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D03568



Distr.
LIMITED
ID/WG.125/7
12 June 1972

United Nations Industrial Development Organization

ORIGINAL: ENGLISH

Interregional Seminar on the Manufacture
and Utilization of Portland Cement

7 - 20 May 1972

Holte, Denmark

THE CEMENT INDUSTRY
IN THE KINGDOM OF SAUDI ARABIA^{1/}

by

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THE CEMENT INDUSTRY IN THE KINGDOM OF SAUDI ARABIA

I. Summary

The historic development of the three cement factories in Saudi Arabia is described. The consumption of cement in Saudi Arabia has been increasing rapidly in recent years due to the agricultural, industrial and social development of the country. Cement consumption reached 1.2 Million tons in 1970 of which about one half was produced locally. The cement industry is presently engaged in expansions of its production facilities. By 1980, cement consumption in the country is projected to be between 2.1 and 2.6 Million tons per year.

The report discusses market conditions, quality, prices and the various and uses of cement.

II. The Historic Development of the Portland Cement Industry in the Kingdom of Saudi Arabia

During the last twenty years the rapid increase in oil production provided the economic resources required for industrial and social development in Saudi Arabia.

The cement industry in the Kingdom is of recent origin. The first cement kiln went into operation in 1958 in Jeddah. This city is not only the commercial and industrial center of the Western Region of the Kingdom located along the Red Sea, but also a major port city through which most of the pilgrims enter the country to visit the holy places of Islam. Considerable construction activities for commercial, industrial and residential buildings has provided a growing market for cement in this area.

Two years later (in 1960), a second cement company was established, with its main office in Damman and production facilities at Hofuf. It was to supply the growing needs of the oil rich Eastern Province located on the Arabian Gulf. Since then, cement consumption in the region has increased considerably as oil companies expanded their production facilities and the size of their local and expatriate staff. Huge quantities of cement were supplied to a number of agricultural development and irrigation projects which have been completed recently by the government. Part of the production is shipped to the growing market in the Central Province.

By 1966 construction activities in the Central Province had increased sufficiently to make the establishment of a third cement company feasible. The plant is located in the capital city of Riyadh. Its production in combination with cement shipments from the factory in the Eastern province cover about half the cement requirements of the region for public and private construction. In particular, the city of Riyadh has grown rapidly in population from 160,000 in 1960 to about 300,000 in 1971.

The map in Fig. 1 gives the location and size of the cement plants in Saudi Arabia as well as in neighbouring countries in the Arabian peninsula.

Fig. 1 EXISTING AND PLANNED CEMENT FACTORIES IN SAUDI ARABIA AND IN NEIGHBOURING COUNTRIES.



■ Operating plant. Figure next to bar indicates annual capacity in 1000 tons.

□ Plant under design or construction. Figure next to bar indicates annual capacity in 1000 tons.

a) The Arabian Cement Company in Jeddah

This company started production in 1952 in a short rotary kiln with a production capacity of 300 tons of cement per day or 100,000 tons annually. The cement kiln was installed parallel to an existing lime kiln. At a later stage, when the sand line tank and an enclosed row and the company lost its main power station, the lime kiln was converted for alternate use in the production of cement and lime. This measure increased the annual production of the plant to about 150,000 tons. In 1961 a new long rotary kiln went into production with a rated output of 600 tons per day or 200,000 tons annually. This expansion increased the production of the Jeddah Plant to 10,000 tons of cement per year. At present, a second expansion of the plant with a 1,000 tons per day kiln is in an advanced stage of planning. The new kiln is expected to go into production in 1965 and to reach its full output in 1968. The plant will then have a total production capacity of 650,000 tons annually. Most of the raw materials are found in the vicinity of the plant. Limestone comes from a band of quaternary coralline limestone found along the coastline. Although deposits are very extensive they vary greatly in chemical composition. Therefore, quarrying of stone suitable for the manufacture of portland cement is restricted to a few areas where contamination of the limestone with salts from the sea remains within reasonable limits. The limited amount of suitable limestone deposits restricts expansion of this plant beyond the planned extension to 650,000 tons annual production.

The limestone is soft, porous and easily ripped. It is selectively quarried to obtain the lowest alkali, sulfur and chloride content possible. Chloride concentrations vary from 0.1% to 0.2% with an average of 0.1%.

Silstone (clay) and gypsum are obtained from deposits north of Jeddah. Iron ore which constitutes about 1% of the raw feed mixture is supplied from surface deposits of hematite at Wadi Fatma, 60 km east of Jeddah.

Because of the high humidity water the dry process is used exclusively in the Arabian Peninsula as well as in all other existing cement plants in Saudi Arabia. Considerable difficulties were experienced in the operation of the first rotary kiln which was a short kiln supplied with suspension pre-heater. The high concentration of

alkalies, sulfur and chloride in the limestone caused the deposition of solid material in the pre-heater and made its operation highly inefficient. The company was finally forced to convert the unit into a long rotary kiln without pre-heater. The same design was adopted for the third 600 tons per day kiln. The kilns are fired with crude oil obtained from the Eastern Province. The poor service life of the refractory lining in the hot zone has resulted in extra expenses through higher than normal consumption of refractory bricks and extra downtime. The problem arises from the nature of the raw materials. The company has carried out a large number of trials using different types of refractories. In recent years some progress has been made in improving the service life of the lining although it still remains below that of comparable plants in other countries.

The company manufactures ordinary portland cement only. A typical analysis of the clinker is shown in Table 1.

b) The Saudi Cement Company in Hofuf

The Hofuf plant went into operation in 1961, with a 300 tons per day kiln. In 1967 another kiln of the same size was added. A third kiln with a rated output of 725 tons per day went into operation early in 1971. It is now in full production and the present output of the plant is 1300 tons per day, corresponding to an annual production of about 400,000 tons. The Saudi Cement company is considering another expansion by adding a fourth kiln with a daily output of 1500 tons, which would more than double the present production of the plant. No decision has been reached as yet concerning the time of execution of this project.

The location of plant at Hofuf has been dictated by availability of large quantities of suitable limestone deposits and other cement raw materials and of natural gas. The proven reserves of raw materials available in the area should be sufficient to supply the plant for more than 100 years with the proposed 1500 tons per day expansion.

Tab. 1 TYPICAL CHEMICAL ANALYSES OF ORDINARY PORTLAND CEMENT CLINKER

	Arabian Cement Co. Jeddah	Saudi Cement Co. Hofuf	Yamama Cement Co. Riyadh
SiO ₂	21.4%	23.8%	21.1%
Al ₂ O ₃	5.6%	3.5%	7.3%
Fe ₂ O ₃	3.6%	2.0%	4.1%
Ca O	64.8%	67.3%	64.8%
Mg O	2.2%	2.0%	1.0%
SO ₃	0.7%	n.d.	0.7%
Ignition Loss	0.3%	0.1%	0.4%
C ₃ S (3 CaO · SiO ₂)	58.5%	66.9%	40.7%
C ₂ S (2 CaO · SiO ₂)	17.2%	17.7%	31.2%
C ₃ A (3 CaO · Al ₂ O ₃)	8.8%	5.9%	12.4%
C ₄ AF (4 CaO · Al ₂ O ₃ · Fe ₂ O ₃)	10.8%	6.1%	12.4%
S M	1/		
A/F	2/	6.30	1.86
LSP	3/	1.73	1.79
		0.946	0.917

1/ SM (Silica Ratio) = $\text{SiO}_2 / (\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$

2/ A/F = $\text{Al}_2\text{O}_3 / \text{Fe}_2\text{O}_3$

3/ LSP (Lime saturation factor) = $\text{CaO} / (2.8 \text{ SiO}_2 + 1.1 \text{ Al}_2\text{O}_3 + 0.7 \text{ Fe}_2\text{O}_3)$

The limestone quarry is located a few hundred meters from the plant site. It contains a dense and hard limestone which is quarried through drilling and blasting. Proven reserves amount to 7 million tons.

Clay is obtained from deposits located at some distance from the plant. The clay is rather dense and requires blasting. The operation of the clay deposit is carried out by a subcontractor. The material is delivered at the plant by trucks.

Iron ore was originally obtained from the vicinity of Jebbai Ossus as magnetite of high purity (96 to 97% Fe_3O_4). However, this material was extremely difficult to grind and the factory has been forced to obtain its supply of iron ore from Wadi Fatma in the Western Province. Deposits closer to the plant contain too much silica and would increase further the already high silica ratio in their cement clinker.

Gypsum is supplied by trucks from a surface deposit located southwest of Hofuf.

The dry process kilns are fired with natural gas supplied by the Arabian American Oil Company on a contract basis. The gas is supplied from a flare located about 7 km from the plant. The six inch pipe line is owned and maintained by the cement company. The gas is sold on the basis of its heating value. A rate of US\$ 0.09 is charged for one million BTU or US\$ 0.215 per 1 million kcal. Consequently, the plant enjoys a considerable advantage in fuel cost compared with the other two cement plants where crude oil is obtained at a delivered cost of US\$ 13 per ton or US\$ 1.23 per 1 million kcal. Fuel consumption per kilogramme of clinker is presently between 1100 and 1200 kcal.

Due to the very low alumina content in the clay the plant operates on a raw mix of exceptionally high silica ration (between 4 and 5). Usually, a silica ration of 2.5 is considered the optimum. Consequently, the kiln temperatures are very high and service life of the refractory lining is lower than normal. A typical chemical analysis of ordinary portland cement clinker produced by this plant is given in Tab. 1.

Taking advantage of the peculiar composition of its raw materials the company recently introduced various types of sulfate resistant

eat cements which meet the requirements of ASTM standard

A good market for the sulfate resistant types exists in the Eastern and Western Provinces where salt attack on concrete can be pronounced. Low heat cements are used for dam construction, particularly in the southwestern region of the Kingdom.

Yamama Saudi Cement Company in Riyadh

The most recently established cement plant belongs to the Yamama Cement Company in Riyadh. The plant started operation with a 300 tons per day kiln (100,000 tons per year). An additional 900 tons per day kiln is about to go into production. The plant is expected to reach full output during the second half of this year, when the annual production of the plant will reach 1,200,000 tons of cement.

The plant is constructed on a vast deposit of high grade limestone which is quarried by ripping and occasional blasting. The limestone is sufficient for any possible expansion of plant capacity.

Locally used clay deposits are located along the Riyadh-Khuraib road, a distance of 50 KM from the plant site. Other usable deposits are located to the south and west of Riyadh.

The plant uses small quantities of silica sand (4% of raw mix) with a silica content of around 90%. It is obtained from sand dunes

located in the desert areas south of Al-Kharj, about 40 KM from Riyadh. The material is a limonitic crust, handled by a local contractor.

Gypsum is obtained through the National Gypsum company which is located very south of Riyadh.

The plant uses crude oil from the Khuraib field as fuel. While other cement producers in Saudi Arabia obtain their electric power from generating sets, the Riyadh factory uses power from the national grid.

The main problem with which this company is faced is shortage of technical personnel for operating the factory. The majority of its operating and maintenance posts are still staffed by expatriates.

A few years ago the company initiated a training program for Saudi nationals.

program for its local staff. A number of candidates were trained on the job and at the facilities of the equipment supplier in Germany. Most of the supervisory functions at foreman's level are now carried out by local staff.

At present the Riyadh plant produces regular portland cement only. Trial runs are being made for production of sulfate resistant types and low heat cement which are believed to find a ready market in the Western Province where, due to raw material limitations, only regular portland cement is produced. After start-up of the 900 tons per day kiln it is planned to use the old 300 ton kiln partly for specialty cements.

d) Cooperation between the Cement Companies in Saudi Arabia

The Industrial Studies and Development Centre (ISDC) has sponsored several industry meetings in order to promote technical cooperation between the three cement companies. At present each company carries a large stock of spare parts because of long delivery time from overseas suppliers. Efforts are now being made to pool the spare parts carried in stock to the greatest possible extent. An exchange of technical information between the companies has also been initiated. Through frequent contacts with the companies and the distribution of position papers the ISDC is also trying to keep the cement industry informed about forecasts of future consumption of cement in the country and about developments in other segments of the construction industry. The ultimate goal of these efforts is the establishment of a National Association of Cement Manufacturers which can promote cement quality and use and advise the customers on the proper use of cement.

III. The Cement Market in Saudi Arabia

a) Cement Consumption

Over the last ten years cement consumption in Saudi Arabia has been steadily rising. The historic data presented in Figure 2 have been obtained from official import statistics and production figures supplied by the three cement companies. In the absence of official population statistics, per capita cement consumption given in Table 2 has been calculated on the basis of unofficial estimates of population. The data are subject to a certain amount of error.

Over the last five years total consumption of cement went up about 65% while per capita consumption during the same period rose by 50%, from 187 kg in 1965 to 278 kg in 1970.

Data for Gross National Product (GNP) and a correlation between GNP and cement consumption from 1964 to 1970 are shown in Table 2 and Figure 3. Per capita cement consumption for a given per capita GNP is considerably higher than in many other countries. A UNIDO publication^{1/} lists the following correlation between per capita cement consumption (Y in kg) and per capita GNP (x in US\$):

$$\log Y = 1.02 \log x - 0.58$$

this relationship has been based on a survey of 100 countries. The higher per capita cement consumption reflects the special nature of the Saudi Arabian economy where economic activities have been greatly influenced by the sharp increase in oil revenues and where government sponsored construction projects require considerable amounts of cement.

Projections for future cement consumption have been made on the assumption of continued government expenditures for public construction and agricultural, industrial and social development projects. Estimate I in Fig. 2 was made in 1969 on the basis of trend extrapolation and population growth. The more optimistic estimate II has been prepared in 1971. It employed the same methods of prediction and has taken account of recent developments in oil revenues and in

^{1/} Building Materials Industry, UNIDO monographs on Industrial Development, New York 1969.

Fig. 2 PRODUCTION AND CONSUMPTION OF PORTLAND CEMENT IN SAUDI ARABIA

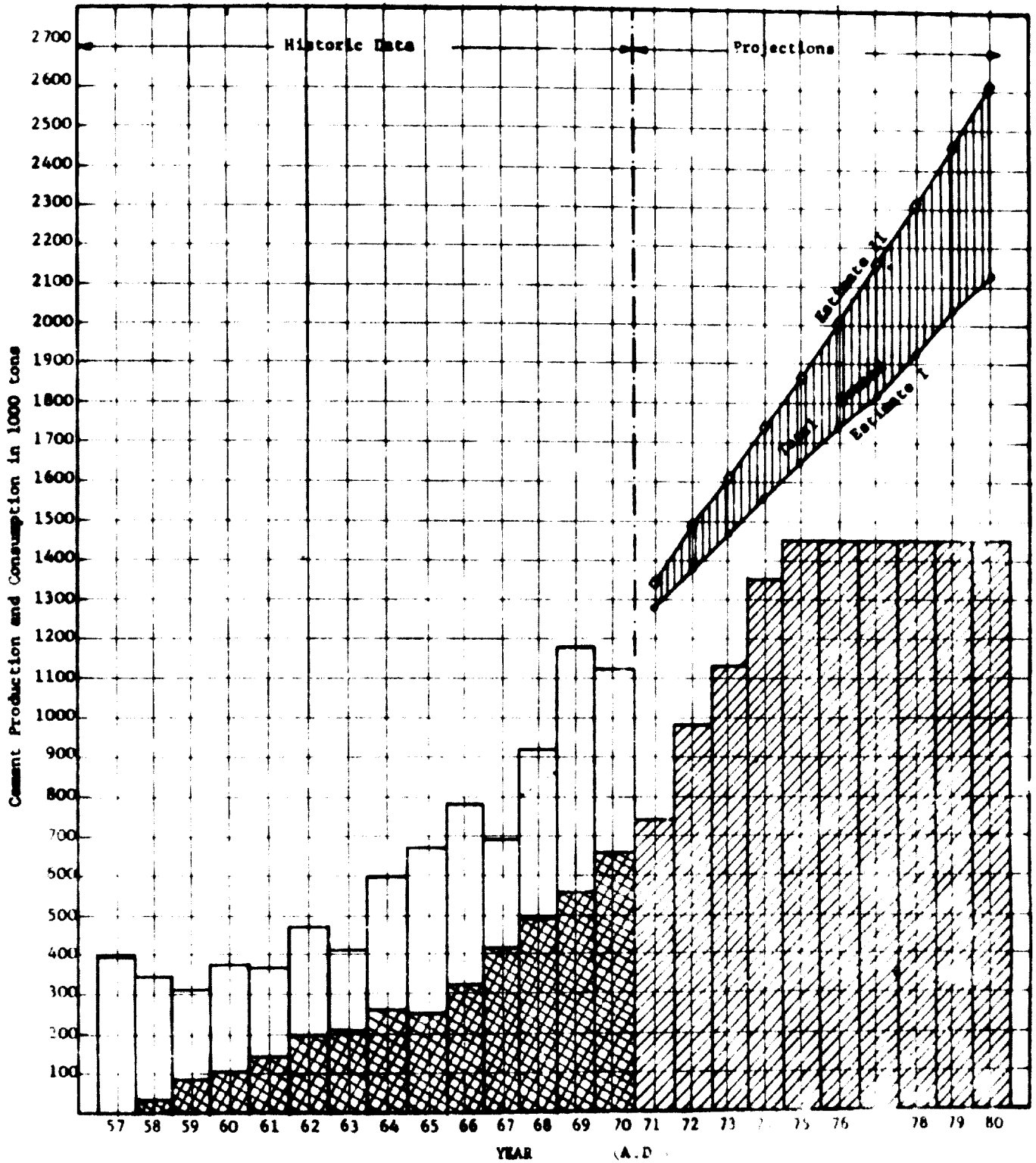


TABLE 2 **DEVELOPMENT OF GROSS NATIONAL PRODUCT (GNP)**
AND CEMENT CONSUMPTION IN SAUDI ARABIA

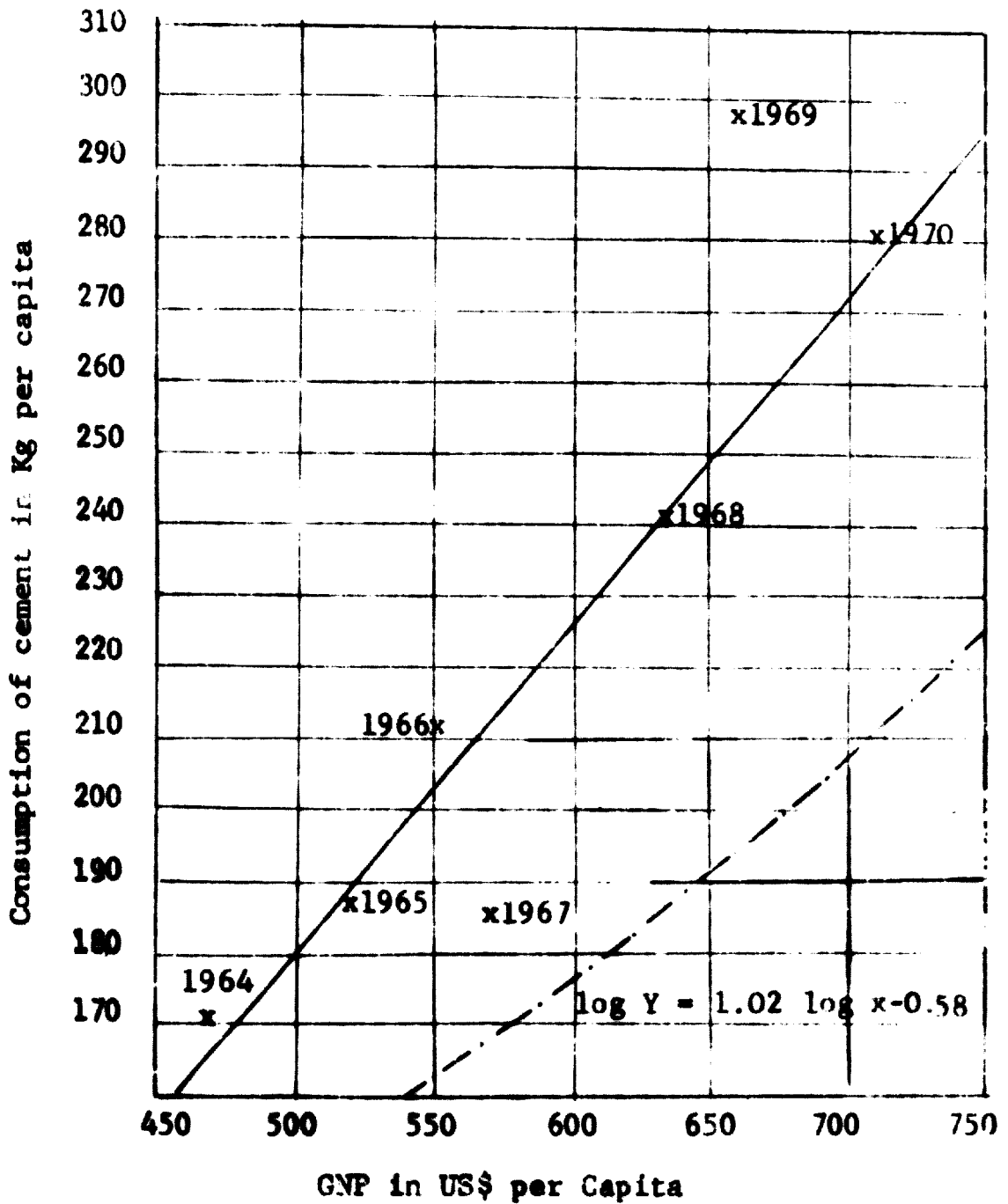
YEAR ^{1/} A. D.	G N P ^{2/}		Cement Consumption	
	In Million US \$	In US \$ per capita	In Thousand Tons	In Kg. per capita
1957			396	130
1958			377	121
1959			314	99
1960			376	116
1961				
1962			367	111
1963			472	140
1964	1668	473	409	119
1965	1863	517	598	170
			672	187
1966	2024	550	779	212
1967	2248	598	694	184
1968	2444	635	923	240
1969	2612	663	1179	299
1970	2855	710	1120	278

1/ Statistics for cement imports for Saudi Arabia are given in Hijra years. Slight inaccuracies are experienced in the data for cement consumption by conversion into Gregorian years.

2/ Real GNP in 1967 prices. For conversion into US \$ a rate of 4.5 Saudi Riyals per US \$ has been used.

GNP data are from Statistical Summary, published by Saudi Arabian Monetary Agency, September 1971.

Fig. 3 Correlation between GNP and Cement Consumption in Saudi Arabia.



Correlation line $\log Y = 1.02 \log x - 0.58$
according to footnote on page 18.

government spending for projects. This projection may cover actual conditions fairly well in the initial period of the forecast but may draw too optimistic a picture in later years. Actual consumption is expected to be somewhere in the shaded area between the two curves in Fig. 2. According to these forecasts total consumption of cement will increase from 1.12 Million tons in 1970 to somewhere between 2.13 and 2.62 Million tons in 1980. The corresponding per capita figures for cement consumption are 278 kg for 1970 and between 403 and 495 kg for 1980.

After a slow start local cement companies have expanded their production capacity rapidly in recent years. The initial kiln size at the three plants was 300 tons per day. In recent extensions kilns with a capacity of up to 900 tons were installed in order to take advantage of economies of scale. The Saudi Cement Company in Hofuf is planning an extension with 1500 tons per day kiln as soon as markets for its output can be secured. Despite the expansions carried out sizable quantities of cement had to be imported. One reason has been that forecasts in the past consistently under-estimated the actual size of demand. The ISDC in co-operation with other agencies is now trying to update these forecasts at regular intervals so that new trends and consumption patterns can be taken into considerations in planning future extensions. The result of these projections will be made available to industry so that their investment schedules can be planned accordingly. In 1970, only 59% of the country's consumption was covered by locally produced cement. The rest was imported from neighbouring countries and Japan.

Two cement markets have developed in the Kingdom. In the past they have been largely independent of each other due to the large transportation distances involved. One of them covers the Eastern and Central Provinces. This is supplied with local cement from the plants in Riyadh and Hofuf and with imports through the port of Dammam and - to a lesser extent - Yanbo for the Gassim and Hail regions. The other market covers the Western Province including the Northwest and Southwest, and is served by the cement plant in Jeddah and through imports in the Red Sea ports, mainly Jeddah, Yanbo and Jizzan.

The expected situation on the two markets is given in Table 3. Considerable shortage of locally produced cement was experienced in the Eastern and Central Provinces in 1971. The start-up of a new

725 ton kiln at the Hofuf plant during April 1971 has improved the supply situation towards the end of last year. In early summer 1972 the 900 tons kiln in Riyadh is expected to go into operation. We expect that by the end of 1972 and for the following 3 to 4 years installed production capacity in the Eastern and Central Provinces will be sufficient to meet cement demand.

The Western Province will continue to be under-supplied with local cement for the foreseeable future even after the scheduled expansion of the Jeddah plant in 1975. Between one-third and one-half of the cement used in the area will still have to be imported unless additional production facilities are established. These possibilities will be discussed in Chapter V.

b) Cement Quality

Ordinary portland cement from local plants is manufactured according to British Standard BS 12. Sulfate resisting types and specialty cements produced by the Hofuf plant meet the requirements of ASTM Standard C 150-68. A committee appointed by the Ministry of Commerce and Industry is in the final stages of drafting a Saudi Arabian National Standard for regular portland cement in consultation with the three cement companies. The proposal follows the requirements of BS 12 with some modifications. The limits for fineness have been tightened in comparison with BS 12 and the ISO - RILEM method adopted for the determination of compressive strength. After final approval the Ministry of Commerce and Industry intends to have local and imported cement controlled through a public laboratory for compliance with the requirements of this standard.

The quality of local cement is considered fair. Complaints are voiced not so much about average quality as about lack of uniformity between shipments. Among imports Japanese cements are by far the most popular ones because of high strength and uniform quality. While the properties of many other cements, local and imported, suffer considerably during shipment and storage, particularly in the hot and humid regions along the east and west coasts, the properties of Japanese cement appear to be little affected. Other sources of cement are Egypt, Jordan, Ethiopia and Iraq for the market in the Western Region and Pakistan, India and Iraq for the Eastern and Central Provinces.

Tab. 3 ESTIMATES OF CEMENT CONSUMPTION AND LOCAL SUPPLY IN GUATEMALA 1970-1980

A.D.	Eastern and Central Provinces		Western Province		(4) - (5) in 1000 tons
	Estimated Consumption in 1000 tons (1)	Estimated Production in 1000 tons (2)	Estimated Consumption in 1000 tons (4)	Estimated Production in 1000 tons (5)	
	(3) in 1000 tons		(6) in 1000 tons		
1971	590	390	+ 200	350	+ 370
1972	645	630	+ 15	350	+ 440
1973	690	780	- 90 *	350	+ 490
1974	740	800	- 60 *	550	+ 360
1975	790	800	- 10 *	650	+ 320
1976	845	800	+ 45	650	+ 380
1977	895	800	+ 95	650	+ 440
1978	955	800	+ 155	650	+ 515
1979	1005	800	+ 205	650	+ 585
1980	1070	800	+ 270	650	+ 655

* A negative figure indicates that production capacity exceeds demand.

Frequently, customers in Saudi Arabia judge the quality of cement by color, a dark grayish green product like the Japanese cement being the preferred one. Local factories have been unsuccessful in convincing customers that no correlation exists between cement quality and color. Cement producers are now adjusting process conditions in their kilns to obtain a cement of the color desired.

c) Cement Prices and Competitive Situation

The ex-works price of locally produced cement has been set by agreement between the Ministry of Commerce and Industry and the cement producers. For 1972 these prices are as follows:

Arabian Cement Co., Jeddah	US\$ 24 per ton
Saudi Cement Co., Hofuf	US\$ 26 per ton
Yamama Cement Co., Riyadh	US\$ 29 per ton

(Conversion rate 1 US\$ = 4.15 Saudi Riyal)

The higher price of cement in Riyadh reflects the fact that the local cement company operates a rather small kiln where production costs are higher than in the other plants. In all cases local cement is sold at very profitable prices. It is believed that excessive government regulation of this industry under the free market conditions prevailing in Saudi Arabia would ultimately lead to a black market which would be difficult to control. Besides, the dividends paid by the cement companies are not excessive as expansion programs are financed partly by retained earnings.

A lasting improvement in cement prices will have to be achieved by increasing the supply of cement and by promoting the establishment of a competitive market. Therefore, the government is trying to encourage future expansion of existing facilities with large kilns, preferably in the 1000 tons per day range or more, and the establishment of new plants if necessary. A few months ago the government reduced import duties on cement from US\$ 5.06 to US\$ 2.29 per ton in order to lower market price of imported cement.

Rapid expansion of plants in the Eastern and Central Provinces in combination with lower import duties have considerably improved the supply situation in this area. The retail price of Japanese cement in Riyadh has dropped from US\$ 38.6 per ton during summer 1971 to US\$ 31.3 per ton during March 1972. A similar drop in price was experienced in the Eastern Province. Japanese cement is still priced considerably above local cement, due to customer

preference as a consequence of its favourable performance. Other brands, such as cements from India and Pakistan which were sold in the Eastern Province at US\$ 27.7 per ton last summer are now on the market at prices slightly below the cost of local cement (US\$ 25.3). It is expected that cement prices in the Eastern and Central Provinces will stabilize at levels considerably below present ones as soon as the new kiln of the Riyadh plant is in full operation.

In the Western Province the establishment of a second cement company is encouraged as the only way towards an improved supply situation and a competitive market with lower prices. Because of the shortage of local cement in the area recent reductions in import tariffs decreased the cost of imported cement much less than in the rest of the country (from between US\$ 36.2 and 38.5 ton last summer to between US\$ 33.7 and 36.2 per ton in March 1972).

IV. END USES OF CEMENT

a) Construction Activities in Saudi Arabia

For the period 1962-1969 growth in value added for construction averaged 12.1% per year. 1970 contribution of construction (in constant 1967 prices) to the Gross Domestic Product reached US\$ 178 Million.

Construction figures include building construction, civil engineering work and other expenditures for projects. A substantial part of construction expenditures, about 50%, are financed by the government. According to the Development Plan total construction activities are expected to increase at a 10% annual rate while building construction is generally expected to expand at a slightly lower rate of 8% annually.

The level of construction depends a great deal on government spending for projects. Considerable quantities of cement are expected to be used in port construction on the Red Sea coast and along the Arabian Gulf. Dam construction for flood control and irrigation is likely to continue, particularly in the Asir Region (Southwest). Improvement of the municipalities and construction of primary and secondary roads, particularly in the mountainous South-west, is expected to consume appreciable quantities of cement. In 1971, a housing department has been established with the task of initiating the construction of low cost houses and the promotion of the establishment of a Housing Finance Corporation which will assist in financing private residential construction.

b) Concrete Work

In the larger cities and towns traditional mud house construction is gradually being replaced by concrete structures. The predominant method of building uses a reinforced concrete frame with non-bearing walls of masonry blocks of concrete or structural clay. Concrete aggregates in the Western Province are of good quality. Those available in the Central Province frequently contain excessive quantities of clay and fines. The Eastern Province is short of good aggregates particularly in the larger fractions. A few aggregate plants produce washed aggregates. The remainder use a simple screening process.

port in suitable instructors who can
the basic concepts of concrete technology.
The work is caused by lack of understanding
the use of improperly graded aggregates.
ing to the government or larger institutions
ing engineers and architects. The quality
instances ranges from fair to excellent.
Quality is generally not as good as it could be.
The use of fair faced concrete has recently
results. This method reduces maintenance
eliminating plastering work which generally
durability.

In the country are hollow concrete blocks
blocks are produced in a large number of
expensive equipment. With the exception of
series the blocks are of poor quality and
1, sold at very low prices (US\$ 6.00
s produced in larger plants are sold
load bearing blocks and US\$ 12.00 per
Only two manufacturers in the country

ods of construction most blocks are of
However, appreciable quantities of load
ted to be used in the construction of low
designers are planning to use load bearing

erial Studies and Development Centre in co-operation
ment of Public Works in Riyadh has recently carried
of the quality of masonry blocks throughout the Kingdom
of which a National Standard for Masonry blocks is
out. It is hoped that the establishment of minimum
requirements will reduce the large number of substandard
on the market.

d) Prefabricated Concrete Parts

Attempts to introduce pre-cast concrete parts such as pre-stressed items or prefabricated fencing posts and walls have been unsuccessful because they either have been introduced too early or without sufficient financial resources to ensure proper market penetration.

In a competitive market the successful introduction of prefabricated building units depends on a number of conditions. Essentially, the market must have reached a stage of development where the degree of accuracy, finish and performance obtainable with prefabricated parts can be fully utilized. In case of larger parts or building systems, the customer must be ready to accept a certain degree of uniformity in building design. Finally, the use of prefabricated parts requires a market of sufficient size to provide advantages in cost and time of completion. Low cost manpower for the building trades is still in plentiful supply as a considerable number of migrant labor is drawn into Saudi Arabia from neighboring countries, particular Yaman.

Efforts are now being made to promote the production of certain types of precast concrete parts such as beams and deck slabs for the low cost housing program where due to large series and repetitive design features successful introduction seems likely.

e) Asbestos Cement Industry

In 1970, an Asbestos Cement Plant with an annual output of 36,000 tons came into operation in Damman. The plant which operates under license and with capital participation from the Swiss Eternit group produces high and low pressure pipes for water supply, drainage and sewerage. Early this year a small unit producing corrugated asbestos cement sheets has been put into operation. The pipes produced by this plant are used in various water projects and sewerage schemes in the municipalities of the Region. Corrugated sheets enjoy considerable popularity in industrial construction and the erection of a full scale plant is being planned. The factory obtains its supply of cement in bulk delivery trucks from the Hofuf plant. The type of cement produced in Hofuf was found to be very suitable for the production of asbestos cement products. The asbestos cement company is presently engaged in construction of a second plant for pipes in Jeddah in order to take advantage of the considerable number of water and sewage projects under way in the Western Province.

V. FUTURE DEVELOPMENT OF THE CEMENT INDUSTRY IN SAUDI ARABIA

As mentioned before installed production capacity in the Eastern and Central Provinces is expected to meet demand for the next 3 to 4 years. At times, even a small surplus capacity may exist. The cement company in Hofuf is actively engaged in developing oil well cements and other specialty cements as an addition to its present manufacturing program of regular and sulfate resisting types. The growing cement consumption in Kuwait and the countries in the Arabian Gulf area may provide an attractive but highly competitive market for the Saudi Cement Company. A small cement plant has been in operation in Doha for several years and additional plants are planned for Abu Dabi and Dubai (see Fig. 1). However, the Hofuf plant with its large kilns and low fuel costs should be in a very good position successfully to compete in the area. Depending on the success of these efforts further plant expansions, at the Hofuf plant, may come in 1977 or later.

No expansion of the Riyadh plant is foreseen in the near future. The Yamama Cement Company will be engaged in major marketing efforts to replace foreign cement not only in Riyadh but also in the Gassim and Hail regions where due to improved road connection economic activities are expected to pick up in the next few years.

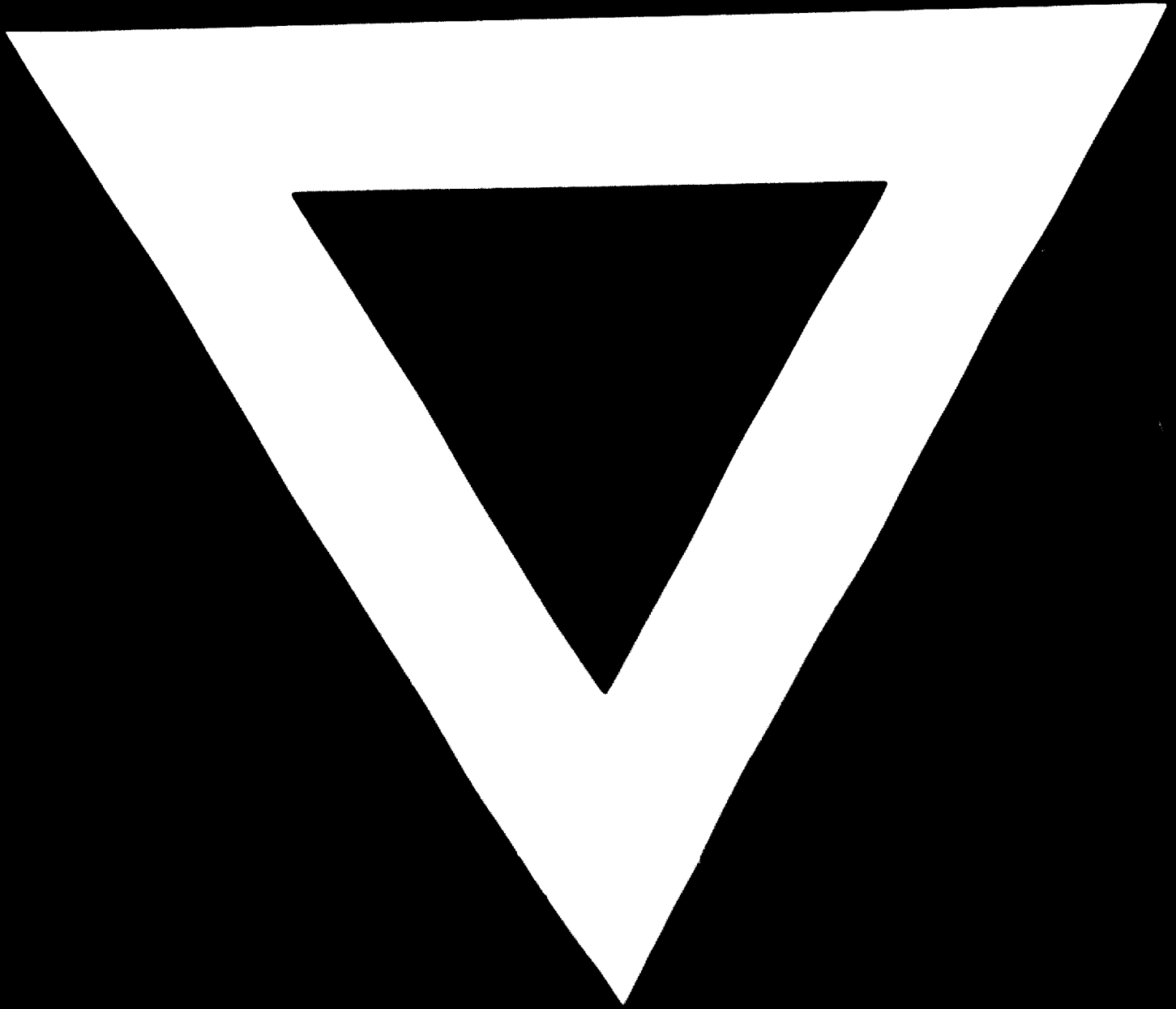
A preliminary study carried out by a consulting firm indicated the availability of suitable raw materials for the manufacture of cement near Buraydah in the Gassim area. However, due to the proximity of this location to Riyadh construction of production facilities there is unlikely to materialize in the foreseeable future. A plant supplying the Buraydah-Hail regions would be very small and at a competitive disadvantage vis-avis the larger units at Riyadh.

In the Western Province the establishment of a second cement factory which would solve the consistent shortage of locally produced cement is actively encouraged. Preliminary surveys for suitable raw materials have been carried out in the Yanbo area north of Jeddah. Suitable deposits of limestone have reportedly been found at several places along the Red Sea. The establishment of a rotary kiln without pre-heaters producing 1000 tons per day or more has been suggested.

The Southwestern Region of the Kingdom is gaining importance as an agricultural area. Mining industries may also materialize. The area is relatively densely populated (around 1 Million) although

most of the people are living in rural settlements and smaller towns. Even if a second plant is established in the Western Province as suggested above, by 1977 demand is expected to exceed the production capacity of local plants. A third plant may be located in the Southwest provided suitable raw materials for the manufacture of cement are found. Originally a grinding and bagging unit could be constructed in the Jizzan area and be supplied with cement clinker from Jeddah or elsewhere. If feasible, production facilities could be added to the grinding plant later on. Production capacity of a plant in the Southwest should be large enough to supply local consumption as well as limited quantities for export to northern Yemen which is presently being linked with the highway system in Saudi Arabia and in which only a small cement factory is operating near Hodeida (see Fig 1).





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