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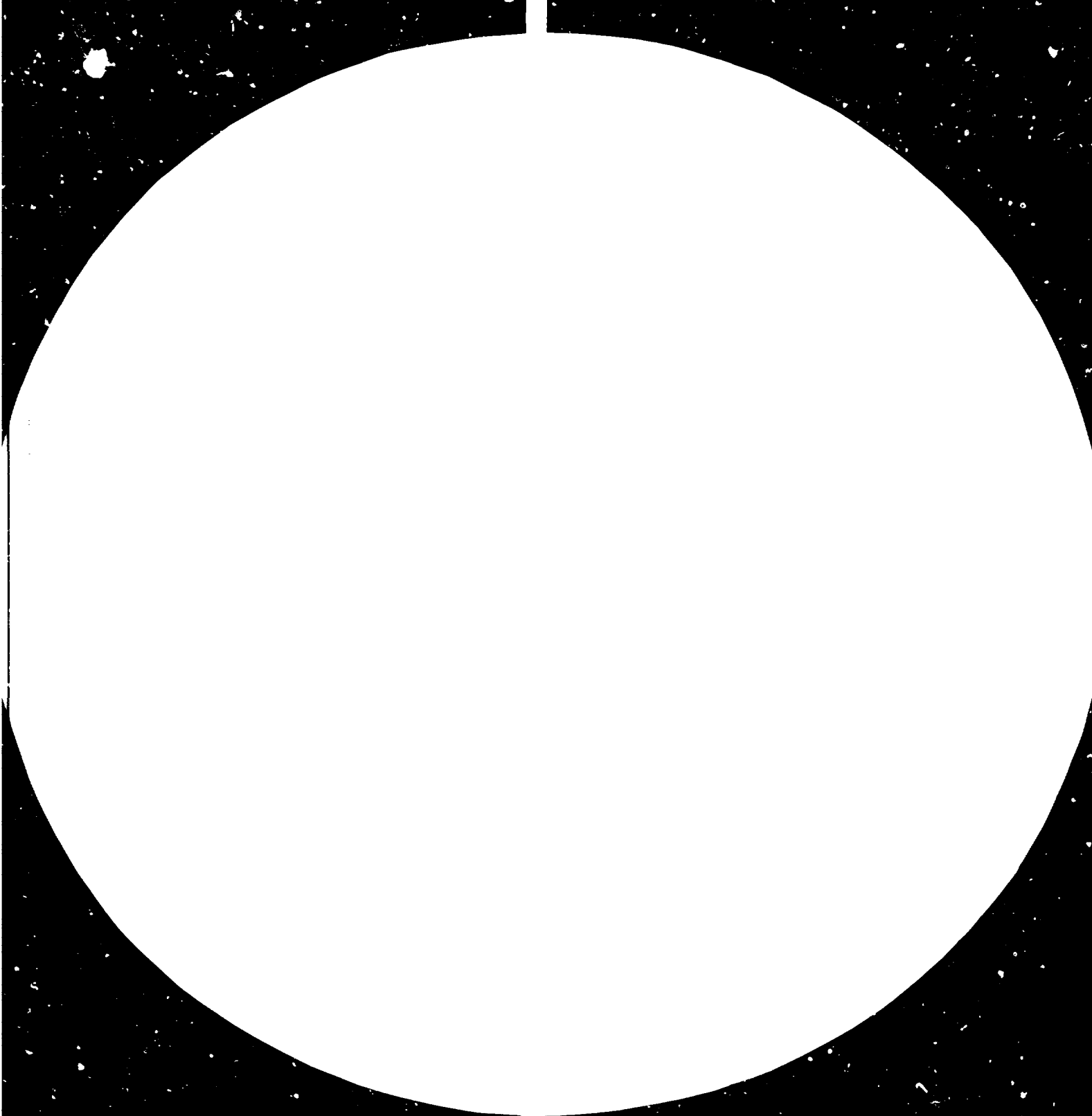

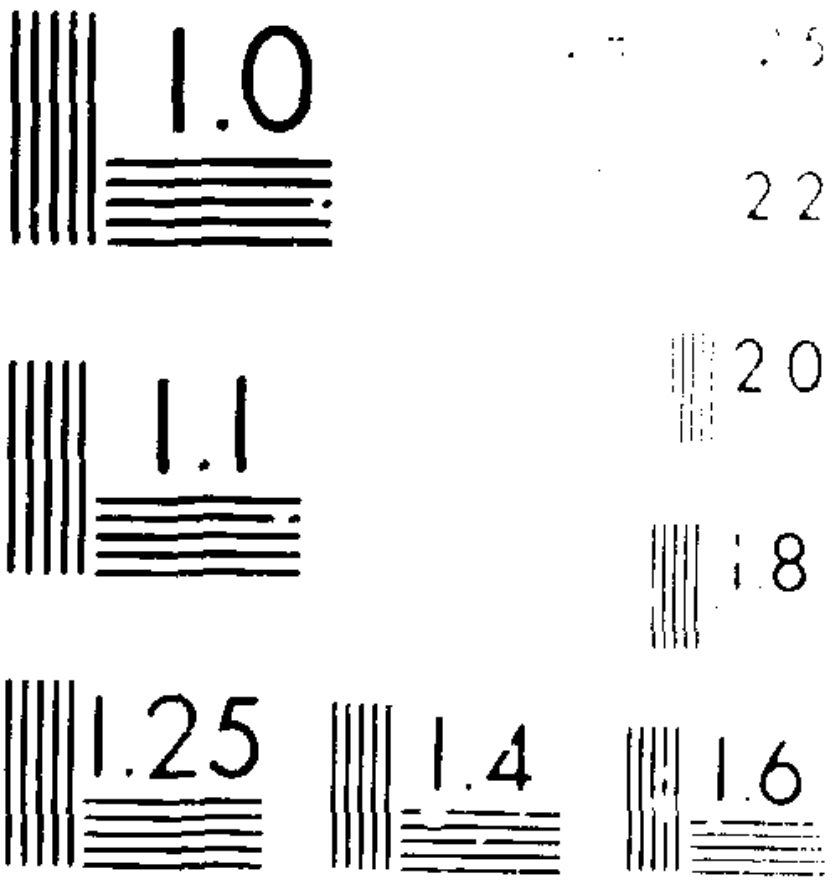
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DP/ID/SER.A/390
3 March 1982
English

DEVELOPMENT OF A THIRD CEMENT FACTORY IN KENYA

SI/KEN/82/801

KENYA

Technical report: Appraisal of the Kerio Valley Development Authority's Cement Plant Project

Prepared for the Government of Kenya
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 consultant

United Nations Industrial Development Organization
Vienna

V.82-22811

Explanatory notes

References to dollars ($) are to United States dollars. The monetary unit in Kenya is the shilling (KSh). During the period covered by the report, the value of the shilling in relation to the dollar was $1 = KSh 10.40.

References to tons (t) are to metric tons.

The following acronyms of organizations are used in this report:

BPCC	Bamburi Portland Cement Company Limited, Mombasa
EAPCC	East African Portland Cement Company Limited, Athi River
KVDA	Kerio Valley Development Authority, Nairobi/Eldoret

In addition to the common abbreviations, symbols and terms and those accepted by the International System of Units (SI), the following have been used:

a	year
cal	calorie (1 cal = 4.1868 J)

Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO).

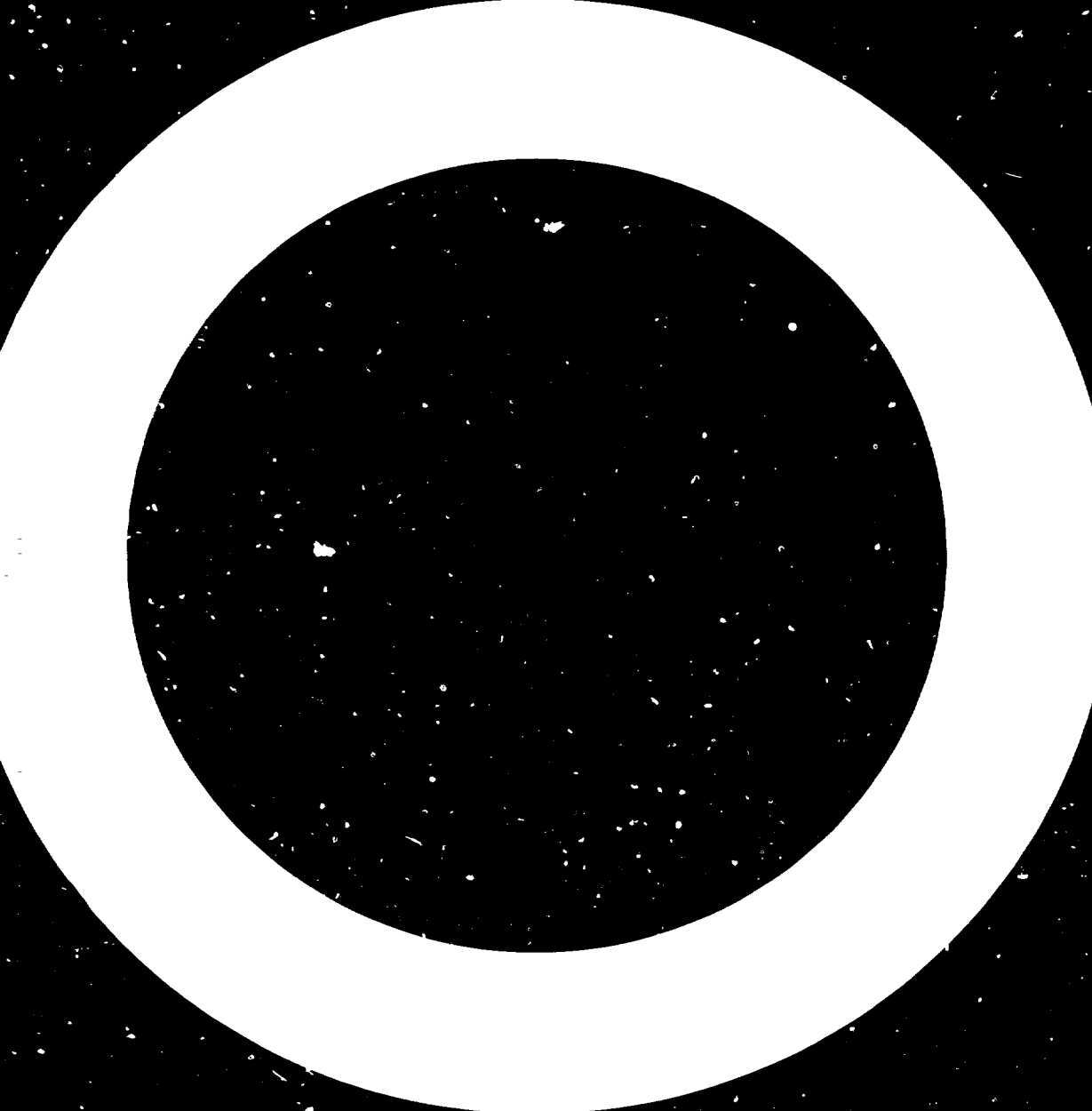
The boundaries shown on maps do not imply official endorsement or acceptance by the United Nations.

ABSTRACT

Following a request by the Government of Kenya for assistance by the United Nations Industrial Development Organization (UNIDO) in the appraisal of a proposed third cement plant to be located in the western region of Kenya, a cement specialist was fielded on 21 January 1982 for a mission of one month under the project "Development of a third cement factory in Kenya" (SI/KEN/82/801).

Together with his counterpart, a mining engineer and geologist of the Kerio Valley Development Authority (KVDA), the expert visited the existing two cement factories located at Athi River and Bambury, and discussed problems concerning the supply of cement to the western region of Kenya. The expert also visited the prospective raw material deposits and made investigations concerning infrastructure, transportation, marketing and energy supply.

The expert found that embarking on a project for an integral cement plant for 300,000 t/a is not recommendable at the present time due to many missing factors. Marketing and the supply of energy, e.g., seem to be serious bottle-necks. He opts for a step-by-step approach to the establishment of future, most probably decentralized, cement production units and recommends, among others, to improve existing plants, which costs a fragment of a new plant; to investigate carefully the quality of raw materials for future plants; and to promote production of low-energy cement such as pozzolana Portland cement and, if feasible, pozzolanic cement with 20% and 40% of pozzolanic additives respectively.



CONTENTS

Annexes

INTRODUCTION

The Government of Kenya requested assistance by the United Nations Industrial Development Organization (UNIDO) in appraising a proposed third cement plant to be located in the western region of Kenya. A cement specialist was subsequently fielded on 21 January 1982 for a mission of one month. His job description is contained in annex I.

Together with his counterpart, a mining engineer and geologist of the Kerio Valley Development Authority (KVDA), the expert visited the existing two cement factories located at Athi River and Bamburi, and discussed problems concerning the supply of cement to the western region of Kenya. The list of persons met is given in annex II. The expert also visited the prospective raw material deposits and made investigations concerning infrastructure, transportation, marketing and energy supply.

The manufacture of cement in Kenya started in 1933/1934 when the East African Portland Cement Company Limited (EAPCC) went onstream with their clinker-grinding plant located in the Nairobi industrial area. Clinker was imported from India and the United Kingdom of Great Britain and Northern Ireland, and cement was marketed in bags.

The first integrated cement plant in Kenya has been built by the Bamburi Portland Cement Company Limited (BPCC) and started production of cement in 1954, using two vertical shaft kilns. The plant is located at Bamburi near Mombasa. The BPCC is today operating eight kilns, (six shaft kilns and two rotary kilns), employing semi-dry and dry process respectively. The total clinker production is about 3,400 t/d, and by adding gypsum and pozzolanic materials the yearly production of cement reaches about 1,250,000 t.

An upgrading of the two rotary kilns by means of precalciners could increase the cement production to 1,700,000 t/a by the end of 1983. Furthermore, a conversion from oil to coal firing which will take place soon, will contribute to reduced fuel costs and considerable savings in foreign currencies. The BPCC is exporting most of its production.

In 1958 EAPCC built its first integrated cement plant at Athi River near Nairobi, using a wet-process kiln with a capacity of 350 t/d. In 1974 EAPCC completed an extension by another wet-process kiln with a capacity of 450 t/d, bringing their production to about 250,000 t/a of cement. Finally, in 1979, a new 2,000-hp raw mill was added, and by reducing the water content in the

slurry and modifying the chain system in the two kilns, todays capacity is exceeding 450,000 t/a, which constitutes an impressive improvement of the kiln capacity.

Considering that export of cement is becoming more and more difficult, the Kenyan cement industry is going to face problems in view of the fact that the total local cement consumption in 1981 reached only 650,000 t, while the annual cement production available to the Kenyan market by 1983 will be over 1,000,000 t.

One bag of cement landed in Eldoret, about 815 km from Bamburi, costs between KSh 67 and KSh 75 or about $140/t.

RECOMMENDATIONS

1. A study should be carried out with a view to improve the distribution of cement. The usefulness of the containers and silos shown in annex III which have been successful in many countries, should be investigated and in the western region of Kenya cement distributors should contemplate the erection of receiving silos at the railway stations.

2. The search for good-quality pozzolanic materials should be intensified, since without pozzolana a clinker-grinding plant will not be economically feasible.

3. A techno-economic feasibility study for a clinker-grinding plant should be carried out as soon as possible.

4. Raw material investigations for clinker production should be made, including topographical mapping, geological mapping, a drilling campaign covering core drilling (about 1,700 m) and auger drilling (about 300 m), and chemical analyses.[1/] For each 2.5 - 3 m of core an analysis should be made. Furthermore, gypsum and iron ore should be looked for as these raw materials seem not to be available nearby the prospective plant site.

5. Since the availability of energy is crucial in the establishment of a new cement plant (fuel plus electric power amount to about 64% of the variable costs), an energy-supply study should be given high priority.

6. Only after having completed recommendations 4 and 5, should an overall techno-economic feasibility study for cement production facilities be undertaken.

7. In addition, an energy study for the existing cement plants should be conducted, as each plant suffers from different energy problems.

8. Assistance from some international organization should be sought for the implementation of some of the studies recommended, specifically those concerning energy.

1/ Estimated costs of drillings and analyses are: drilling $150-$200/m 6-component analysis $180-$200/one sample; 11-component analysis $350-$400/one sample.

I. FINDINGS

A. Raw materials

Limestone

The expert visited the Mines and Geology Ortum Camp and the nearby limestone deposit which seems to be rather dirty, i.e. only 60-70% can be expected to be useful for clinker production. Quarrying will be very expensive because selective quarrying will be needed, and blasting will produce a large number of boulders for which secondary blasting will be required.

Another limestone deposit was visited thanks to Julian Richard Vearncombe, an Earth Scientist from the United Kingdom of Great Britain and Northern Ireland, who has carried out some academic works in the area. This limestone body is situated about 15 km from the Ortum Camp and seems to be of good quality. Further investigation should be carried out soonest.

The most suitable location of a future clinker production unit would be between Ortum and Marich Pass. The quantity of limestone from the two limestone deposits would probably be sufficient to supply a 500,000 t/a unit. However, the plant capacity foreseen in this report is only 300,000 t/a, for which about 400,000 t/a of limestone are required.

Clay

The expert also visited a huge clay deposit, situated near Kapenguria, about 30-40 km from Ortum. (See annex V.)
Visually it looks like kaolin, and therefore it might be poor in iron oxide. Auger drilling will have to be done. The quantity needed is about 75,000 t/a of clay.

Iron ore and sand

It seems important to find out from where to quarry iron ore. Investigations should be made soonest. The expert assumes that about 15,000 t/a of iron ore will be needed.

Sand does not constitute a problem as many river beds are available for sand supply. An estimated quantity of 15,000 t/a will be needed.

Gypsum

It is unknown from where gypsum can be supplied. According to J.R. Vearncombe the second limestone deposit may contain gypsum, although this is not very likely. The yearly requirement of gypsum is about 15,000 t.

Pozzolanic materials

The feasibility of a clinker-grinding plant will fully depend on the availability of cheap pozzolanic materials.

Pozzolanic materials, or, more correct, pozzolana, is extremely interesting for both developed and developing countries. Pozzolana is a raw material having pozzolanic properties, i.e. the ability to combine with lime (CaO) at normal temperature and in the presence of water to produce compounds having hydraulic properties. It is also interesting to know that very fine ground pozzolana can combine with the free lime in clinker; this means that coarsely ground clinker with a free-lime content of more than 1% can be used together with very finely ground pozzolana.

The experts suggestion to use a small 20 t/h cement mill has two reasons: firstly, it is more economical to ensure that a clinker grinding plant is working full load right from the start; secondly, if in the future the plant is extended by a big mill, the smaller mill can be used for grinding pozzolana separately. This way a high-quality pozzolan Portland cement can be produced at very low cost. This kind of cement is even better than ordinary Portland cement.

Thus, the search for pozzolana is extremely important. The quantity needed for a 20 t/h clinker-grinding plant or 120,000 t/a pozzolana Portland cement is about 24,000 t/a.

B. Infrastructure and communications

The road from Mombasa through Nairobi to Ortum and the Marich Pass is all the way asphalted or macadamized.

Railway connections are rather poor. The narrow-gauge tracks of colonial times (3 ft 5 1/2 in) are still in use and improvements are badly needed. First steps have been made to build an extension track which will pass very closely to the plant site envisaged for the clinker production unit. Frequent breakdowns and an insufficient number of available diesel-electric locomotives contribute to a poor efficiency of the railway.

The reason why there is not enough cement available in western Kenya is due to the limited possibility of returning empty waggons on the single-track line to Mombasa for loading of bagged cement.

Telecommunication in Kenya is fairly good and microwave stations are going up in many towns.

Road transportation costs

Road transportation costs are approximately KSh 1.25-KSh 1.75 per t-km. The cost of gasoline is KSh 7.50/l and that of diesel oil KSh 4.95/l. For the purpose of a feasibility study a figure of about KSh 2/t-km should be considered.

Railway transportation costs

The railway company has more than 30 different tariffs, but the average price charged is in the region of KSh 0.50-KSh 0.60/t-km.

For the purpose of a feasibility study at least KSh 0.75/t-km should be considered as the railways are considering vast investments which will affect prices.

C. Utilities

Coal and diesel fuel supply

For a 300,000 t/a clinker-production unit about 45,000 t/a of coal will be needed (calorific value 6,300 kcal/kg). With 250 transport days per year this means 180 t/d by road or one train per week, each carrying about 1,000 t.

The cost of coal landed at BPCC is KShs 950/t. At the envisaged plant site this cost will be about KSh 1,800/t, provided that the plant will be connected to the railway. Fuel cost per ton of clinker will exceed KSh 250.

The quantity of diesel fuel needed for the quarry equipment may reach about 2,000-3,000 l/d. The use of gasoline should be completely avoided.

Electric power supply

An integral cement plant for 300,000 t/a will need a 10-12 MW power supply. A clinker-production unit requires about 40% less, i.e. 6-8 MW.

The electric power would most probably be supplied by the new 120-MW hydro-power station at the Turkwel river, about 100 km from Ortum. The power station should be in operation by 1987.

It is difficult to forecast the cost of power. At present BPCC at Mombasa pays an average of KSh 0.50/kWh. The price of electricity from the above-mentioned station at the Turkwel river might reach KSh 1/kWh.

Water supply

The supply of water should not create any problem in the Ortum area. The river Morun has plenty of water, even in the dry season.

D. Manpower

Unskilled manpower is available in large numbers. However, it might be difficult to find skilled labour. For this reason it is advisable to build cement production facilities step-by-step, beginning with a 20 t/h clinker-grinding plant. Clinker grinding does not call for any complicated pyroprocesses requiring skilled workers.

II. COST ESTIMATES FOR NEW PLANTS AND CEMENT CONSUMPTION

The expert requested several companies (see annex IV) to telex indicative prices for the complete mechanical and electrical equipment required for:

(a) A clinker-grinding plant with a capacity of 20 t/h;

(b) A complete 300,000 t/a dry-process cement plant.

Some quotations were received before completing this report and are also given in annex IV.

A. Cost estimates for a clinker-grinding plant

Capacity: 20 t/h pozzolana Portland cement (120,000 t/a).

Location: Possibly Eldoret.

Capital expenditure

The total capital expenditure is estimated to be three times the cost of mechanical and electrical equipment CIF Mombasa (see annex IV.)

		Thousand $
(a)	Total capital expenditure ($3.2 \times 3 \times 10^6$)	9,600
(b)	Working capital (One-month production)	1,000
(c)	Interests during construction ($10,600 \times 1.13 \times 10^3$)	1,400
(d)	Contingencies, economical/physical ($9,600 \times 0.3 \times 10^3$)	2,900
	Total investment cost	14,900

This is equivalent to KSh 154,860,000.

Production costs

Variable costs	KSh/t of cement
(a) Clinker, 75%, supplied by BPCC, KSh 700/t, 812 km rail transportation	980
(b) Pozzolana, 20%, KSh 100/t, 100 km transportation by road	60
(c) Gypsum, 5%, KSh 120/t, 500 km transportation by rail	25
(d) Electric power, 36 kWh/t at KSh 1/kWh	36
(e) Bags, 3-ply at KSh 2, 11 bags/t of cement (50% bulk)	22
(f) Grinding media, 0.2 kg/t at KSh 10/kg	2
(g) Water, 100 litre/t	0.50
(h) Maintenance, 5% of equipment cost/year ($3.2 \times 10^6 \times 0.05 \times 120{,}000^{-1} \times 10.5893$)	14
Total variable costs	1,139.50

Fixed costs

(a) Depreciation, 20 years ($157{,}800{,}000 \times 20^{-1} \times 120{,}000^{-1}$)	65.75
(b) Interests 13% per year (Worldbank) ($157{,}800{,}000 \times 0.6 \times 0.13 \times 120{,}000^{-1}$)	102.60
(c) Salaries ($25 \times 2{,}000 \times 12 \times 120{,}000^{-1}$)	5
(d) Overheads	100
Total fixed costs	273.35
Total variable costs	1,139.50
Net production costs	1,412.85
Profit, 30%	422.15
Ex-factory sales price	1,835

The cement produced in that way will probably not be cheaper than cement delivered from existing plants. However, clinker has a big advantage versus cement as it can be stock-piled for years in the open, losing only about 15% of its strength per year. Bagged cement loses 10-20% of its strength after three months, and 20-30% after six months.

B. Cost estimates for an integrated cement plant

Plant capacity: 300,000 t/a of Portland cement.

Plant location: Ortum.

Capital expenditure

The total capital expenditure is estimated to be three times the cost of mechanical and electrical equipment CIF Mombasa (see annex IV).

		Thousand $
(a)	Total capital expenditure (DM 66 x 106 x 3 x 2.3765)	83,300
(b)	Working capital (Two months production)	5,000
(c)	Interests during construction (88,300,000 x 0.13 x 3 years x 0.8)	27,600
	Sub total	115,900
(d)	Contingencies, economical/physical, 30%	34,800
	Total investment cost	150,700

This corresponds to KSh 1,567,280,000.

Production costs

Variable costs		KSh/t of cement
(a)	Limestone, 1.28 t per t of cement	80
(b)	Clay, 0.24 t per t of cement	15
(c)	Iron ore, 0.04 t per t of cement	16
(d)	Sand, 0.04 t per t of cement	0.25
(e)	Gypsum, 0.05 t per t of cement	16
(f)	Explosives, 0.25 t per t of cement	2.50
	Sub total of raw materials	129.75
(g)	Fuel, 140 kg coal/t of cement at KSh 1,800/t delivered to plant site	252
(h)	Electric power, 110 kWh/t of cement KSh 1/kWh	110
(j)	Water, 0.5 m^3/t of cement	2.50
(k)	Refractories, 1.0 kg/t of cement	10
(l)	Grinding media, 0.2 kg/t of cement	2
(m)	Maintenance, 5% of equipment cost/year (DM 55 x 10^6 x 2.3765^{-1} x 10.5893 x $300,000^{-1}$ x 0.05)	41.75

(n) Bags, 3-ply at KSh 2; 11 bags/t of cement (50% bulk)	22
Total variable costs	570

Fixed costs	KSh/t of cement
(a) Depreciation, 15 years average, ($1,595,800,000 \times 15 \times 300,000^{-1}$)	355
(b) Interest charges, 13% (Worldbank) ($1,595,800,000 \times 0.6 \times 0.13 \times 300,000^{-1}$)	415
(c) Pay roll, 600 workers and employees ($600 \times 2,000 \times 12 \times 300,000^{-1}$)	48
(d) Overheads	122
Total fixed costs/t of cement at full production capacity (300,000 t/a)	940
At a run-factor of 0.8	1,175

Sales price

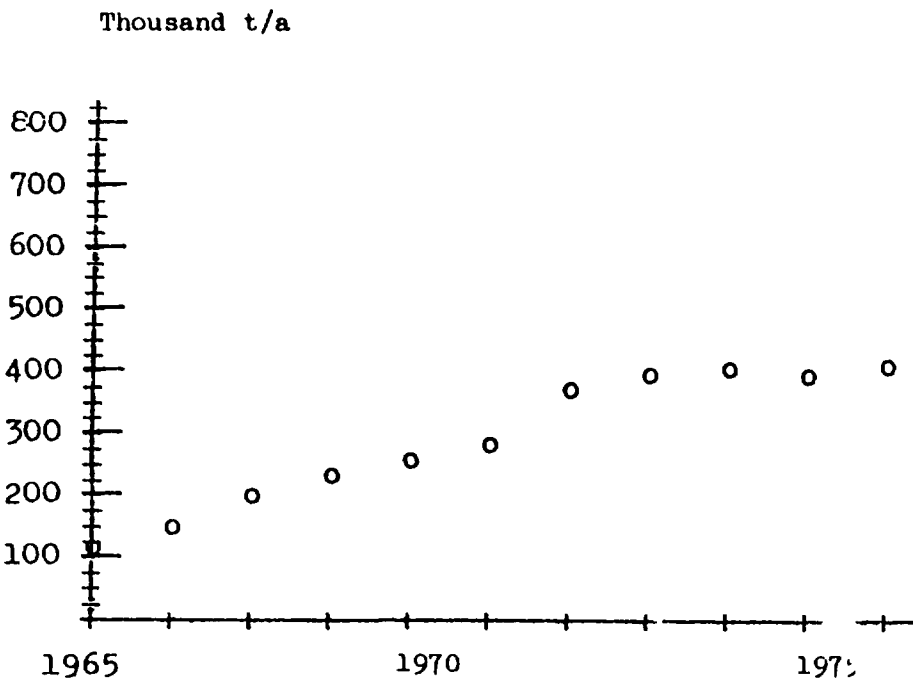
Variable costs	570
Fixed costs, run-factor 0.8	1,175
Net production costs	1,745
Profit, 30%	525
Ex-factory sales price	2,270

It should be noted that the present sales price of cement delivered to Eldoret from BPCC at Mombasa is 1,400 KSh/t.

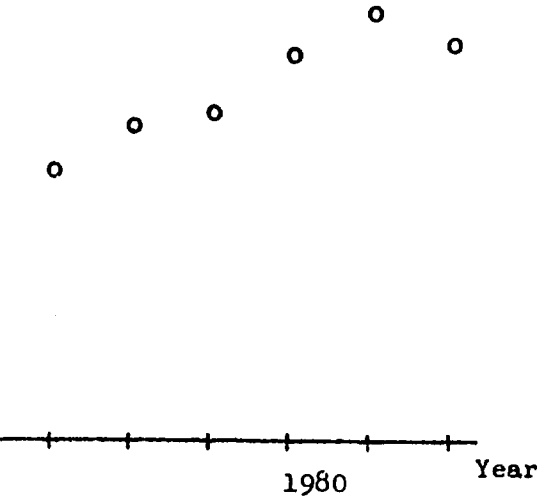
In order to compete with the existing plants, a bigger f[illegible]hould be built only when there is sufficient demand for cement.

C. Cement consumption in Kenya

The figures used in the following graph and table have been supplied by EAPCC.



Cement consumption in Kenya, 1965-1982


1980
Year

Cement consumption in Kenya, 1965-1981

Year	t/a	Year	t/a
1965	105,000	1973	411,000
1966	148,000	1974	403,000
1967	195,000	1975	414,000
1968	232,000	1976	436,000
1969	262,000	1977	513,000
1970	288,000	1978	537,000
1971	373,000	1979	630,000
1972	392,000	1980	696,000
		1981	650,000

Bearing in mind that the total installed cement production capacity in Kenya will exceed 2 million t/a by the end of 1983, while at the same time export is getting more and more difficult, it is extremely hard to see a justification for a third cement plant before maybe 1990.

Annex I

JOB DESCRIPTION

SI/KEN/82/801/11-01/32.1.A

Post title:	Cement specialist
Duration:	Four weeks
Date required:	As soon as possible
Duty station:	Nairobi with travel in the country
Purpose of project:	To assist in the appraisal of a new cement factory proposal
Duties:	The expert will be assigned to the Government of Kenya and will, in co-operation with the Kerio Valley Development Authority, assist in reviewing the plans for the development of the cement industry in the western region of Kenya and specifically evaluate an existing factory proposal. The expert is expected to prepare a report, setting out his findings and recommendations on further action which might be taken.
Qualifications:	Cement expert with appropriate experience in the field of development and operation of cement plants.
Language:	English
Background information:	The cement industry in Kenya is established with two factories: The Bamburi Portland Cement Co. Ltd., located in the coastal area near Mombasa. The factory was established in 1954 and has executed a series of extensions until the present state with two rotary kilns with suspension preheaters and six shaft kilns with a total rated capacity of 1,250,000 t/a following the dry process. The East African Portland Cement Co. Ltd., located in the central region near Nairobi, established in 1957, having at present two rotary kilns following the wet process with a total rated capacity of 250,000 t/a. Extension programmes are scheduled to increase the production capacity up to 450,000 t/a. The two cement plants are providing cement for local demand and for export. There is a growing demand for cement both in the local and export markets. The rate of industrial development is estimated to be 7% according to the Five Year National Development Plan (1979-1983). During this period the establishment of a third cement plant with adequate capacity in the western region of Kenya is anticipated.

Preliminary exploration for raw materials in the west of Kenya has been carried out in the past. These studies emphasize the existence of raw materials.

The Government of Kenya has expressed great interest in the construction of a third cement factory in the western region, and requested UNIDO assistance for a mission to be fielded soonest to assess and evaluate the situation, to plan the necessary activities, and to propose follow-up actions.

Annex II

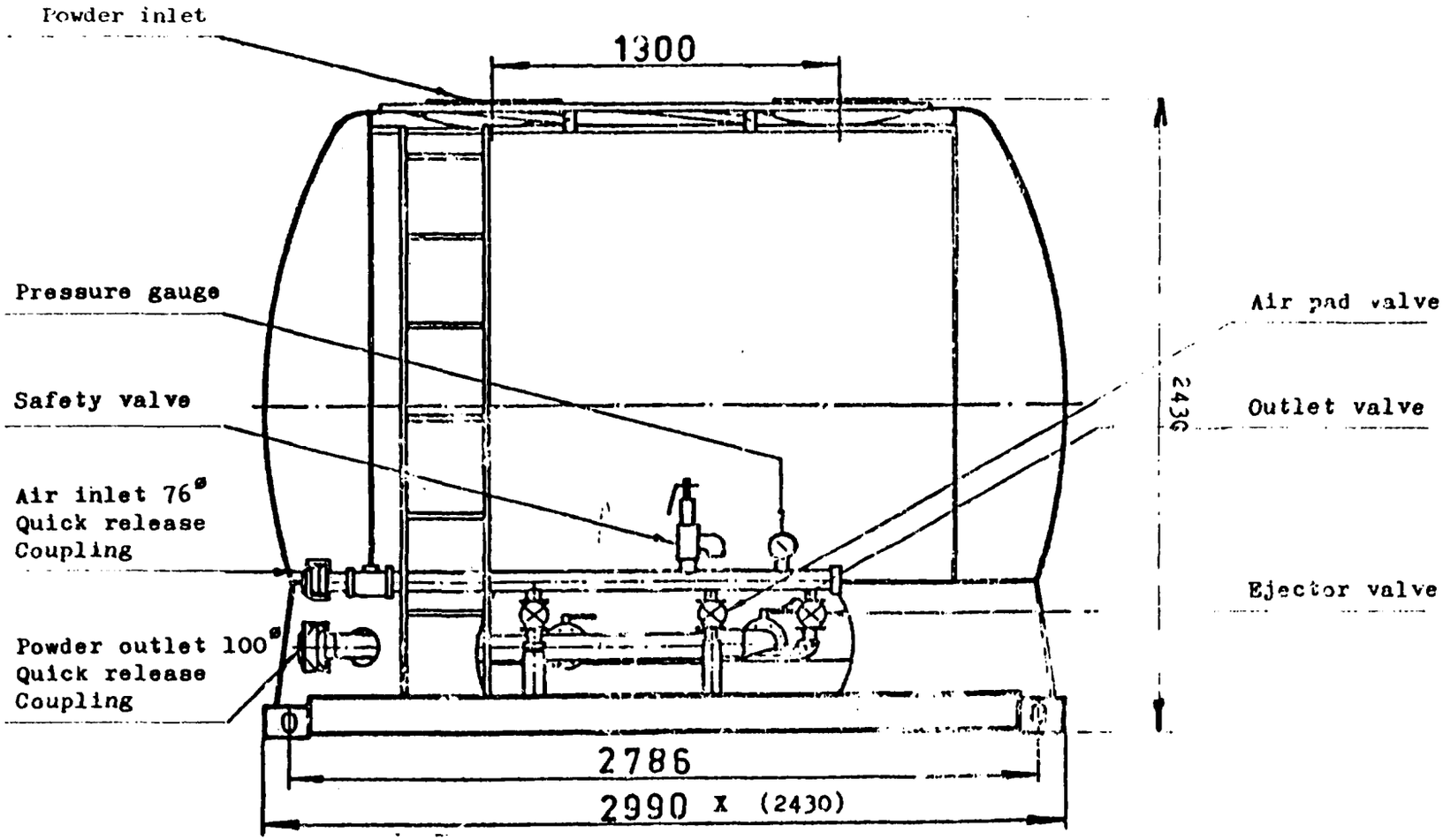
PERSONS MET

H.E. Nicholas Biwott	Minister of State, Office of the President
H.E. Dr. Munyua Waiyaki, M.P.	Minister for Industry
W.J. Wairegi	Director, Technical Division, Ministry of Energy
H.K. Arap Rotich	Managing Director, KVDA
A.M. Ngumi	Mining Engineer/Geologist, KVDA (counterpart to the author)
V.S. Chandrasekhara	Water Resources Engineer, KVDA
William O. Ragen	Divisional Mining Engineer, Eastern Division, Mines and Geological Department, Mombasa
Julian Richard Vearncombe	Department of Earth Sciences, The Open University Milton Keynes United Kingdom
Prof. Rajni Patel	Managing Director, ITET Consultants Ltd., Nairobi
S.W. Karanja	Chairman, EAPCC
John Strachan	Works General Manager, EAPCC
Jivan G. Patel	Works chemist, EAPCC
I.L. Roberts	Managing Director, BPCC
H.C. Hauser	Works Director, BPCC
Folkmar R. Neuert	Export and Sales Manager, BPCC

Annex III

CEMENT CONTAINERS AND SILOS

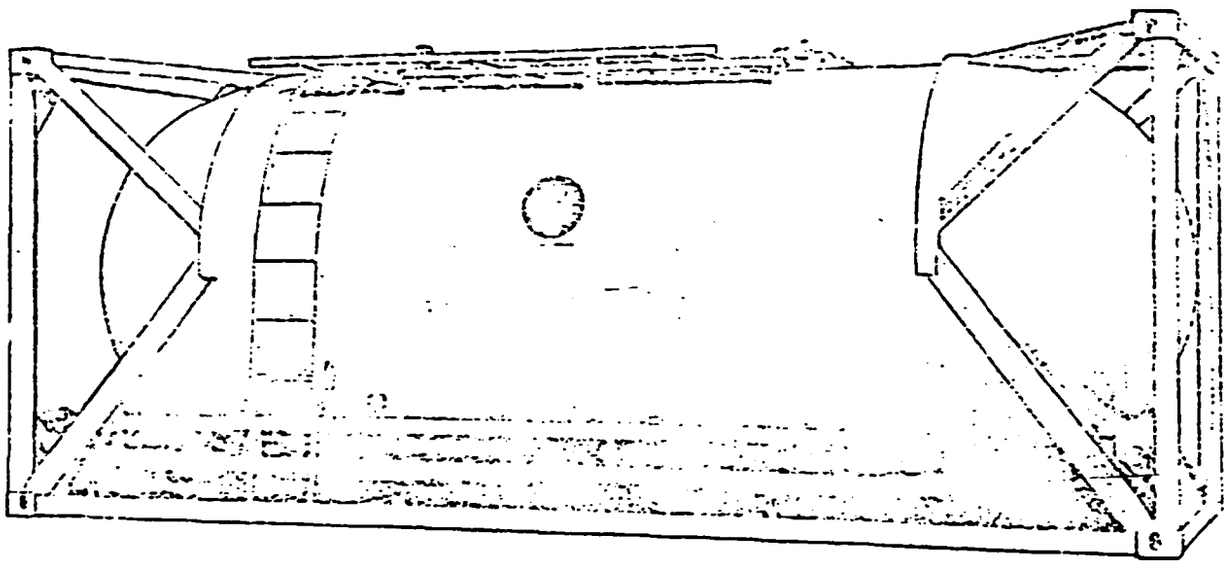
A. 10-tons container for bulk cement



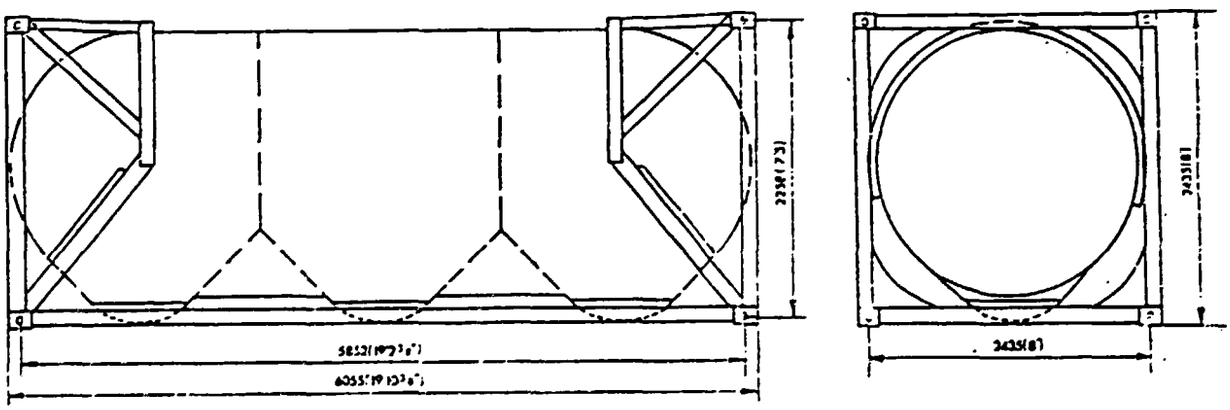
Volume	approximately 9.8 m^3
Tare	approximately 1,930 kg
Total weight	approximately 10,200 kg

Source: Briab AB, Falkenbery, Sweden.

B. Railway container for bulk cement, load capacity 17,650 kg



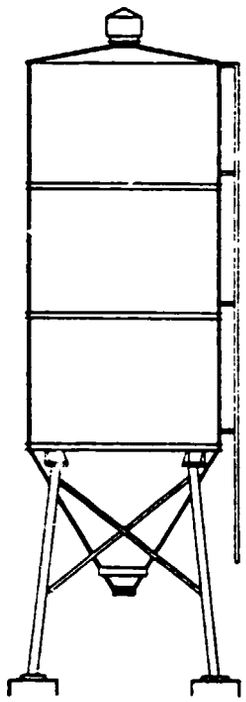
Gross	20,300 kg
Tare	2,650 kg
Capacity	17.3 m^3



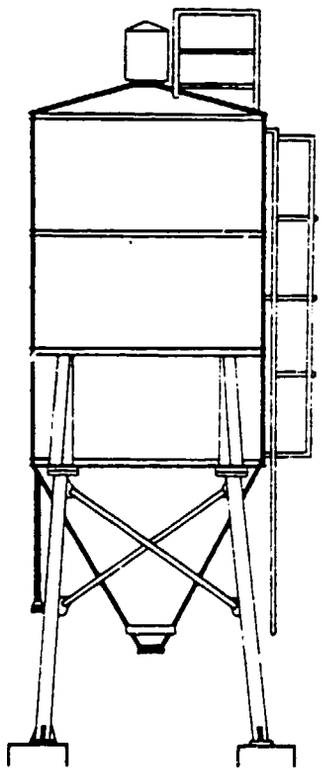
Source: Briab AB, Falkenberg, Sweden.

C. Cement silos, capacity 15 to 90 t, for use by distributors or large-scale contractors

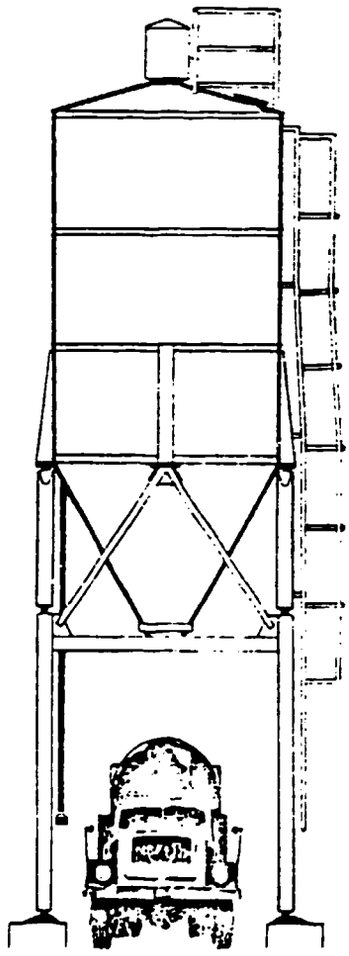
Types StS 15 , 25, 30
height 1.4 m



Types StS 40, 50, 60. 70,
80, 90 height 1.6 m



Types StS 40-90
heights 2.5 and 3.8 m



Source: Doubrava KG, Attnang, Austria.

Annex IV

TELEX SENT TO AND ANSWERS RECEIVED FROM PROSPECTIVE SUPPLIERS

Below is quoted the text of a telex dispatched by the expert.

"From Boeck SI/KEN/82/801. Kenyagov requested technical assistance from UNIDO to perform an independent appraisal of proposed cement plant located west Kenya 70 km north-east of town Kitale. Grateful if you provide us with indicative budget proposal figures for complete mechanical and electrical equipment exclusive quarry equipment CIF Mombasa for: aaa) Clinker-grinding plant, capacity 20 t/h; bbb) Complete 300,000 t/a dry-process cement plant. Your prompt answer to be telexed attention Harald Boeck UNIDO Cement Consultant who submitting draft report to govt on 16 February. (Lagorin UNDEVPRO Nairobi)".

This telex was sent to the following companies:

FIVES-CAIL BABCOCK
Paris
France

KRUPP POLYSIUS
Neubeckum, Federal Republic of Germany

FULLER COMPANY
Catasauqua
Pennsylvania 18032,
United States of America

F.L. SMIDTH AND CO. LTD.
Copenhagen, Denmark

IHI Ishikawajima-Harima
Heavy Industries Co. Ltd.,
Tokyo, Japan

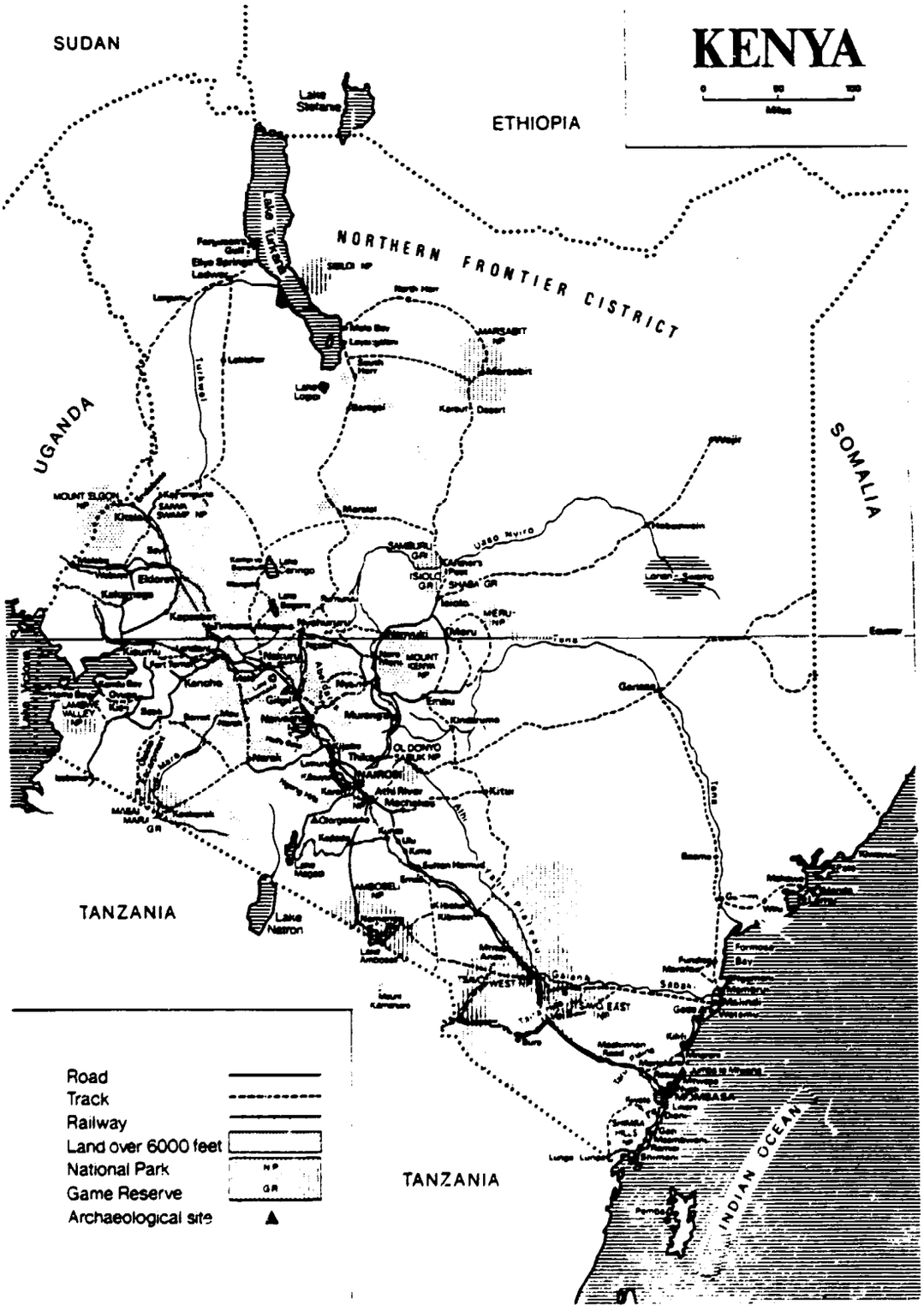
The following answers have been received to date:

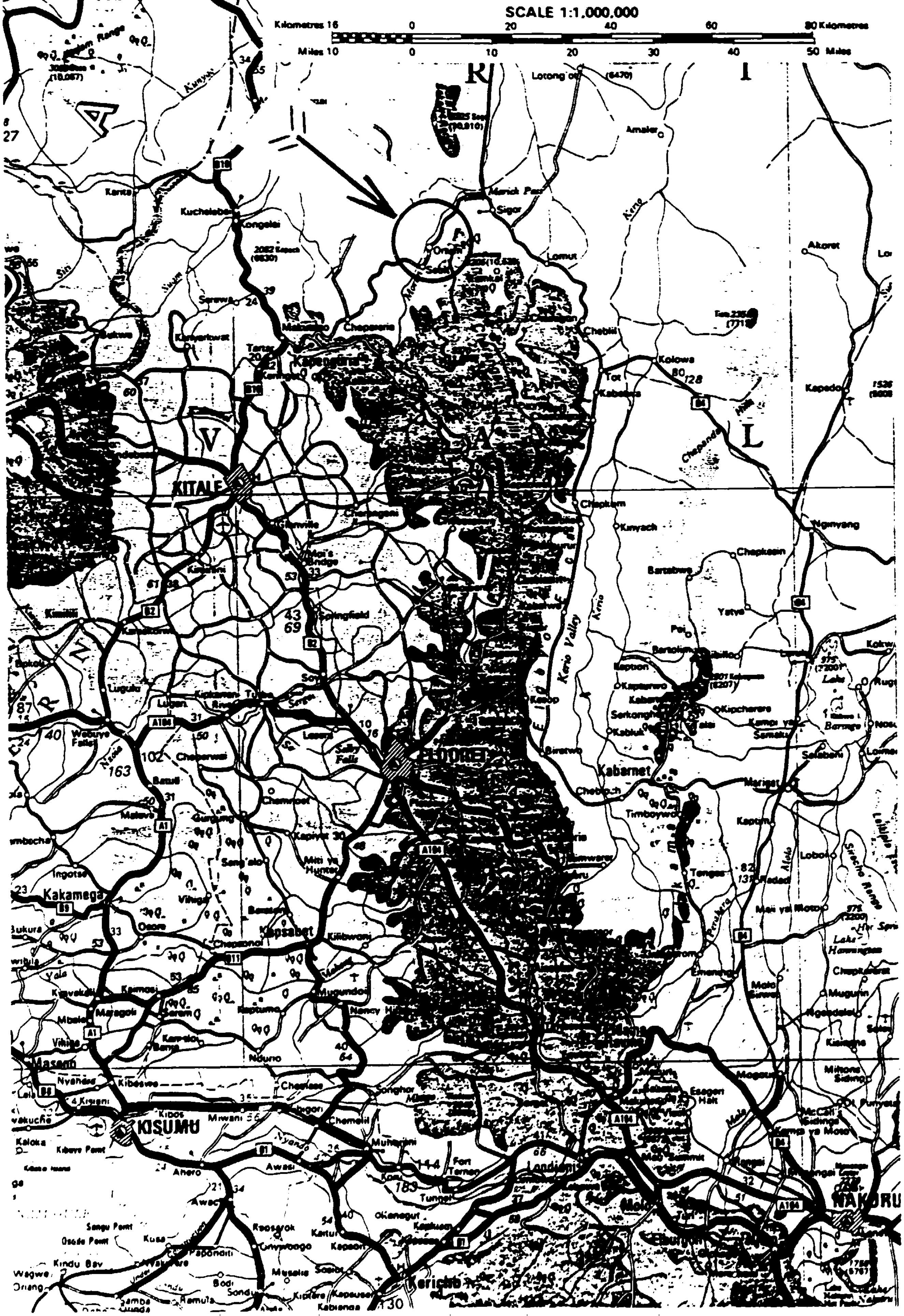
From Krupp Polysius	Indicative cost in million DM
Mechanical equipment for the production line and auxiliary equipment, FOB	41
Electrical equipment, FOB	14
Spare parts, FOB	4
Erection/commissioning	20
Seafreight CIF Mombasa	7
Civil engineering only	3
Total	69
20 t/h clinker-grinding plant with cement transportation, storage and bulk-loading equipment, FOB	4.500
Seafreight CIF Mombasa	0.450
Total	4.950

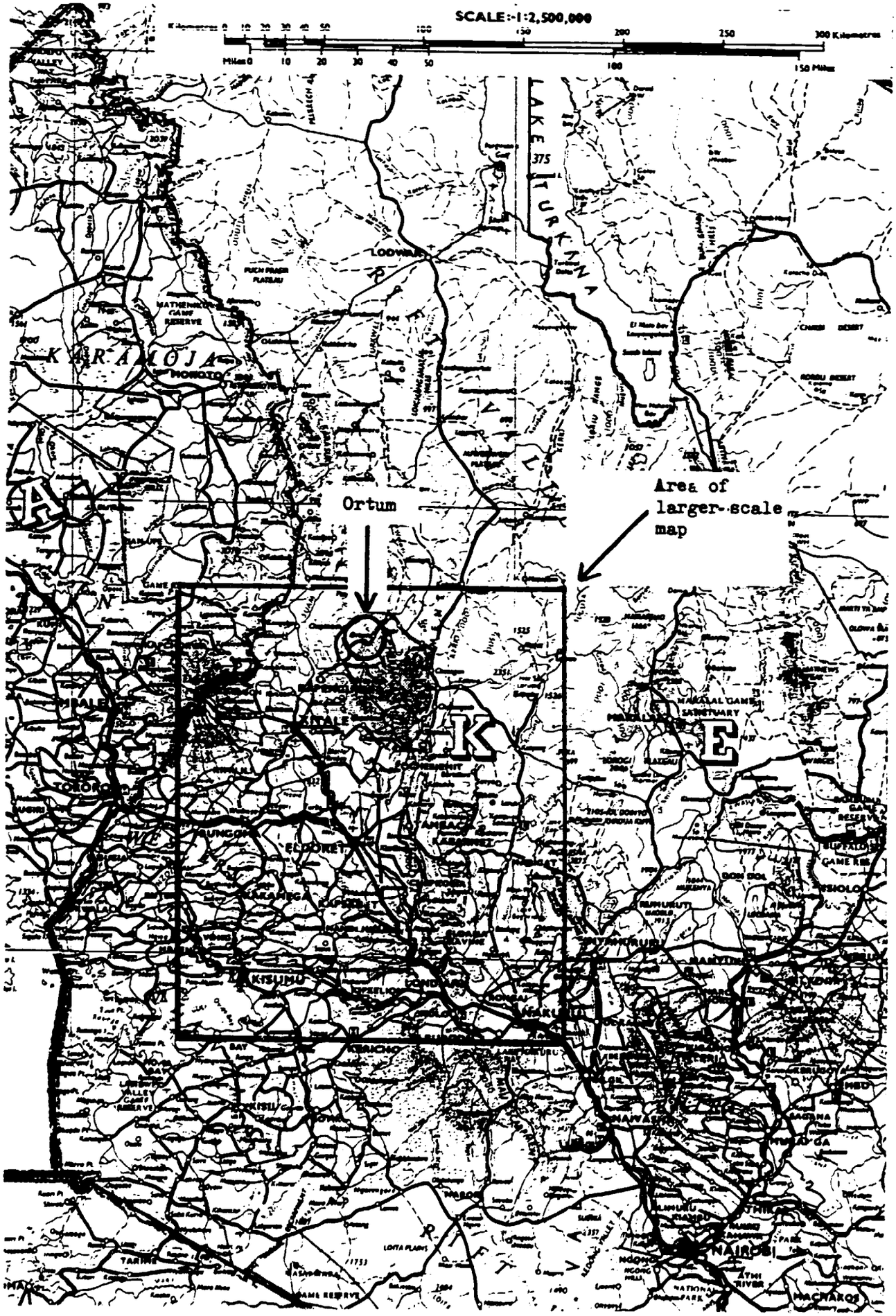
From F.L. Smidth and Co. Ltd.	Million DKr., CIF Mombasa
Mechanical and electrical equipment for a 20 th clinker-grinding plant including packaging facilities, budget price per February 1982	25
Mechanical and electrical equipment for a complete 300,000 t/a dry-process cement plant, budget price per February 1982	160

Annex V

MAPS OF KENYA SHOWING INFRASTRUCTURE, AREA OF RAW MATERIAL DEPOSITS AND LOCATION OF FUTURE PLANT




SCALE 1:1,000,000
Kilometres 16 0 20 40 60 80 Kilometres
Miles 10 0 10 20 30 40 50 Miles
KITALE
KISUMU
NAKURU
Kabarnet
Kakamega
Kapsabet
Kerio Valley
Marich Pass
Sigor
Lotongot
Amaler
Akoret
Kongelai
Kucheleba
Kolowa
Tot
Chesegon
Chepkum
Kinyach
Nginyang
Chepkesin
Bartabwa
Yatya
Kabluk
Marigat
Kampi ya Samaki
Timboywo
Tenges
Mogotio
Londiani
Fort Ternan
Muhoroni
Miwani
Kibos
Ahero
Awasi
Kericho
Kabianga
Mumias
Sondu
Kipkelion
Turbo
Eldoret
Springfield
Moi's Bridge
Lugari
Webuye Falls
Malava
Vihiga
Maseno
Nyahera
Kibwezi
Molo
Elburgon
Mosoriot
Chepterit
Kapenguria
Kimilili
Turbo
Soy
Lugulu
Kipkarren
Chemelil
Chamakat
Kipkabus
Saiwa
Lessos
Kaptumo
Nandi Hills
Kapsowar
Kaptagat
Ngorika
Subukia
Mulot
Kamwosor


SCALE:-1:2,500,000
Ortum
Area of larger-scale map
LAKE TURKANA
KARAMOJA
NAIROBI