill No.2 (1) Air slide for fine product transportation has often jamming troubles. Refer to photo 7 in page 23. (2) The bearing for main drive gear and the shaft of inching device are damaged. (3) The bag filter for the mill and the separator is not used effectively. - Cement mill No.3 (1) The bag filter is not used completely, according to the fact: - Efficiency of classifying and cooling of cement by air-swept type separator are much decreased. - Therefore, the cement mill is forced to be operated under the bad condition due to blowing out of air and cement from the cooling air inlet duct connected to the separator.	- Modification work such as increase of air slide inclination should be immediately carried out by CIC.

Photo 7 Air slide jamming condition of cement mill No.2

<table>
<tr><th>Item</th><th>Present Situation</th><th>Comments</th></tr>
<tr>
<td>7) Packing plant</td>
<td>

° The following major problems in packing plant are coming from persist and chronic lack of spare parts;

(1) The rotary packer of plant No.1 is manually operated by using only 2 spouts (original 10 spouts).

(2) One set of stationary packer of plant No.2 (original 2 sets) is out of order for a long period.

(3) Shortage of paper bags causes troubles of cement shipping.

° Capacity of packers

<table>
<tr><th colspan="2"></th><th>Designed</th><th>Normal</th><th>Present</th></tr>
<tr><td colspan="2">Plant No.1</td><td>60 t/h</td><td>50 t/h</td><td>10 t/h</td></tr>
<tr><td rowspan="2">Plant No.2</td><td>No.1</td><td>45 t/h</td><td>40 t/h</td><td>40 t/h</td></tr>
<tr><td>No.2</td><td>45 t/h</td><td>40 t/h</td><td>0 t/h</td></tr>
<tr><td>Total</td><td></td><td>-</td><td>130 t/h</td><td>50 t/h</td></tr>
</table>

Remarks: Normal capacity of plant No.2 is presumption.

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<td>

° Lack of spare parts is serious problem to Thayetmyo cement plant.

° Present actual capacity:

50 t/h x 6 hours/shift
= 300 t/shift

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</table>

Item	Present Situation	Comments
8) Quality control	° Basic quality control of the Thayet cement plant is being carried out in accordance with "B.S. 12, 1958." ° Quality control standard limits compared with the actual data are as follows:	

° Raw mill slurry

Items	Allowable standard	Actual data		
		Raw mill No. 1B	Raw mill No. 2	Raw mill No. 3
Water (%)	40±2	40.7	-	40.8
Fineness (%) (Residue on 170 mesh)	10±2	10.1	-	10.4
Viscosity (cm)	6±2	4.6	-	4.8

Source: CIC report dated 31 March 1987
Note: Figures show the daily average of every 2 hours.

Comments: ° Slurry control is very stable.

° Kiln feed slurry

Items	Allowable standard	Actual data		
		Kiln No. 1	Kiln No. 2	Kiln No. 3
Water (%)	40±2	-	-	41.2
Fineness (%) (Residue on 170 mesh)	10±2	-	-	10.3
$CaCO_3$ (%)	76±0.2	-	-	76.2

Source: CIC report dated 31 March 1987.

Comments: ° Agitator No. 2 is out of order.

Item	Present Situation	Comments

° Clinker

° Chemical test results

	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	SO_3	L.O.I	Free CaO	H.M	S.M	I.M	L.S.F
B.S 12 1958	-	-	-	-	<4.0	<3.0	<3.0	-	2.00* -2.10	2.10* -2.40	1.80* -2.10	0.66 -1.02
Kiln No.3	22.14	3.52	4.84	64.7	1.45	0.26	0.02	0.21	2.12	2.65	1.38	0.92

Note 1) Figures indicate the plant operational standards.

° Litre weight

	Plant limit (kg/l)	Shift average 1	Shift average 2	Shift average 3	Average	Range
Kiln No.3	1.25 - 1.35	1.25	1.29	1.27	1.27	0.09

Note: Figures show the daily average of every 2 hours.

- It is recommended to prepare the plant own control limits in chemical tests.

- The kiln burning condition seems very stable according to the results of actual litre weight.

° Specific surface of fine product

Cement mill	Plant limit (cm^2/gr)	Shift average 1	Shift average 2	Shift average 3	Average	Range
No.2	3,000±200	2,934	2,877	-	2,905	165
No.3		3,010	2,980	3,076	3,022	217

Note: Figures show the daily average of every 2 hours.

- Specific surface control is stable.

Item	Present Situation	Comments
• Packed cement	• Test results on daily average cements	

Items	Fineness		Setting Time			Soundness	Comp. Strength		SO_3
	Res. on 170 mesh	Specific surface	W(%)	Ini.	Fin.	mm	3 days	7 days	(%)
B.S 12 1958	10.0% (max)	(3,000 ±200) (cm^2/gr)	-	45 min (min)	10 hrs (max)	5 mm (max)	2,200 P.S.I (min)	3,400 P.S.I (min)	-
Plant No.1	8.2	2,983	31.0	125	2h 55m	1/2	2,962	3,974	-
Plant No.2	7.8	2,955	31.0	125	2h 55m	0	3,035	3,468	-

Source: CIC

Note: Standard of specific surface shows the plant limit.

Comments:

- Quality control at the Thayetmyo cement plant is almost completely carried out on all items except the cement temperature at the mill outlet.

Item	Present Situation	Comments

9) Unit consumption

° Raw material

(Unit: ton/ton-cement)

	Present (1987)
Limestone	1.2097
Clay	0.3722
Siliceous material	0.0635
Ferrous material	0.0158
Total	1.6612
Gypsum	0.0600

Source: CIC

° Natural gas

° Monthly average specific heat consumption for the kiln No.2 and No.3.

(Unit: kcal/kg-cement)

	1984	1985	1986
Maximum	2,519	2,094	2,216
Minimum	1,691	1,741	1,696
Average	1,936	1,853	1,881

Note: Designed heat consumption of the kiln No.3 is 1,360 kcal/kg-cement at 37% water content in slurry.

Comments:

- In general, specific heat consumption in the wet-long process will be 1,350 -1,400 kcal/kg-clinker.
- The reason of high specific heat consumption at Thayetmyo cement plant is that the production rate of kilns is low as 60% compared to the designed figures.

<table>
<tr><th>Item</th><th>Present Situation</th><th>Comments</th></tr>
<tr><td></td><td>

° Property of natural gas

<table>
<tr><td colspan="2">Calorific value</td><td>8,120 kcal/m³</td></tr>
<tr><td rowspan="6">Component</td><td>Methan</td><td>96.4 - 98.8%</td></tr>
<tr><td>Ethan</td><td>0.93 to trace</td></tr>
<tr><td>Propane</td><td>0.98 to trace</td></tr>
<tr><td>Iso-buthan</td><td>0.97 to trace</td></tr>
<tr><td>Nor-buthan</td><td>0.54 to trace</td></tr>
<tr><td>Pentan</td><td>0.10</td></tr>
</table>

</td><td>

- Calculated calorific value by gas component is as follows:

H(high) = 10,032 kcal/m³

H(low) = 9,034 kcal/m³

</td></tr>
</table>

Item	Present Situation	Comments
• Electric power	• Department-wise power consumption (last 3 years) is as follows:	

(Unit: kWh/t-cement)

Dept.	1984	1985	1986
Quarry	4.4	5.4	6.2
Raw material	36.8	43.8	50.2
Kiln/cooler	21.3	19.9	25.6
Cement	41.6	42.4	42.8
Administration	2.6	3.1	4.0
Water pump	2.9	3.6	4.9
Others	3.5	4.4	5.2
Total	113.1	122.6	138.9

Note: Covered area of each department is as follows:

- . Raw material : Crane, raw mill and slurry
- . Cement : Cement mill and gypsum crusher
- . Administration: Factory lighting and workshop

Comments:

- Power consumption shows a tendency to increase year by year.

<table>
<tr><th>Item</th><th>Present Situation</th><th>Comments</th></tr>
<tr>
<td>• Consumables</td>
<td>

° Six sets of seven diesel engines are not available due to a lack of spare parts, and the electric power is presently supplied by Electric Power Corporation.

° Consumables consumption are as follows:

(Per ton-cement)

<table>
<tr><th>Consumables</th><th>Unit</th><th>1984</th><th>1985</th><th>1986</th></tr>
<tr><td>Paper bag</td><td>Nos.</td><td>21-22*</td><td>21-22</td><td>21-22</td></tr>
<tr><td>Explosive</td><td>kg</td><td>0.813</td><td>0.712</td><td>0.665</td></tr>
<tr><td>Grinding media</td><td>kg</td><td>1.06C</td><td>0.995</td><td>1.230</td></tr>
<tr><td>Liner for grinding</td><td>kg</td><td>0.219</td><td>0.250</td><td>0.177</td></tr>
<tr><td>Lube-oil, grease</td><td>Litre</td><td>0.841</td><td>1.036</td><td>0.909</td></tr>
<tr><td>Fire-brick</td><td>kg</td><td>3.234</td><td>1.813</td><td>3.467</td></tr>
<tr><td>Chain part</td><td>kg</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Source: CIC

Note: Cement is shipped only in bagged cement of 50 kg.

</td>
<td>

- Even though taking into consideration that the consumption of grinding media in the wet process is in general about 2 times higher than the dry process, the actual results of consumption at the Thayetmyo plant seems to be a little high.

- Fire-brick consumption seems to be 2-3 times higher compared with other typical wet kilns.

</td>
</tr>
</table>

Item	Present Situation	Comments
• Utility	• Utility consumption is as follows:	

(Per ton-cement)

Utility	Unit	1984	1985	1986
Natural gas *1	m^3	296	272	365
Water	m^3 *2	9.2	11.3	14.6
Diesel oil	Litre	7.7	9.1	9.5

Source: CIC

Note: The figures include consumption in the non-production area such as the administration office, laboratory, workshop, etc.

<table>
<tr><th>Item</th><th>Present Situation</th><th>Comments</th></tr>
<tr>
<td>10) Management

° Man power</td>
<td>° Organization chart

The organization chart of the Thayetmyo cement plant is shown in the attached drawing.

Number of personnel (as of October 1987)

(Unit: person)
<table>
<tr><td>Set-up</td><td>1,619</td></tr>
<tr><td>Appointment</td><td>1,249</td></tr>
<tr><td>Vacancy</td><td>370</td></tr>
</table>
Source: CIC

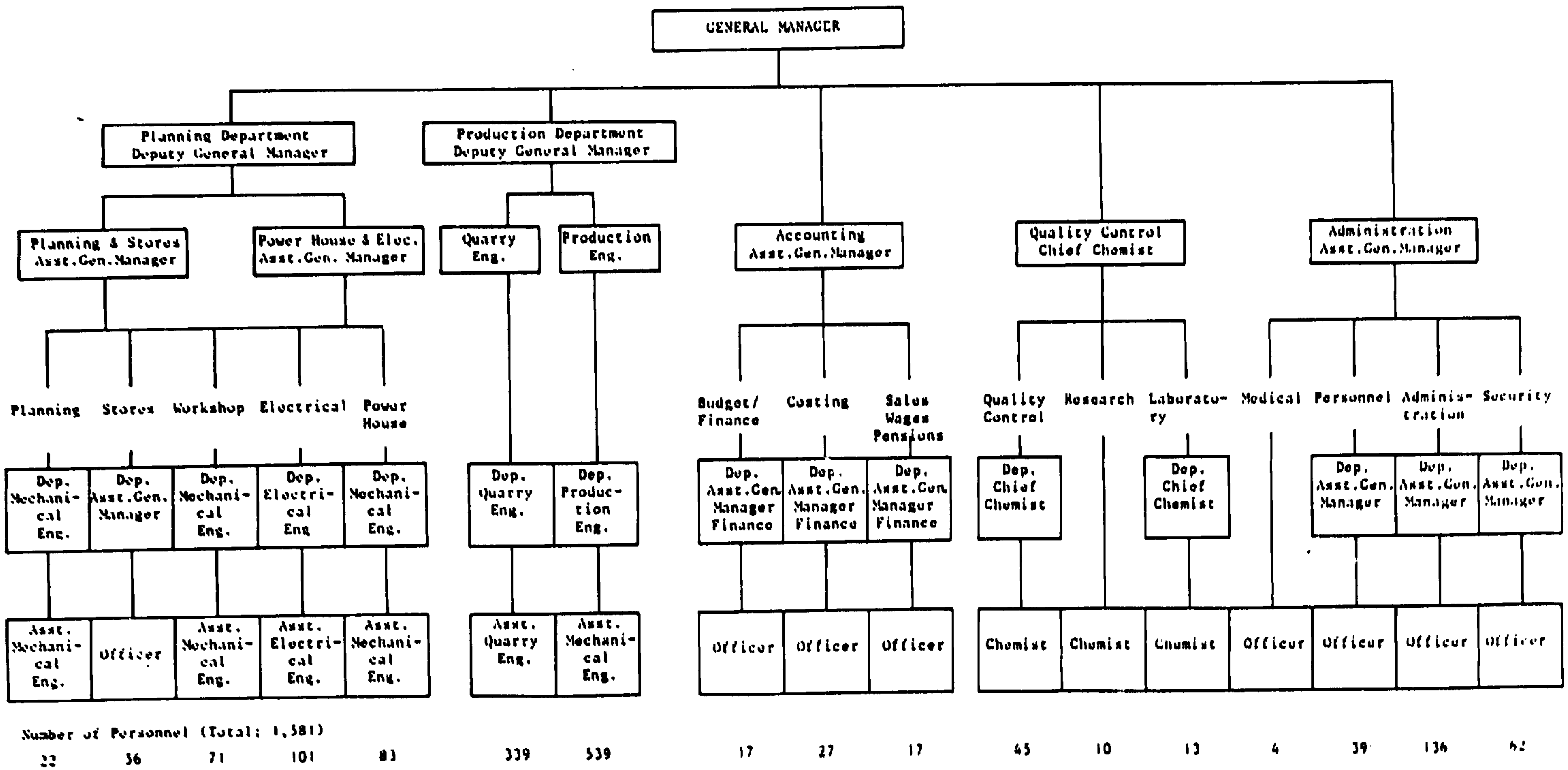
The following high skilled and extensively experienced engineers are presently required for maintenance and operation control in the Thayetmyo cement plant.

(1) Specialists for the preventive maintenance of main machinery

(2) Designers (not draftman) for improvement

(3) Data analists necessary for planning of practical countermeasures</td>
<td>- It is strongly recommended not only to solve problems of a lack of spare parts but also to provide the training of broad areas on the preventive maintenance by foreign experts.</td>
</tr>
</table>

THAYETMYO CEMENT PLANT
Organization Chart
(as of 1985)



Source: CIC, Rangoon

Item	Present Situation	Comments
• Spare parts	• In general, major consumable parts in the cement factory are as follows: (1) Hammer for crusher (2) Grinding media and liner plate (3) Refractory (4) Grate plate for clinker cooler (5) Conveyor belt (6) Filter bag for bag filter (7) Canvas for air slide (8) Parts for packers No stock of the above items (1), (4), (5), (6) and (8) is kept at present, which has brought the Thayetmyo cement plant the serious situation disturbing the stable operation.	- It must be strongly envisaged that the plant operation under a lack of major consumable spare parts will cause the serious damages of important mechanical and electrical equipment.
11) Environmental pollution	• There is no regulation standard to control the environmental pollution in Burma. The existing dust collectors for each kiln exhaust gas are out of function.	- It is recommended to decrease the dust emission from the chimney by repairing the dust transportation equipment and dust collectors.