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CEMENT AND CONCRETE INDUSTRY IN A.R.E.[1/]

by

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C O N T E N T S

I- C E M E N T P R O D U C T I O N I N ARE

ARE has always been one of the considerable countries in the field of cement manufacture. Continuous efforts have been effected for development of its production processes so as to cope with the recent trends through application of modern machinery and equipment. Egyptian cement has mainly participated in the industriallization plans, in virtue of abundance of ample raw materials in viccinity to suitable industrial centers.

1- HISTORICAL ASPECTS :

The first installation for cement industry had been installed on I900 at Massara I6 Kms. southern to Cairo, where shaft kilns were erected for a yearly production of I00 000 tons of cement through dry process. During the year I9II a small factory had been erected in Alexandria for manufacture of natural cement from raw materials imported from Dalmacia in Yogoslavia. The interruption of imports during the first world war interrupted its operation during critical periods, after which it resumed its production but with permanent irregularities untill it finally stopped by the year I963. Rotary cement kilns were first introduced by Toura cement company with a yearly cement production of I60 000 tons through wet process. This had been followed by a similar rotary kiln, started on I930 at Kafr El Elw, 4 kms. Southern to Helwan, with a yearly productivity of 95 000 tons of cement, installed by Helwan portland cement company, which started on I960 a white cement rotary kiln of 40 000 tons yearly production.

By the year I950 Alexandria portland cement company started a rotary cement kiln in Mex of Alexandria with I50 000 tons yearly production. On I960 the "National cement company" started producting Blast Furnace Slag cement with a yearly capacity of 300 000 tons.

2- CEMENT PRODUCING FACTORIES :

The Cement sector is composed of 4 factories following the wet process :-

a- Tourah Portland Cement Co. : Established in I927, located at Tourah south to Cairo. It started its production in I929.with a capacity of I00.000 ts/year by means of two rotary kilns. The production increased during 30 years till it reached more than 900 000 ts/year in I957, then the production capacity was increased to I.400 000 ts/year as a result of the extension projects which included the introduction of a new rotary kiln of a yearly capacity of 500 000 ts. The factory includes a foundery for spare parts and a factory for paper sacks.

b- Helwan Portland Cement Co. : Established in I929, located at Helwan by the Nile River side in Kafr El Elw regeon. In I930 the company started its production with a capacity of 60 000 ts/year by means of one retary kiln. The production increased during 30 years and reached 940 000 ts/year .

In I967, the production capacity of the company increased upto 1 440 000 ts/year, as a result of the extension project which included the erection of a new kiln of a yearly capacity of 500 000 ts.

The company includes a unit for production of white cement and a factory for manufacture of paper sacks.

c- Alexandria Portland Cement Co.: Established in 1948 at Mex in the western industrial center of Alexandria. In 1950, the company started with a production capacity of 110 000 ts/year by means of one rotary kiln. The production was then increased as a result of execution of the first extension project achieved in 1963, and the production capacity was increased up to 300 000 ts/year. As a result of execution of the second extension project the production capacity increased up to 500 000 ts/year by the addition of a third rotary kiln with a production capacity of 200 000 ts/year which was installed by the end of 1966. The company includes a gypsum plaster burning plant and a factory for cement products.

d- The National Cement Co.: Established in 1956 in Tabbin south to Helwan, specialized in the production of Portland Blast Furnace Cement. For this reason the factory was built near by the Iron & Steel Works at Helwan to be near the source of blast furnace slag which forms 35% of the composition of the slag cement. The company started its production in 1960 with 2 rotary kilns of a yearly capacity of 180 000 tons each. A third kiln with 300 000 to yearly capacity has been added which had been put into operation as from 1970.

3- VARIETY OF CEMENT PRODUCTION :

Cement industry in ARE involves the following types :-

a- Ordinary Portland Cement: complying with Egyptian Standard Specifications No. 373/1963, B.S.S. No. 12/1958, & A.S.T.M. No. C150/65 type I.

b -Rapid Hardening Portland Cement: Compling with Egyptian Standard Specifications No. 373/1963, B.S.S. No. 12/1958, & A.S.T.M. No. C150/65, Type III.

c-Sulphate Resisting Portland Cement: Complying with Egyptian Standard Specifications No. 583/1965, B.S.S. No. 4027/66, & A.S.T.M. No. C150/65 Type V.

d-Low Heat Portland Cement: Complying with Egyptian Standard Specifications No. 541/1964, B.S.S. No. 1370/1958, & A.S.T.M. No. 150/65 Type II.

e-Portland Blast Furnace Cement: Complying with Eyptian Specifications Order No. 103/64 (Ministry of Industry), B.S.S. No. 146/58, & A.S.T.M. No. C205/65,I.

f-Mixed Portland Cement (Karnak): Complying with Egyptian Specifications Order No. 240/65 (Ministry of Industry)

g-White Portland Cement: Complying with all requirements of Ordinary Portland Cement and has the same properties thereof.

h-High Resistance Portland Cement (Superfine 4100): Complying with German Standard Specification DIN 1164.

4- DEVELOPMENT & INCREASED REQUIREMENTS:

Cement industry in ARE has been a proportional function with the increased development and extension of civil work. The historical aspects of its consumption and local trends of its marketting has been coping with expansion of industrialization plans and progress in civilisations schemes, which can be obviously traced during the last decade.

It has been emphasised that cement local consumption in ARE did not exceed 3000 tons/year on I889. It increased to I00 000 tons/year during the few years proceding the first world war after which it showed a slight decrease followed by a progressive increase up to a yearly consumption of 4I3 000 tons on I938. The advanced cement requirements attained a revolutionary trend with the industriallization plans and civilisation projects achieved as from the year I952 where cement consumption amounted to 94I 000 during the year I952 and jumped up to 2 I00000 tons during the year I963, as indicated by the following statistical table , coping with the vast progress recently accomplished during the last decade, with the advanced economical development leading to higher living standards and affording prosperous national income. The vital trend in aspects of life in countryside villages involves a major part of rural development augmenting the average individual consumption of cement aiming to cope with developing international standards.

Local cement production is progressively covering the increased cement requirements with a planned surplus for export. By the year I963, rotary kilns in full action amounted to I7 with installed yearly capacity of 2 400 000 tons of cement.

During the last five Years Industriallization plan, four new production lines have been introduced through extension of the new four cement factories as follows:-

	Factory destination	Yearly capacity by 1963	5 years Plan extension	Present yearly capacity
I-	Tourah	900	500 000	I 400 000 ts
2-	Helwan	940	500 000	I 440 000 ts
3-	Alexandria	300	200 000	500 000 ts
4-	Tabbin	360	300 000	660 000 ts
	Total	2500	I 500 000	4 000 000 ts

It is evident that the present production situation, the advancing development in recent industriallization and construction, and the ambitious export targets, all impose an increased demand upon cement, actually exceeding the present installed capacity.

Such a situation augments the importance of mixed cements which are - at least - covering amply application which does not necessarily require especially high strength as in mortar, plastering and plain concrete. Actually the manufacture of Blast - Furnace - Cement (with 35% Slag) and Karnak - Cement (25% Sand) increased to the order of one million tons/year. Thses types of mixed cements considerably participated in eliminating production descripency untill the future extensions are completely executed.

5- EXTENSIONS:

Consequent studies for progressive cement requirements for scheduled industriallization and constructional investments indicated an estimate of 5 million tons of cement for local consumption by the end of the present five years industriallization plan. By addition of I 000 000 tons planned magnitude of export, the total yearly cement requiremnts would amount of 6 million tons.

As the total installed production capacity of the four cement factories is 4 000 000 tons, adequate extension projects have been scheduled. The first five years plan (72/73 - 76/77) of the National industrialization scheme aims at a yearly increase of 2 million tons of cement comprising four main extensions :-

500 000 ts/year : Extension of Tourah Cement Co (Dolla)
500 000 ts/year : New factory at Upper Egypt.
500 000 ts/year : New factory at Alexandria.
500 000 ts/year : Extension in the National Cement Works.

2 000 000 ts/year.

It is planned that each of the said extensions will be based upon a kiln of 2000 ts daily production, thus amounting to 600 000 ts/year. The extension of the National Cement Works will be devoted to Blast Furnace Cement, thus raising the production up to 900 000 ts/year . Furthermore the second half of the Ten Years Plan is supposed to comprise one more big unit at Helwan Portland Cement Co., and a new factory in Upper Egypt by the Red Sea coast. This means an increase in production amounting to:-

600 000 ts/year: New factory in Upper Egypt
900 000 ts/year: Extension in the National Cement Works.
600 000 ts/year: Extension of Tourah Cement Works.
600 000 ts/year: New factory in Alexandria
600 000 ts/year: Extension in Helwan Cement Works.
600 000 ts/year: New factory by Red Sea Coast.

3 900 000 ts/year.

By addition of the present capacity of 4 million tons, the total production will increase up to 7.8 million tons by the end of the Ten Years Plan.

CEMENT MOVEMENT IN A.R.E.

DURING THE PERIOD 1929- 1951

Year	Production capacity	Local consumption	Exports	Imports
1929	180 000	540 106	-	469 944
1930	540 000	388 522	-	192 555
1931	540 000	318 595	-	81 865
1932	450 000	369 559	-	117 867
1933	450 000	367 116	8 128	92 988
1934	450 000	356 359	22 951	86 528
1935	450 000	372 099	45 829	82 888
1936	625 000	384 097	30 636	34 566
1937	625 000	349 451	520	28 967
1938	625 000	412 485	-	47 434
1939	625 000	389 555	-	36 784
1940	625 000	293 000	72 415	3 544
1941	625 000	385 809	4 865	-
1942	625 000	417 809	2 748	-
1943	625 732	822 732	-	-
1944	825 000	403 885	14 780	-
1945	825 000	411 883	17 950	-
1946	825 000	556 547	31 952	-
1947	735 000	682 606	7 723	-
1948	885 000	787 484	12 180	-
1949	1 015 000	873 117	4 010	-
1950	1 135 000	1 017 800	1 819	-
1951	1 270 000	1 118 102	4 479	-

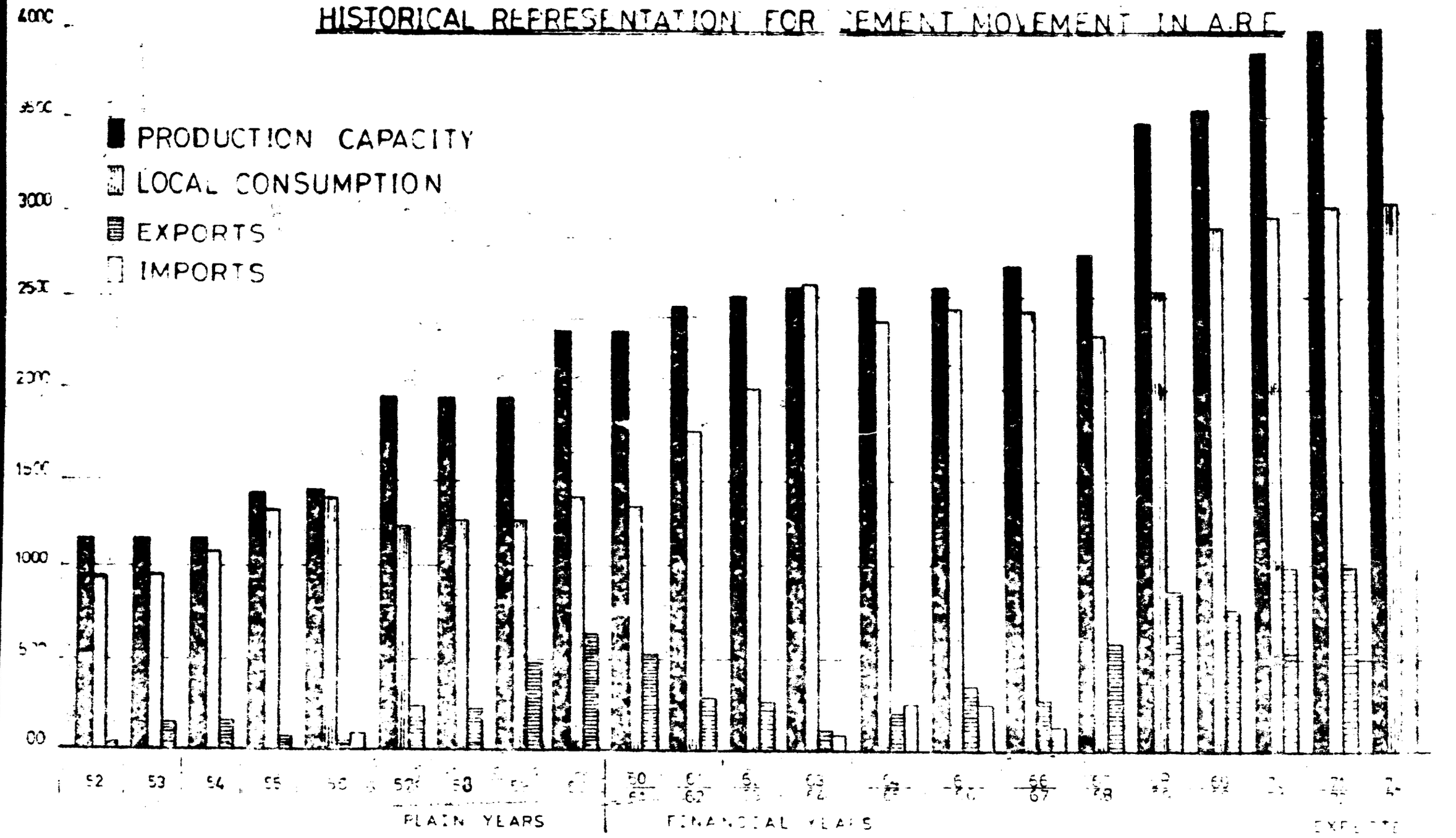
CEMENT MOVEMENT IN A.R.E.

DURING THE PERIOD 1952 - 1973

Year	Production capacity	Local consumption	Exports	Imports
1952	1 270 000	940 756	6 018	-
1953	1 270 000	950 782	129 950	-
1954	1 270 000	1 089 886	153 561	-
1955	1 420 000	1 320 534	54 707	-
1956	1 450 000	1 411 000	12 739	85 000
1957	1 950 000	1 235 060	228 236	-
1958	1 950 000	1 270 665	219 206	-
1959	1 950 000	1 288 035	491 089	-
1960	2 310 000	1 400 421	650 137	-
60/'61	2 310 000	1 356 417	529 700	-
61/62	2 430 000	1 750 000	274 198	-
62/'63	2 500 000	2 072 948	263 177	-
63/64	2 560 000	2 578 577	101 078	90 800
64/65	2 580 000	2 578 029	191 209	245 888
65/66	2 580 000	2 437 057	355 058	222 780
66/67	2 680 000	2 422 308	271 298	126 199
67/68	2 750 000	2 294 705	600 200	-
68/69	2 670 000	2 572 864	885 863	-
69/'70	3 800 000	2 843 015	887 000	-
70/71	3 800 000	2 917 808	915 803	-
71/72	x 4 000 000	3 100 000	900 000	-
72/73	x 4 010 000	3 110 000	900 000	-

x Expectations based upon development of local consumption, extension projects, and scheduled exports.

HISTORICAL REPRESENTATION FOR CEMENT MOVEMENT IN A.R.E



II- RAW MATERIALS

The abundance and suitability of ample raw materials imparted vast success to Egyptian Cement Industry in respect of quantity and quality, and thus established one of most important industries in recent Egyptian economics; Cement could always be locally obtained at incompetent prices despite increasing costs.

Hereinafter follows a brief account of each of the main raw materials, Limestone, Clay, Gypsum:-

1- LIMESTONE:-

Limestone formations are widely deposited over vast areas on huge scale. Some of it lies adjascent to the Nile valley, starting from the illongated Mokattam hills, of a hight fluctuating around 200 meters. It is neighbouring-in its northern part-to eastern side of Cairo with its subburbs at Maadi, Tourah, Helwan and Tabbin where it forms a secure resource for Cement and Iron & Steel industries. At the western side lies some hills of less height, destinguished by location of Pyramids and Sphynx. A series of hills extend along the Nile valley on both eastern and western sides, whereas the difference in height is not any more obvious northern to Assyut where the valley is sunk between two cliffs of more than 200 meters height, untill the huge loop at Kena, after which a topographic alteration differentiates both valley sides to the south: On the west side extends the stretched hill side bordering the western desert; On the east side there projects a series of peaks of limestone hills, which the weathering conditions have sharpened. They bulge amongst low hills covered with gravel or clay. Further to the south between Edfo and Aswan the Nile valley is more narrow, being surrounded by Nubian Sand-Stone which is not suitable for cement manufacture.

As to the Red Sea formation, limestone hills are extended along Cairo-Suez road, untill it meets Akaba huge mountains located western to Suez Gulf.

As to Alexandria regeon the limestone is extended through parallel hills, seperated from each other by longetudinal vallies following the Mediterranian Sea coast.

2- CLAY :

After completion of the last stage of " Aswan High Dam" most of Nile Clay is precipitated in the newly developped lake " Nasser " behind the Dam, and consequently this continuous supply of clay has to be substitnted by other clay resources.

Old terraces of clay are comprising clay deposts representing ancient Nile vallies extending in the following regeons:-

a- Nile valley near by the chain of hills along the Nile especially El Saff, Assyut, and Kena.

b- Wadi Al Natroun and its extension south wards to Cairo and North wards to Alexandria.

c- Aswan clay which is intercalated with the Nubian Sand Stone.

e- Kalabsha with its Caoline with Alumina content up to 40% .

3- GYPSUM:

Gypsum deposits are distributed around the Gulf of Suez, in Sinai peninsula, in a great extension in the northern part of Egypt, and in the Eastern Desert. The deposits in the northern part and around the Gulf of Suez were deposited in shallow laked by evapouration. The eastern desert gypsum and the Sinai deposits occur in the coastal planes of the red sea and the Gulf of Suez. The evapourite deposits extend for hundreds of kilometers along the coastal plains of the red sea and the Gulf of Suez. The variation in the thickness of this deposit is partly due to deposition in areas of quiet water. The formation consists of solid white gypsum, weathering to a hard coralloid-like hackly surface of uniform yellowish brown colour. Intercalated shales are rare and generally confined to the base of the uppermost positions of the formation, while sands and gravels are partially absent.

CHEMICAL ANALYSIS
OF AVERAGE RAW MATERIALS SAMPLES

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	L.O.I.	Total
Limestone (Helwan)	7.20	2.18	1.42	48.08	1.[illegible]	0.5[illegible]	38.40	99.60
" (Tabbin)	9.48	4.30	1.50	46.66	[illegible].24	0.7[illegible]	34.53	99.49
" (Alex.)	2.00	0.7[illegible]	1.05	5[illegible].24	C.[illegible]7	0.4[illegible]	41.06	99.39
Marl (Alex.)	46.01	7.69	4.30	19.52	2.4[illegible]	0.9[illegible]	17.72	98.63
Clay (Helwan)	59.77	13.73	11.13	3.01	2.60	0.6[illegible]	7.94	99.06
" (Tabbin)	63.00	10.00	8.99	2.50	[illegible].53	0.30	5.59	99.92
" (Alex.)	47.10	16.70	9.50	2.50	2.72	[illegible].60	15.60	99.92
Gypsum (Hamam)	0.32	0.30	0.30	35.16	0.24	45.[illegible]	19.33	99.54
" (Gharbanyat)	1.40	1.00	1.00	39.4[illegible]	0.[illegible]	42.70	13.74	9[illegible].38
" (Ballah)	8.00	[illegible].16	1.00	30.68	0.3[illegible]	37.[illegible]	19.16	99.64

III. COST & SALES PRICE

The progressibely increasing elements in cost price of cement stand as one of the most important questions when mentioning profitability of its manufacture. Various factors are imposing extra burdens upon economics of cement producing units, especially the general inflation of international prices of spare parts and implements, the special effect of increased cost of fuel which forms quite a considerable proportion of cost value, the increased wages and high social expenditure for improvement of general environmental conditions coping with the required human standards, the tremendous rise in transport fares whether for raw materials or products, in addition to high depprociation rates caused by vast extension projects. Despite all these factors, the selling cement price has been maintained within strictly controlled limits without any appreciable increase, in virtue of its fundamental importance in construction and industrialization, and also for enabling proper competition with world export prices.

The actual value of cost price varies from one factory to another depending upon its location, size, and special circumstances. The export price is function of different marketting conditions, but the local selling prices are fixed as follows :

Local price per ton ex-works, Cairo factories

	L.Eg.	£	US$
Normal Portland Cement	7,-	6,I8	I6,I0
Rapid Hardening "	8,-	7,06	I8,40
Mixed Cements	6,600	5,74	I4,96

The situation as a whole indicates the necessity of precise studies for modification of production procedures, application of most economical procedures, adoption of modern advanced processes, utilization of adjisted material handling and work study.

IV. CEMENT IMPORT & EXPORT

Local cement consumption had once been relying upon a considerable proportion of imports untill cement productivity develped to such an efficiency as to cover local requirements and still afford a considerable surplus for export.

I- IMPORTS:

Although the yearly cement production progressively increased parallel to the planned extensions, yet some imports have been practiced on small scales. Imports came to their maximum of 245 000 tons during the year 64/65, followed by a decrease to 223 000 tons during the year 65/66, then further to 130 000 tons in 66/67. The cement imports were entirely stopped, whereas exports obviously increased.

Although the said imports have been effected to fulfill requirements, of the local consumption, yet there had been exports - on the other hand - exceeding the imported amounts. During the year 63/64 the imports were 90 000 ts whereas 132 000 ts were exported. By the year 64/65 imports were 245 000 whereas 291 000 were exported. These exports had been accomplished so as to maintain the traditional export markets.

2- EXPORTS:

On the year 1953 the exported cement amounted to 130 000 tons, and progressively increased up to an average yearly standard of 800 000 tons. The scheduled standard is already raised up to 900 000 tons/year.

Cement export procured a special importance as one of the fundamental items among national resources.

Export activities introduced Egyptian cement through vast markets in various countries including :

Lybia, Leiberia, Ghana, Guinia, Neygeria, Sudan, Abosynia, Sumal, Seudi Arabia, Eden, Yemen, South Arabia. Katar, Bahrain, Kuwait, Jordan, Lebanon, Seylon, Pakistan, Burma, Nong kong, Cyprus, Turkey, Poland, Tscheckoslovakia.

Cement forms one of the fundamental components in the industrial sector in ARE. Its recent production amounts to about 25 million Egyptian pounds rated at the market price representing 1.25% of the total industrial products of which the value fluctuates around 2 000 million pounds.

V. PRODUCTION PROBLEMS

The Cement industry occasionally encounters some problems which are mostly overcome by spotaneous efforts, but some of the questions are still an open field of research. The following are two instances of such questions.

I- FORMATION OF CLINKER RINGS:

Formation of clinker rings in the burning zone of rotary kilns is one of undesirable phenomena hindering production. This handicap is aggravated in Alexandria Portland Cement Works where the excessive growth of clinker coating in the burning zone reduces the free passage, the draught is consequently accelerated at the constricted zone, thus retaining the charge behind the ring. The excessive dust evolved by self grinding of the retained charge, and the burning deficiency caused by the abrupt rushes into the burning zone promotes tendency to ring development, and the economics of the rotary kiln are upset. Various related studies have been effected where the well defined determining factors have been traced. Long studies have been accomplished but no definate line could be drawn up for disclosing any decisive conclusion as to direct relation between each of the factors and clinker ring tendency. Ultimately a temporary solution has been adopted through shooting clinker rings by a Remington gun, but there stands the risk of bombarding the projectile against firebrick lining. The whole problem is presented for further investigation.

2-APPLICATION OF SALTY CLAY:

The River Nile has been bringing about tremendous amounts of fat clay which represented one of the most valuable resources as raw material for cement manufacture. After the installation of Aswan High Dam, most of the suspended clay is decanted in the newly formed lake "Nasser" southern to the dam. This phenomenon drew the attention to utilization of clay from other resources. The idea of excavation of clay from the bootom of "Maryut Lake" thus attained a special importance. Detailed prospection work has been effected by drilling in the bottom of the lake which revealed enormous amounts of fat clay of 2-10 meters depth. The main problem lies in the high salinity of the clay amounting to 1-12 % determined as Sodium Chloride. The most economic procedure would be to dredge the clay by a floating unit, followed by pumping the clay as slurry to the factory through a pipeline 2200 meters long. There stands still the question of desalting However the experience of the factories applying seawater for slurry mixing should have by now attained a solution for the probem of alkali-aggregate destructive reactions. Experience in these fields are quite appreciated.

VI- CONCRETE TECHNOLOGY

Reinforced concrete construction had been introduced to A.R.E. in early stages of its application. The volume of its utilisation became appreciable since the beginning of this century. The ancient Egyptian Museum had been built during the Year 1907 from reinforced concrete construction. At that early stage the whole housing project of Heliopolis had been a sphere of elabourate concrete work. During the first world war the mobile Kantara bridge had been installed across the Suez canal upon massive concrete foundations. The concrete technology has vastly expanded eversince to cover progressive requirementsof modern life,including complicated design requirements,with resistance to sulphates and chemical action,low heat of hydration for huge dams and other massive concrete castings. Although a considerable progress is visualised in the classic fields of concrete application,yet the adoption of modern trends of concrete technology in various cement products,the utilisation of light-weight concrete,precast and prestressed elements,is still far from the wide pieces actually practiced by developed countries in this concern.

1- CEMENT PRODUCTS:

Most of the cement products prevailing in the country are produced by " The Egyptian Company For Pipes & Cement Products". Otherwise cement products are manufactured by various small industries scattered all over the country,whether self sufficient for special projects or productive to a commercial scale.

The manufacture of pipes and cement products relies upon the Egyptian cement as a basic raw material for the manufacture of various products used in different kinds of construction,housing and public utilities.

The main production lines involve hollow bricks,tiles,Asbestos-cement pipes and sheets (flat & corrugated),reinforced concrete poles for lighting,pipes,special segments for protection of underground cables. New kinds of products were introduced,for instance prestressed concrete railway sleepers,and special precast elements.

2- LIGHT-WEIGHT CONCRETE:

The technology of light weight concrete in A.R.E. is not yet developped to any appreciable extent as to cope with the modern trends in developed countries, where the light-weight aggregates are manufactured at a considerable scale, thus leading to the new economics in civil construction.

The endeavours practiced so far in this concern are represented by light weight building blocks produced by " Misr Concrete Co." by applying an aggregate of Pumice stone naturally occuring on small scale along the seaside nearto Marsa-Matruh. Another example is the so called Celton bricks produced from foamed cement-by the Egyptian Sand Bricks Co.

As to the future prospects-in this connection-long research work has been effected for production of expanded clay. Early studies have been initiated by Helwan Portland Cement Co. which has been followed by the " Building Research Institute " and the " National Research Center". After completion of the last stage of " Aswan High Dam " most of the Nile Clay is precipitated in the newly developped lake "Nasser" behind the Dam, and consequently the idea of erection of an expanded clay factory is rather vague. However further investigations are being effected for studying other possibilities with geological clay deposits amongst Mokattam hills at Helwan, Tabbin, Abu Rawash, in the western desert, and in various spots in the Nile valley. No well defined picture has been drawn up yet.

The most promising possibility is envisaged in the application of bloated slag which represents an ideal light weight aggregate. The subject had been introduced to the last five years scheme for sciuntific research work. Detailed studies have been accomplished by the "Building Materials" section in the Faculty of Engineering, Cairo University with the assistance of the research section of the Iron & Steel Co. All ends affirmed the suitability of the blast furnace slag- of Helwan Iron & Steel works-to the purpose of bloating, and the resultant concrete showed a specific weight reduced to 70-75% of the normal magnitude, with consequent reduction of 25-30% of the dead load upon the main construction. The bloated

[illegible] project has been foreseen for execution through the extensions of the Iron & Steel Industry.

5- PRECAST ELEMENTS:

A.R.E. has always been interested in following up the vast progress achieved by the developed countries in the field of manufacture of precast elements, and its advanced application for installation of immense buildings within record time. The elaborate projects of housing and rural development, being executed through the national five years and ten years plan, necessisate special interest in adoption of precast elements in speeding up execution and improving its economics.

Long studies have been effected for introduction of modern processes of precast elements manufacture in the service of housing projects. It has been emphasised that the vast adoption of these processes are to be postponed to a following stage. This was due to various considerations, most important of which is: that implements required for execution are not yet mong industrial production lines in A.R.E. Heavy machinery for production of precast equipment, special heavy load carriers, high range cranes, are not yet well established, where as they are abundantly produced in developed countries. The big investments required for importing such heavy machinery is spared during the present stage-for more urgent projects of closer priority.

However a gradual start is foreseen during the present ten years plan. This start will be considered as introductory step into the project, where general plans for sites, designs, procedures will be well defined. Meanwhile the technical personnel required for execution will attain specialised skill which is indispensable for good performance.

VII- BUILDING PLANS & ACTIVITAS

Cement is considered a basic element in building and construction schemes, as the common practice is based upon concrete construction and brickwork, and consequently no substitute for cement has been established. The average rate of application of cement varies around 12 000 tons for every one million pounds in the budget of building and construction.

1- HOUSING PROGRAMS:

The present ten years plan 72:1982 aims at building:-

700 000 lodging units for substitution and renewal.

750 000 lodging units to cope with population increment.

1 450000 Total planned lodging units.

The said units are programmed as follows:-

Unit levels	Economic	Moderate	Advanced	Total
Percentage No.	75	22	5	100
Average cost:unit(LEg)	810	1440	2700	
Number of units	1 090 000	320 000	40 000	1 450 000
Value : Building (Million LEg)	860	460	110	1430
Area "	123	64	15	202
Services "	159	83	20	262
Total "	1162	607	145	1914

The first stage of execution during the five years plan 72:1977 aims at building:-

350 000 lodging units for substitution and renewal.

350 000 lodging units to cope with population increment.

700 000 Total planned lodging units.

The said units are programmed as follows:-

Unit levels	Economic	Moderate	Advanced	Total
Percentage No.	75	22	5	100
Average cost:unit(LEg)	810	1440	2700	
Number of units	52 500	145 000	20 000	700 000

Value :	Building (Million LEg	424	222	54	700
	Area "	59	31	8	98
	Services "	76	40	10	126
	Total "	559	293	72	924

The estimated cement requirement for the said housing projects during the ten years plan would amount to 17 million tons,of which 8 million tons will be utilised during the first 5 years plan.

The planning work has foreseen location of comunities in industrial regeons,and tourist particulars in touristic spots. For economy in time and investment, it has been foreseen for standordisation and introduction of the system of precast elements,to such a capacity as to produce 10 000 lodging units:year by the end of the first five years plan. The scheduled development also comprises the mechanical preparation of aggregates,adoption of central automated concrete batching plants, application of modern cranes,concrete dumpers and conveying belts.

2-RURAL PROJECTS

The total number of villages in A.R.E is 4 000 composed of nearly 4 million dwellings. A general plan for reconstruction is scheduled over 20 years comprising complete substitution of 60% and partial reconstruction of 27% of the total dwelling volume,in addition to installation of proper sanitary services,public utilities,well organised centers for education,security and medical treatment,industrial units for processing agricultural crops,workshop for manufacture and maintenance of farming implements.

The general schedule aims at substitution and reconstruction of the following units:

First stage	: Five years plan	72/1977	: 240 000 units.
Second stage	: " " "	77/1982	: 700 000 "
Thied stage	: " " "	82/1987	:1 400 000 "
Fourth stage	: " " "	87/1992	:1 660 000 "
Total volume over 20 years			4 000 000 units.

The preliminary estimate for the total value amounts to 1500 million pounds excluding potential peasant efforts,roughly predicted as 12% of the total investments.

Cement requirements have been estimated to be:20 000,59 000,228 000, 298 000,365 000 tons for the first five years successively with a total of 935 000 tons.

5- PUBLIC SANITARY TRANSACTIONS

Studies have been effected for fulfillment of potable water requirements,progressively increasing with the execution of housing programs and industrialization plans in addition to the vast rural improvements.A general plan has been foreseen for the coming 20 years with total expected investments of 564 million pounds,of which 100 million pounds will be invested during the first five years 72/1977,whereas 21 millions of it will be devoted for cement-asbestos pipes.

A general plan has also been foreseen for the next 20 years substancials for drainage and sewage,including improvements and amendments of old systems,services for new housing projects,in addition to adequate drainage facilities for underground water. Total investments are estimated as 152 million pounds of which 53 millions will be invested during the first five years 72/1977 comprising 21 million pounds for building and construction.

4- GENERAL CONSTRUCTION SECTOR:

According to actual rates of application during the present financial year 71/1972,
cement requirement amounts to 12 000 tons of cement for every one million pounds of constructional production value. The five years plan 72/1977 has been worked out with a construction rate of the order 300 million pounds for every year of the plan. This would lead to 300x12000=3.6 million tons yearly consumption of cement,thus indicating a total cement requirement of 18 million tons during the five years plan.

VIII. SUMMARY

The first installation for cement production had been installed on I900 with shaft kilns for a yearly production of I00 000 tons. Rotary kilns were first introduced by Tourah Cement Co. on I929 with I00 000 tons yearly capacity. This had been followed by Helwan Portland Cement Co. on I930 with a yearly productivity of 95 000 tons, then Alexandria Portland Cement Co. on I950 with I50 000 tons yearly output, and ultimately the National Cement Co. in Tabbin on I960 with 300 000 tons starting yearly capacity. The four cement factories expanded to cope with progress of industriallization plans untill they have attained a yearly production of I 400 000 ts, I440 000 ts, 500 000 ts, 660 000 ts successively , with a total installed capacity of 4 million tons, of which 3 million tons are devoted for local consumption and one million for export. The present five years plan of the national industriallization scheme aims at a yearly increase of 2 million tons, and by the end of the ten years plan the total production capacity will amount to 7.8 million tons/ year which copes with future cement requirements at that time.

The types of cement being produced at present are: Ordinary, Rapid Hardening, Sulphate Resisting, Low Heat, Blast Furnace, Mixed, White, and High Resistance Portland Cements.

Raw materials required for cement manufacture are abundantly occuring in various localities. Limestone formations are widely deposited over vast areas along the Nile valley starting from Mokattam hills, in addition to the Red Sea formation extending along Cairo-Suez road untill Ataka Mountains located western to Suez Gulf. In Alexandria regeon:

limestone is extended through parallel hills following the Medeterranian Sea Coast. Nile Clay which had been brought forward with the Nile water is now being precipitated in the newly developped lake southern to Aswan High Dam. Consequently other substitutes - from old terraces of clay deposited in various spots - are under consideration. Gypsum deposists are destributed around the Gulf of Suez, in Sinai peninsula, in the Eastern Desert, and in a great extension in the northern part of Egypt.

The progressively increasing elements in cost price of cement are imposing extra burdens upon economics of cement producing units, especially the general inflation of international prices and labour costs. On the other hand the selling prices are fixed for cement in virtue of its fundamental importance in construction and industriallization. It is therefore essencial to adopt most economical procedures, modern advanced processes, and adjusted material handling.

Local cement consumption had once been relying upon a considerable proportion of imports which attained its maximum of 245 000 tons during the year 64/65, followed by a decrease untill cement productivity developed to such an efficiency that covered local requirements with a considerable surplus for export which progressively increased up to an average of the order of 800 000 tons per year.

The cement industry occasionally encounters some problems which are mostly overcome by spotaneous efforts, but some of these questions are still an open field of research. Two instances are forwarded for study: Clinker ring formation is so aggravated in Alexandria Portland Cement works that the economics of rotary kilns are upset.

Despite long studies, yet no definate line could be drawn up for disclosing any decisive conclusion. The second question lies in utilization of salty clay (1-12% Nacl) excavated from the bottom of Maryut lake to the depth of 2-10 meters, to be pumped as slurry through a pipe line of 2200 meters length. Most valuable is the experience in desalting with an economic procedure and application of seamater in the wet process raw mixture and still avoiding any possible harm of alkali aggregate reactions. The concrete technology has vastly developed in the classic fields of utility including elabourate requirements of industriallization, but the adoption of modern trends of technology in various cement products, the utilization of light-weight concrete, precast and prestressed elements, is still far from the wide paces actually practiced by developed countries in this concern. The Egyptian Company for pipes & Cement Products covers requirements of hollow bricks, tiles, Asbestos - cement pipes and sheets (flat & corrugated), reinforced concrete poles for lighting, pipes, special segments, and prestressed concrete railway sleepers. Long research work has been effected for production of expanded clay, but no well defined picture has been drawn up yet. However the most promising possibility is envisaged in the bloated slag project which is foreseen through the extensions of the Iron & Steel Industry. Studies have been effected for introduction of modern processes of precast elements manufacture in the service of housing projects. The execution has rather been delayed - so far - because required implements are not yet within industrial production lines in ARE, as such big investments have been spared for more urgent projects of closer priority. However a gradual start is foreseen during the present 5 years plan.

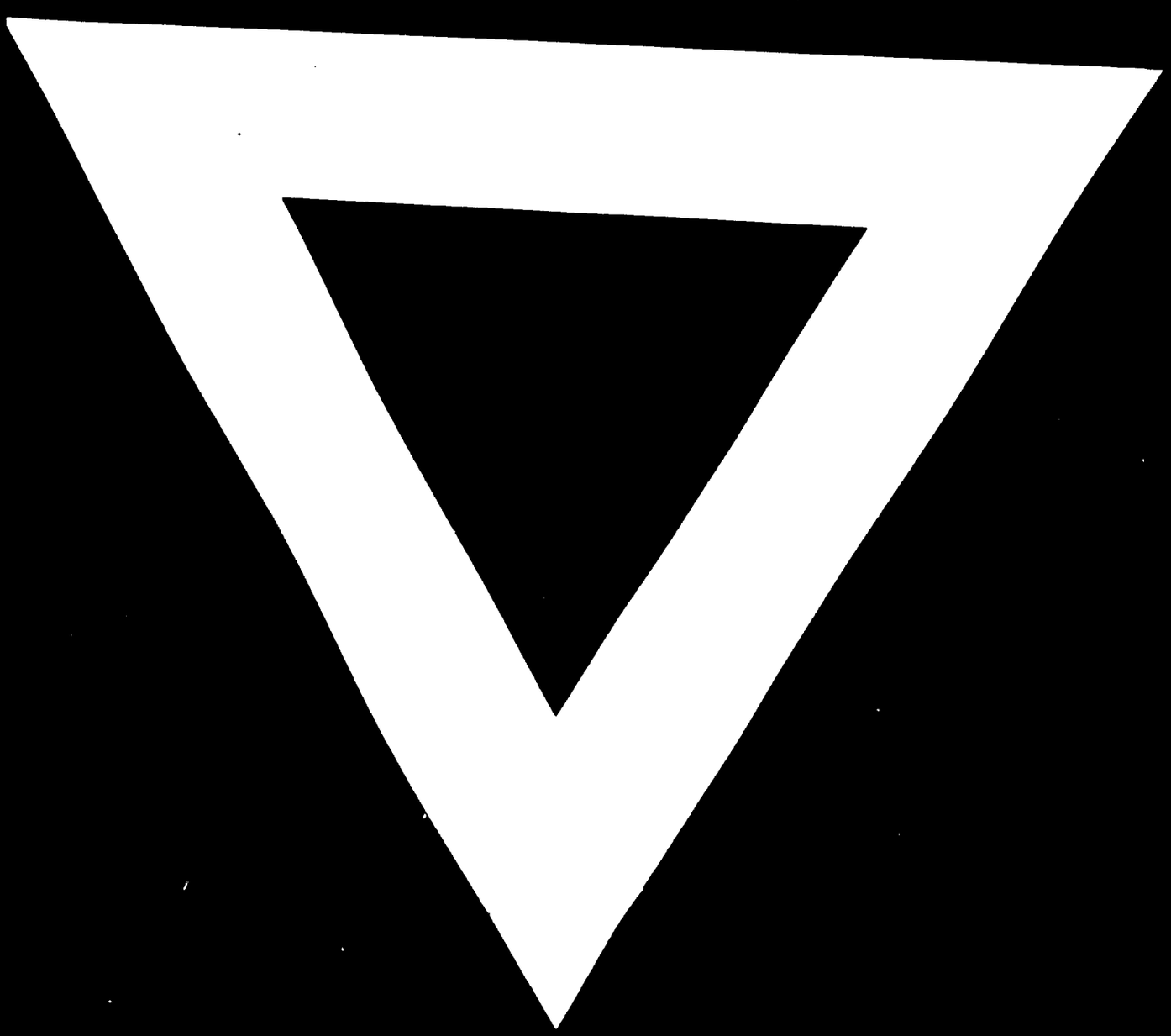
Cement is considered a basic element in building and construction. A general housing program has been scheduled for building I 450 000 lodging units during the next ten years 72/I982, with a total estimated value of I 9I4 million pounds, of which the first stage of execution during the first five years plan 72/I977 involves 700 000 lodging units with an estimated value of 924 million pounds. Cement requirement for the said housing projects : during the I0 years plan would amount to I7 million tons, of which 8 million tons will be utilized during the first 5 years plan.

Rural projects have been planned for substitution and reconstruction of 4 million houses over the next 20 years, with a total value of I500 million pounds. Cement requirement herefor amounts to 965 000 tons during the first five years.

With the execution of housing programs and industrialliz ation schemes, a general plan has been forseen for potable water projects for the comming 20 years with total expected investment of 362 million pounds, of which I00 million pounds will be invested during the first 5 years, whereas 2I millions of it will be devoted for cement - asbestos pipes.

A general plan has also been foreseen for the next 20 years substancials for drainage and sewage, with total investments of I52 million pounds, of which 53 millions will be invested during the first five years, comprising 2I million pounds for building and construction.

Generally speaking, the five years plan 72/I977 has been worked out with a construction rate of the order 300 million pounds for every year of the plan, equivalent to a total cement requirement of I8 million tons, meaning 3.6 million tons cement yearly consumption.



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