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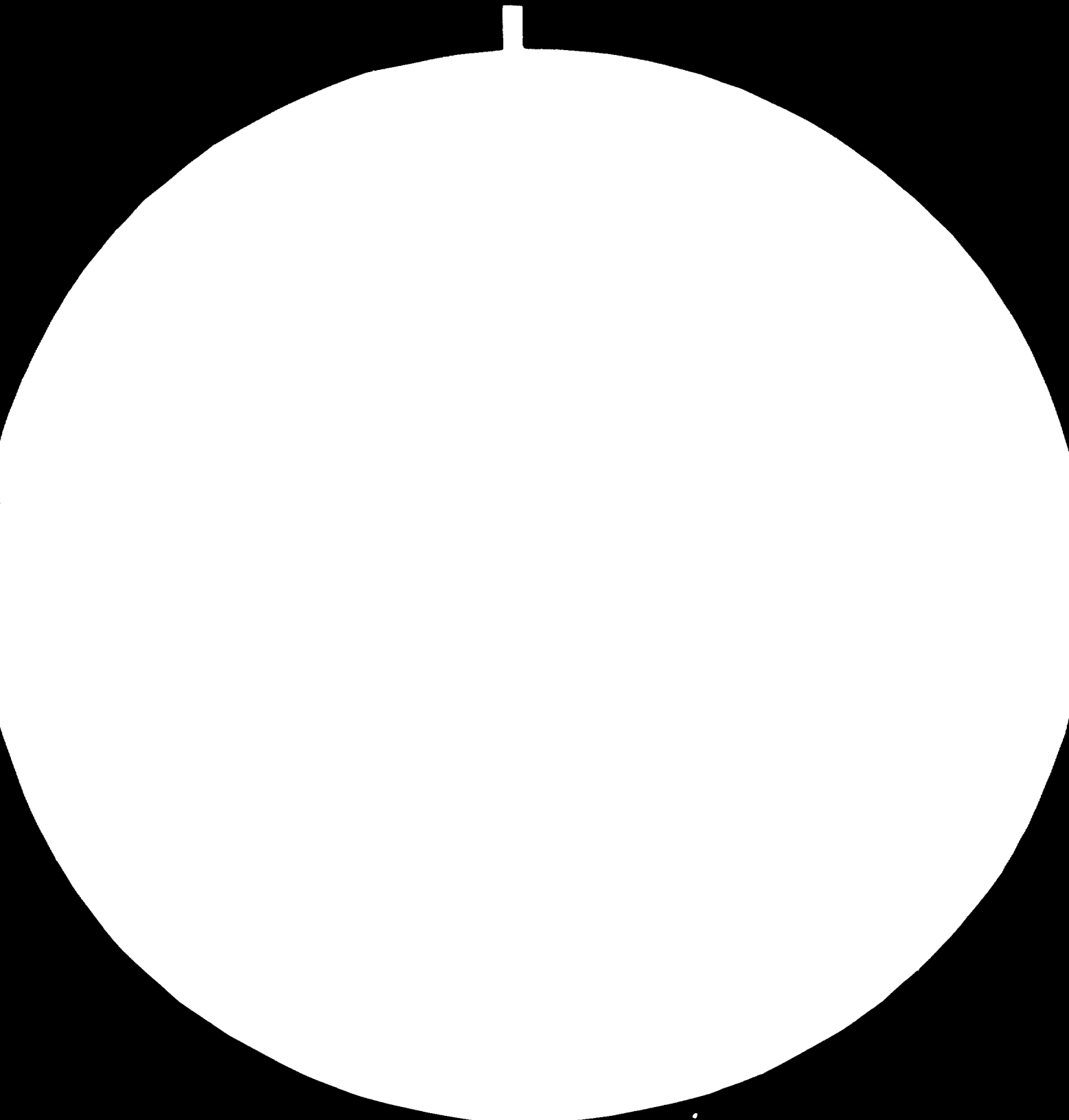

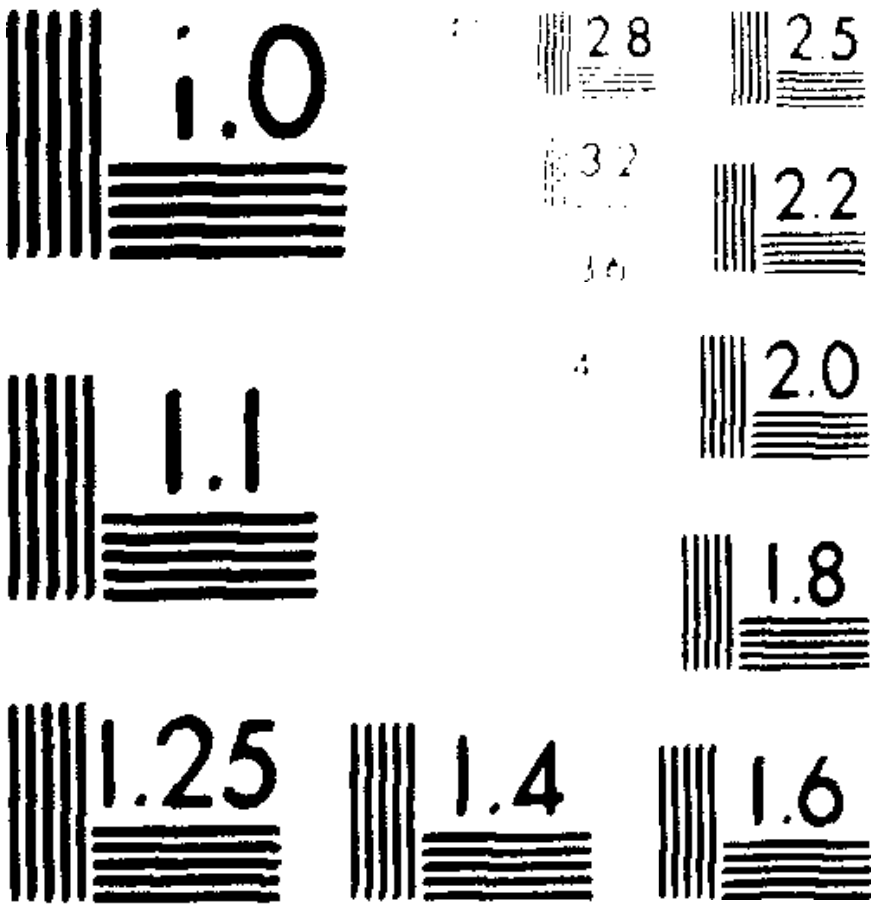

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CEMENT RESEARCH AND DEVELOPMENT CENTRE

DP/TUR/72/034

TURKEY

Technical report: Energy-saving conversion and expansion of Bartin Cement Plant

Prepared for the Government of Turkey
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Harald C. Boeck, cement expert

United Nations Industrial Development Organization
Vienna

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Explanatory notes

References to tons (t) are to metric tons.

References to dollars ($) are to United States dollars.

Besides the common abbreviations, symbols and terms, the following abbreviations have been used in this report:

ÇISAN	Türkiye Çimento Sanayii T.A.S. (Turkish Cement Industries Company - TCIC)
CRDC	Cement Research and Development Centre
kcal	kilocalorie
kJ	kilojoule
t/a	tons per annum
t/d	tons per day

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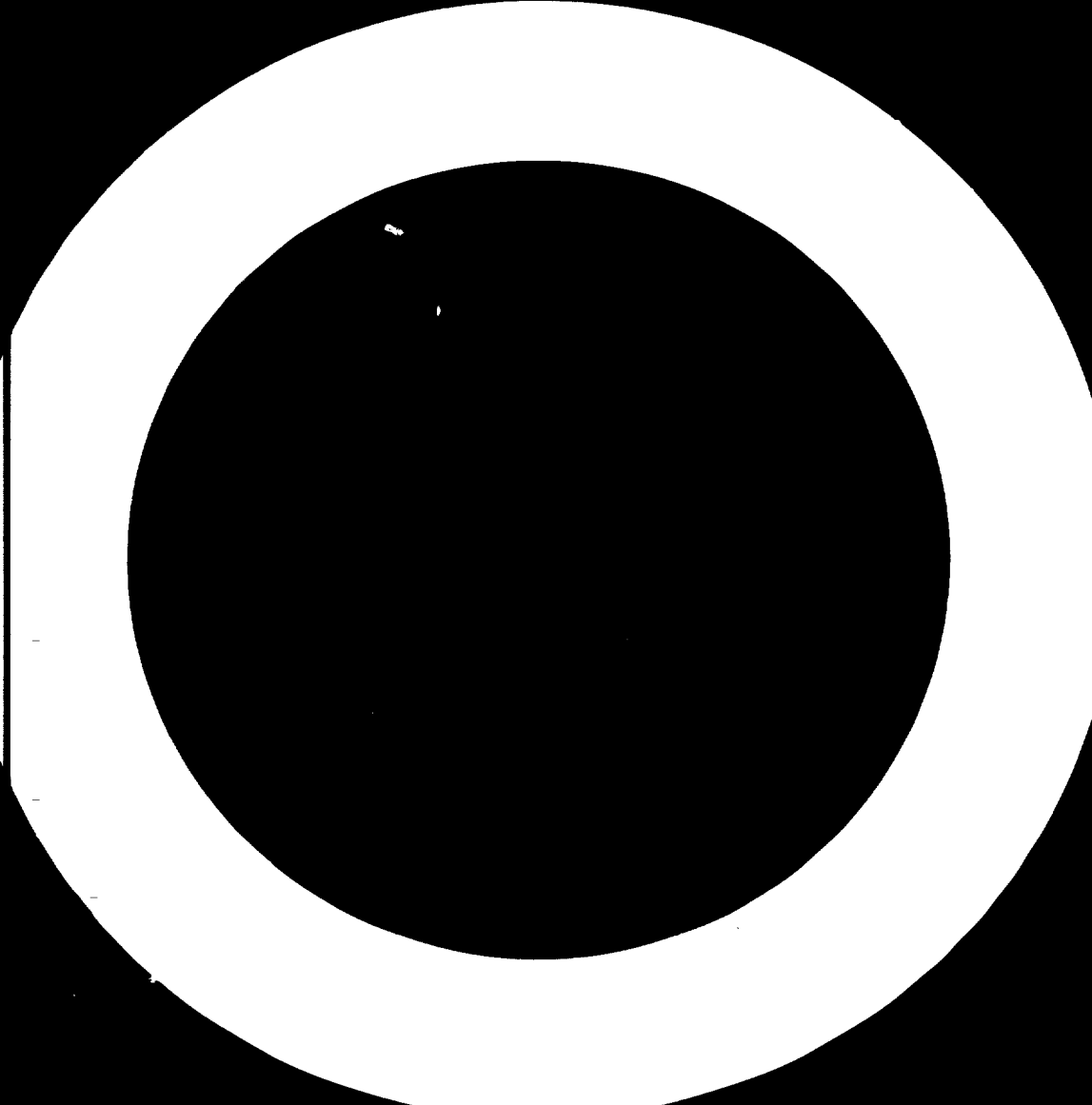
ABSTRACT

As part of the ongoing project of the United Nations Development Programme (UNDP) "Cement Research and Development Centre" (DP/TUR/72/034) that the United Nations Industrial Development Organization (UNIDO) is carrying out as executing agency for UNDP, a cement consultant was sent on 14 December 1980 on a mission of 15 days to Anakara.

The purpose of the expert's mission was to assist the feasibility study group of the Cement Research and Development Centre (CRDC) at Ankara, which has carried out two feasibility studies for the conversion and extension of the Bartin Cement Plant.

The expert, after a review of these studies, recommends to convert the existing plant from wet to semi-wet process and suggests additional measures such as further core drillings, a different slag granulating process and the provision of preblending facilities for the new Bartin II Cement Plant.



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INTRODUCTION

As part of the ongoing project of the United Nations Development Programme (UNDP) "Cement Research and Development Centre" (DP/TUR/72/034) that the United Nations Industrial Development Organization (UNIDO) is carrying out as executing agency for UNDP, a cement consultant was sent on 14 December 1980 on a mission of 15 days to Ankara.

The Cement Research and Development Centre (CRDC) at Ankara has carried out two feasibility studies for the Turkish Cement Industry Corporation (ÇISAN), one dated October 1980, concerning an expansion of the Bartin Cement Plant, and the other, December 1980, elaborating on the conversion of the existing plant from wet to dry process. The Bartin Cement Plant is located about 190 km north of Ankara. The purpose of the expert's mission was to review these studies and to assist and advise the feasibility study group of CRDC according to his findings.

The two feasibility studies, which both should be considered as pre-feasibility studies, have been discussed with the counterpart and the following pages of the report contain recommendations for the conversion of the Bartin I Plant, which may reach a capacity of about 235,000 t/a, and for Bartin II, which is estimated to produce 1,420,000 t/a. The total production would thus be about 1,655,000 t/a of cement.

The recommendations are given under the assumption that raw materials are available in sufficient quantity and quality and that there is a market for cement.

RECOMMENDATIONS

A. Bartin I Cement Plant

Existing main machinery

This plant, which is using the wet process, has a capacity of 200,000 t/a and the following equipment:

Crusher	80 t/h, Fives Lille-Cail, France
Raw mill, slurry	40 t/h, Fives Lille-Cail, France
Slurry silo	3,000 t
Rotary kiln	3.40 Ø x 120 m, FLC, France
Cooler	Grate cooler, Constantin, France
Cement mill	2 x 60 t/h, Krupp, Federal Republic of Germany
	1 x 80 t/h, FLC, France
Cement silos	4 x 2,500 t
Packaging plant	65 t/h, FLC, France
Coal mill	7 t/h

Energy-saving conversion

It is recommended to convert the existing Bartin I Plant from wet to semi-wet process. The other alternative would be a conversion from wet to dry process by providing the kiln with a one- or two-stage preheater. With the second alternative the production could be raised by about 40%, with a fuel consumption of about 4,200 kJ/kg of clinker (1,000 kcal/kg), but it calls for considerable civil works and a new raw mill department.

Considering the projected expansion of Bartin II which would produce 1,000,000 t/a of clinker and about 1,420,000 t/a of cement using blast furnace slag as additive, and in view of the very poor soil condition at the existing plant site of Bartin I, it seems unwise to invest too much in the conversion of that plant.

The conversion from wet to semi-wet process is a very simple operation which can be done with a minimum of investment and a relatively short stoppage of the kiln. The plant will continue to use slurry so that no change of the

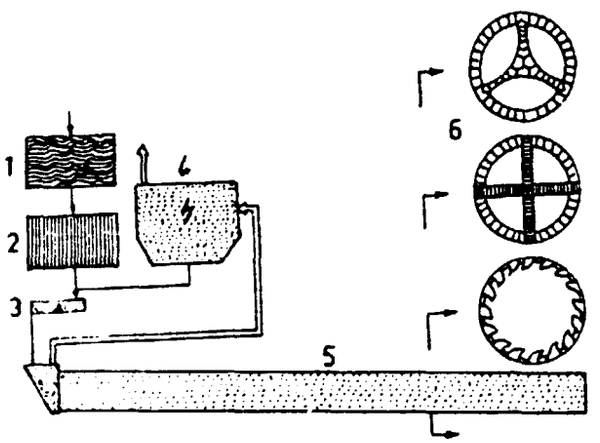
raw mill is required. However, it might be necessary to change the milling process from open- to closed-circuit in order to increase production.

Between the slurry-storage tank or silo a filter press will be installed reducing the water content of the slurry from about 36% to 18%.

The filter cake will pass an extruder which will make the filter cake suitable for kiln feed.

The kiln length will remain unchanged but inside the kiln the chain system will be replaced by heat exchangers as shown in the figure.

Long wet kiln with filter-cake feed



Key: 1 Wet preparation of slurry
2 Filtration plant
3 Kiln feed
4 Electrostatic precipitator
5 Long Kiln
6 Heat-exchange elements in kiln

Source: Zement-Kalk-Gips, Nr. 7, 1980, p. 337.

Fuel consumption is expected to drop from 6,280 to about 4,600 kJ/kg clinker (1,500 to 1,100 kcal/kg) and production could increase by about 10% to 220,000 t/a of clinker.

With a calorific value of 23,000 kJ/kg (5,500 kcal/kg) of coal at a price of approximately $50/t the yearly savings will be 220,000,000 x 400 x $5,500,000^{-1}$ x 50 = $800,000 per year.

The total investment cost may be considered somewhat high, i.e. in the range of $200-250 per t/a, as compared to $188 in the suggested conversion from wet to dry process inclusive a precalciner.

B. Bartin II Cement Plant

The feasibility study group of CRDC has conducted a study for a 1,000,000 t/a clinker production unit. By using granulated blast-furnace slag as an additive, the cement grinding unit will reach a capacity of about 1,420,000 t/a of cement.

The feasibility study, which is dated October 1980, is very impressive and well presented which affirms the appreciable progress made by the feasibility study group of CRDC.

The expert is convinced that this project should be promoted, and would like to make the following recommendations:

1. Further raw material investigations should be carried out. Core and/or auger drillings are indispensable. For a 1,000,000 t/a clinker production unit about 2,500-3,000 m of cores with a recovery of at least 90% are normally necessary. However, in this case less core metres could probably be done as the quarry is already known

The cost of core drillings would be in the range of $150-200 per m of core, including the cost for the chemical analysis of the cores. Thus the total cost would be approximatelv 200 x 3,000 = $600,000.

Without such investigations it would be very difficult to obtain a loan from any bank.

2. Receiving granulated blast-furnace slag with a moisture content of 30% means high energy consumption for water evaporation. It is therefore important

that the slag granulating process be revised and if possible changed to another process so that the granulated slag will contain less water.

3. The total investment cost for the project should be revised.

For a plant with a capacity of 1,420,000 t/a cement the weight of the machinery would be in the range of 12,000 to 14,000 t with an average price per kilo of about $5.50/kg, taking into consideration that a large part of the equipment can be locally made. Thus, the cost of the mechanical equipment would amount to about $70 million. The total investment cost is usually 2.5-3 times the cost of mechanical equipment, i.e. 70 x 2.5 = $175 million. If the investment were below that amount the quantity and quality of production could be severely limited since cost reductions are usually made by providing smaller storage and dedusting capacities.

4. Preblending facilities should be considered for limestone, marl, granulated slag and coal. Preblending plants are considered to be among the biggest energy-savers in a cement plant.