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DEVELOPMENT OF THE BRICK INDUSTRY IN NORTH AFRICA

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THE BRICK INDUSTRY

1. Introduction

In North Africa bricks have for a long time past been the traditional material used in construction. In all the Maghrib countries many brickworks may be found which produce bricks, hollow ceiling tiles and tiles of very good quality. Indeed, often their quality might even be termed excellent. Mention may be made of many important buildings constructed of brick in all the North African countries. Il all these countries, we find relatively extensive production by local craftsmen in addition to industrial production. In Sudan and Libya, there is no industrial production, and the entire production of bricks, tiles and related products, results from the work of local craftsmen. In the United Arab Republic, production of bricks is very widespread, but almost the whole of this production, comprising solid bricks of indifferent quality, is attributable to local craftsmen. In Libya, frequent use is made of blocks hewn from porous limestone instead of bricks. Libya's requirement in bricks, tiles and related products are met through imports and through handicraft production. The raw materials needed for the manufacture of bricks may be found in almost all parts of Algeria, Morocco, Tunisia and Sudan. Conditions in the United Arab Republic are different. Hitherto, red bricks have been prepared by using the alluvial deposits that are washed up every year on the Banks of the Nile. Now that the High Dam is on the point of completion, a large proportion of these alluvial deposits will be washed up at the foot of the Dam, which will make it possible to establish new factories for the production of silica bricks composed of sand and lime, and treated with steam in autoclaves. At the same time however it will

and similar products based on new clay deposits.

In North Africa, red bricks remain the basic material used in building; and with the development of construction work in North Africa, it will be necessary to develop the brick industry to keep pace with that development, while taking the special circumstances that prevail in the United Arab Republic into account.

2. The evolutionary trend in the consumption of bricks, tiles and related products

With the exception of Libya, all the countries of North Africa are self-sufficient as regards the supply of bricks, tiles and related products, so that imports and exports play no essential part.

In the foreign trade statistics we may find the products of the brickworks divided up into two categories according to the SITC or BTN classifications:

SITC	BTN	
662.4(1)	69.04	Building bricks;
662.4(2)	69.05	Roofing tiles, chimney pots, liners and other constructional ceramic ware.

Statistics relating to foreign trade in, and to production and consumption of, bricks, tiles and related products may be found in Annex I. As far as imports are concerned, group 662.4(1) is entirely negligible except in the case of Libya. In the case of Algeria, group 662.4(2) includes foreign trade figures only for the years 1961 and 1963; in these two years, imports of tiles amounted to 29 per cent of consumption in 1961, and 16 per cent in 1963. Thus, with the foregoing exception, and also that of Libya, imports of tiles are negligible. It may be considered that in Algeria at the present time, imports of bricks are negligible and imports of tiles are of the order of 3 million single bricks or about 12 thousand tons per year.

Production of bricks, tiles and related products during the period 1960-1965 were as follows:

TABLE 1

Production of bricks, tiles and related products in North Africa

1000 tons

	Algeria		Morocco	Tunisia		U.A.R.		Libya
	Bricks	Tiles	Bricks Tiles Hollow ceiling tiles	Bricks	Tiles Hollow ceiling tiles	Bricks	Drains	Bricks (handi-craft)
1960	489	66	119	79	2	2,800	15	-
1961	486	79	124	84	2	2,560	16	-
1962	143	44	134	90	2	2,625	21	-
1963	194	65	138	100	2	3,318	22	-
1964	275	104	115	105	2	3,605	23	14
1965	320	119	96	113	2	3,973	23	16

TABLE 2.

Consumption of bricks, tiles and related products in North Africa

1000 tons

	Algeria	Libya	Morocco	Tunisia	U.A.R.
1960	587	NA	117	80	2,800
1961	599	NA	120	86	2,560
1962	200	NA	134	92	2,625
1963	272	NA	138	103	3,318
1964	390	50	115	108	3,605
1965	452	67	96	115	3,973

Brick consumption in Algeria reflected the major decline in the national economy during the period 1960-1963, when investment fell from US$ 934.8 million in 1960 to $ 328.2 million in 1964. Brick consumption sank to its lowest level - about 200,000 tons - in 1962; but after this decline consumption again increased from 200,000 tons in 1962 to 272,000 tons in 1963, 390,000 tons in 1964 and 452,000 tons in 1965.

No statistics are available relating to brick consumption in Libya. Industrial bricks are not produced in that country. A proportion of requirements is covered by parpens or stone blocks and the remainder partly by imports and partly by handicraft production.

In Morocco, brick consumption attained its highest level in 1963 with some 138,000 tons; and in subsequent years consumption declined to about 96,000 tons in 1965, owing to the keen competition of parpens.

In Tunisia, the development of brick consumption is very regular. Consumption has increased, rising from some 80,000 tons in 1960 to 115,000 tons in 1965. The same regular progress in consumption may be observed in the United Arab Republic, where consumption amounted to about 2,743,000 tons in 1965.

In Sudan only solid handicraft bricks are produced, and a part of the country's requirements are met by imports.

3. Domestic production

i) Algeria

In 1966, seven out of fifty-two enterprises in Algeria had come to a standstill. The rate of utilization of capacity at the forty-five brickworks in production in 1965 was 57.04 per cent. Tile manufacture is financially more profitable for the plants, and demand for tiles is greater than demand for bricks. The rate of utilization of capacity in tile manufacture was 75.37 per cent.

Statistics relating to the brickworks and tileworks in Algeria will be found in Annex II.

(ii) Morocco

In Morocco, there are eleven main brickworks, which are shown on Map N° 1.[1/] It may be estimated that the rate of utilizatio of brickworks is approximately 85 per cent. At present, the brick industry is experiencing a recession in Morocco. Production in 1955 amounted to some 160,000 tons, with local craftsmen producing 50,000 tons.

(iii) Tunisia

In Tunisia, there are at present nearly fifty enterprises, the majority of which produce handicraft bricks; but two of them are ultra-modern (the Djemmal Brickworks and that of La Tunisoise Industrielle). A review of tunisian brickworks is given below:

1. La Tunisoise Industrielle

- One major plant at Manoubia in the neighbourhood of Tunis. Production amounts to 60,000 tons per year;
- One small new plant at Souk-el-Arba in the western part of the country, not far from the Algerian frontier. Production commenced in April 1967. Capacity is 15,000 tons per year;
- One small plant at El Hamma de Gabès in the southern part of the country. Capacity is 15,000 tons per year.

2. Union Générale

- Two factories at Djemmal in the centre of the country, 20 kms. from the port of Sousse. Capacity is 90,000 tons per year.

3. Medium-sized brickworks

- One at Bizerta, producing 4,000 to 5,000 tons per year;
- One at Menzel Djemil in the Bizerta region, with a capacity of 4,000 to 5,000 tons per year;
- One at Sfax, with a capacity of 4,000 to 5,000 tons per yea

1/ This Map is missing

4. Groups of small local enterprises operated by craftsmen

These exist mainly in the regions of Nabeul, Mokmine, Kasserine and Tozeur. These small-scale enterprises manufacture products such as solid bricks and bricks with three or six holes. Total capacity is assessed at between some 20,000 and 30,000 tons per year.

(iv) Libya

In Libya, there is only small-scale handicraft production. It is estimated that, in 1964, production amounted to 4 million single bricks or 14,000 tons, and that in 1965 the figures were 4.65 million single bricks - that is, 16,000 tons. A valuable contribution is also made in Libya by natural soft stone, which is very white in colour and is sawn into blocks measuring 40 x 28 x 18 cms. Mechanization of this process is being carried out. In 1964-65, this production accounted for about 17.5 million blocks or 350,000 cu.m. - in other words, production was estimated at 875,000 tons worth $2,650,000. It provided employment for a large labour force.

(v) United Arab Republic

In the United Arab Republic, building bricks at present include ordinary red bricks, concrete bricks and blocks, and bricks made of silica-lime. In terms of the volume employed, bricks are the main building material of the United Arab Republic. Ordinary red bricks, made from the alluvial deposits of the Nile, represent approximately 90 per cent of the country's total brick consumption. The main types of building bricks utilized in the United Arab Republic are ordinary red bricks moulded by hand - in other words, handicraft bricks - extruded bricks and machine-pressed bricks. The most usual dimensions are 25 x 12 x 7 cms. in the case of solid bricks and 40 x 20 x 20 cms. in the case of blocks.

Ordinary red bricks constitute approximately 90 per cent of

total consumption. The brickworks are located at intervals along the banks of the river. Brickworks in Cairo produce about 2 million bricks per day. The form of these bricks is irregular and the quality poor. They can only be used for brick partitions in buildings whose structural framework is of concrete.

The extruded bricks and mechanically-pressed bricks are of good quality, and their resistance to compression is 150 kgs. per sq.cm. in the case of extruded bricks and 400 kgs. per sq.cm. in the case of pressed bricks. Approximately 4 million single bricks of this type are produced annually, and they are used for building bridges and highways, and for other constructional work requiring high-quality materials.

To summarize the situation, in the United Arab Republic, only 4 million bricks, or a mere 3.5 per cent of total production, amounting at present to 1,135 million bricks, are industrially produced.

(vi) Sudan

There only exists small-scale handicraft production of solid bricks, and there are no statistics available for assessment of production. Brick imports are negligible.

4. Observations arising from a study of the local industry

In North Africa, bricks are the traditional building material, and raw materials for brick-making may be found everywhere in the North African countries. Bricks combine all the properties that are useful and necessary in building materials: price, mechanical properties, thermal properties, ease of manufacture, durability and resistance to bad weather. Using bricks also makes it possible to economise on plastering, and red bricks may be used as an architectural feature.

Generally speaking, bricks of an inferior quality are produced ny handicraft methods. Hollow bricks manufactured by hand can only be used for simple purposes. It is desirable to replace handicraft production by the progressive introduction of industrial production.

Concrete blocks, known as parpens or agglomerates, always constitute a product that competes with bricks, as do asbestos cement slabs with tiles. Substitutes for bricks and tiles can, however, only be utilized within certain limits; and as the modernization of brick production proceeds, they will always be competitive with other materials.

In North Africa, white houses are traditional. In former times, the practice of painting houses white was adopted for the sole purpose of reflecting the sun's rays. Nowadays, the insulating properties of bricks are of such an advanced standard that it is possible to introduce with them a new element into architectural construction and architecture in North Africa, by erecting brick walls without external plastering. This helps at the same time to effect economies.

It is customary to proceed in this manner, using bricks, in countries where climatic conditions are more difficult, such as, for example, the Scandinavian countries, the United Kingdom and the Soviet Union. Despite their climatic conditions, which are more rigorous than those in North Africa, the life-span of their buildings can be calculated in centuries.

The quality of industrial bricks manufactured in North Africa is, in many instances, excellent and the quality of the workers is also very high. These factors favour the development of the brick industry.

5. Development projects up to 1980

To determine the requirements in bricks and the development of brick production up to 1980, we must first of all discover to what extent the national economy, and hence building activity, will develop. Next it is necessary to evaluate the production of bricks and tiles and, taking this evaluation as a basis, formulate proposa to meet the future situation. The following may be used as methods of projection:

(a) Evaluation of brick requirements for building activity in North Africa;

(b) Comparison of the figures obtained by (a) with figures relating to development in countries of the European and American continents, where statistics are not lacking.

(i) The statistical method

In Annex III will be found projections of development in the domestic economies and in construction work in North Africa, based on the United Nations documents entitled: "ECA Study on Industrialization and Economic Cooperation for North Africa (N°2), Provisional Macro-Economic Data on Economic Development during the Period 1964-1980", and "Construction in the Development Programmes in North African countries".

In order to establish guidelines for the development of brick production in North Africa, it will be necessary first of all to study the development of brick consumption in other countries. Statistics relating to brick consumption use as the unit of measure ment numbers of bricks rather than weight, but this is of no import ance. In Annex III, Table 2, the following information is given:

value of investment channelled into construction, brick consumption in millions of single bricks, and brick consumption in numbers of single bricks per $1,000 used in construction in the various countries of the world during the period 1953-1963. An evaluation of brick consumption in the North African countries during the period 1955-1965 may be found in Annex III, Table 3, in which brick consumption is shown according to country.

In a United Nations document entitled "The Brick Industry",1/ the relationship between cement consumption and brick consumption in twenty countries of the world is considered. It demonstrates that the growth of one is directly linked with the growth of the other. In its turn, the growth of the building industry and of public works exerts a direct influence on the growth of cement and brick consumption. The correlation between cement consumption and brick consumption in the world in 1950 could be expressed by the following equation:

In 1950

$$\log Y = 1.2707 \log X = 1.2131 \text{ (Assumption I);}$$

and after some ten years the correlation changed and could be expressed by the following equation:

$$\log Y_1 = 0.8270 \log X + 0.1816 \text{ (Assumption II)}$$

The difference between these two equations may be observed in the results obtained for the Sub-region (Table 4).

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TABLE 4

Evaluation of brick consumption by the North African countries

	Cement consumption in 1000s of tons				Brick consumption in 1000s of tons based on						
					Assumption I				Assumption II		
	1964	1970	1975	1980	1964	1970	1975	1980	1970	1975	1980
Algeria	585	960	1300	1800	275	377	554	838	445	571	748
Libya	330	860	1200	1610	50	328	500	727	406	535	682
Morocco	910	1040	1400	2000	115	418	609	958	475	607	816
Tunisia	330	510	730	1060	105	169	266	428	264	354	483
UAR	2430	3500	5000	7500	3605	1952	3070	5140	1296	1741	2434
Sudan	430	400	560	850	50	124	190	323	216	285	402
Maghrib	2155	3370	4630	6470	545	1292	929	2951	1590	2067	2729
UAR and Sudan	2860	3900	5560	8350	3655	2076	3260	5463	1512	2026	3836
Sub-region	5015	7270	10190	14820	4200	3368	4189	8414	3102	4093	5565

(ii) The direct method

These two methods provide us with different results only in the case of the United Arab Republic, where it may be seen that, according to national statistics, brick consumption was 3.6 million tons per year in 1964, whereas the figures for consumption arrived at on the basis of the two assumptions are lower, being 1.3 million and 0.96 million tons per year respectively.

Another method of projection must, however, be sought. We are going to employ the direct method, based on direct evaluation, as this method appears to be more accurate than that based on statistical

evaluation. The procedure for employing this direct method is as follows: we are aware of the amounts channelled into investment in construction work as well as of the consumption of bricks, tiles and related products in former years, and we are able to estimate how many building units have been constructed of these materials. In the United Nations document entitled "ECA study on Industrialization and Economic Cooperation for North Africa", a projection of investment to be applied to construction work up to 1980 may be found. On the basis of this document, a projection of construction work in North Africa has been made in the United Nations report entitled "The Construction Industry in the Development Programmes of North Africa." The results of this projection may be found in Annex III, Table I.

A projection showing the consumption of bricks, tiles and hollow ceiling tiles will be found in Annex III, Table 4, where the following prerequisites apply:

1) The density of solid bricks is approximately 1.8 to 2.2, and of hollow bricks 1.0 to 1.4;
2) Tile consumption amounts to approximately 40 kgs. to 1 sq.m. of roofing;
3) Consumption of hollow ceiling tiles is approximately 95 kgs. to 1 sq.m. of ceiling;
4) As the quality of bricks, tiles and related products improves in the future, we must reckon with an increase in the percentage represented by hollow bricks, and also with the introduction of hollow ceiling tiles in the United Arab Republic, as this is a building material that presents many advantages in ceiling construction.

The requirements in bricks, tiles and related products calculated in accordance with this procedure will be found in Annex III, Table 4, and the results of this evaluation are as follows:

TABLE 5

Projected requirements of bricks, tiles and related products based on direct evaluation

	Requirements in bricks and hollow ceiling tiles in 1000s of tons				Requirements in tiles in 1000s of tons			
	1964	1970	1975	1980	1964	1970	1975	1980
Algeria	276	432	732	1.052	10	17	33	49
Libya	57	243	254	352	6	19	23	32
Morocco	112	248	390	630	4	9	10	15
Tunisia	104	188	357	560	3	6	9	13
UAR	1.650	1.690	2.072	2.618	-	-	-	-
Sudan	56	81	146	253	1	2	3	5
Maghrib	549	1.111	1.733	2.594	23	51	75	109
UAR and Sudan	1.706	1.771	2.218	2.871	1	2	3	5
Sub-region	2.255	2.882	3.951	5.465	24	53	78	114

When we compare the results of projection based on the direct method, we may perceive that differences emerge as far as brick consumption in the United Arab Republic and tile consumption in Algeria are concerned. In the United Arab Republic, brick consump amounts to 1.65 million tons according to calculations, but acco to the statistics it amounts to 3.6 million tons. The explanatio this discrepancy lies in the fact that the statistics of the Unit Arab Republic cover brick production as a whole, whereas in the other countries handicraft production is not included in the statistics. The construction work upon which our calculations ar based covers only the monetary sector. Brick requirements for th

non-monetary sector in the United Arab Republic appear to be considerable, which is probably also attributable to the poor quality and hence cheapness of handicraft bricks.

In Algeria, requirements for tiles amounted, according to the statistics, to about 103.000 tons in 1964, and to only 19,000 tons approximately according to the calculations. This discrepancy may be explained by the divergence between the monetary and non-monetary sectors.

Tiles are very popular in Algeria for roofing purposes, whereas in the other African countries many other materials are used for roofs. Especially in the non-monetary sector, tiles are used almost exclusively in Algeria. For that reason, Algerian tile requirements must be estimated without losing sight of the non-monetary sector's requirements and of roof maintenance. If we reckon with a growth rate of 5 per cent annually, tile requirements will amount to some 225,000 tons in 1980.

In the United Arab Republic, requirements amounted to 520 million bricks in 1952, and to 1,135 million single bricks in 1965. In this 13-year period, the rate of growth amounted to 6.2 per cent. If we apply the same growth rate to the period 1964-1980, we arrive at a figure of 2,700 million bricks consumed in 1980.

In a United Nations document[1/] prepared by the Government of the United Arab Republic, we find that the estimated consumption of ordinary red bricks - in other words, handicraft bricks - amounted to 2,000 million annually in the United Arab Republic in 1965, and that planned consumption would reach 3,000 million bricks per year in 1970, which implies a growth rate of 8.4 per cent in brick consumption. Estimated consumption in 1965 is in contradiction with that indicated in the official statistics. It is possible to put forward proposals for developing the brick industry in the United Arab Republic without studying in very great detail the conditions

1/ E/CN.14/AS/II/2/F/1/1

that prevail there, especially as regards raw material resources. The following remarks are designed merely to provide an indication:

1. It is necessary to establish the industrial production of burnt bricks, and especially of hollow bricks and hollow ceiling tiles;

2. Up to 1980, it must be anticipated that the quantity of solid burnt bricks produced by craftsmen will progressively decline. This type of brick is of inferior quality, and will be replaced in the future by industrial bricks. It must, however, be expected that hand-made bricks produced by local craftsmen will still be used for secondary purposes;

3. It must be anticipated that silica-lime bricks will be used. Current production amounts to 20 million single bricks per year, and will increase to 700 million bricks per year in 1970, according to the development plans of the United Arab Republic;

4. Owing to the fact that investment, productivity and the other techno-economic indicators relating to the manufacture of red bricks, silica-lime brick and concrete blocks are virtually the same, we can advance an approximate initial estimate of the development in red bricks manufacture, based on new clay deposits, and may anticipate that during the period under consideration (i.e. up to 1980) requirements for building materials used in making walls and partitions will be covered to the extent of 40 per cent in 1980 by red brick production, compared with 90 per cent in 1966. These results emerge from investigations which will make it possible to determine what scale of brick manufacture will be matched by resources of clay. In order, further, to verify our deductions and proposals, we can examine another indicator, namely brick consumption for every $1,000 of investment applied to construction purposes.

This indicator reflects the level of costs in the country, local customs in using certain forms of construction, the various materials employed and the structure of buildings, etc... It is unusual for this indicator to show a sudden change.

Table 6 shows past evolution of this indicator during a period of some ten years in several countries of the world; and Table 7 uses the same indicator to project proposals advanced for the North African countries.

TABLE 6

Brick consumption per $1,000 invested in construction work

(expressed in single bricks per $1,000)

and as a percentage of the base year 1953

	1953		1955		1958		1960		1962		1963	
	Brick consumption per $1000 of construction	Percentage	Brick consumption per $1000 of construction	Percentage	Brick consumption per $1000 of construction	Percentage	Brick consumption per $1000 of construction	Percentage	Brick consumption per $1000 of construction	Percentage	Brick consumption per $1000 of construction	Percentage
Austria	1.832	100	1.862	109	1.477	98	1.370	98	1.241	97	1.140	94
Belgium	2.957	100	2.835	93	2.287	85	1.838	-	1.456	-	1.423	-
Finland	-	-	365	102	226	72	164	55	170	62	161	61
France	594	100	650	109	409	96	332	80	288	73	275	77
Federal Republic of Germany	1.452	100	1.217	91	872	70	711	64	557	59	480	54
Italy	2.008	100	2.801	118	988	120	896	109	506	70	-	-
Netherlands	1.748	100	1.613	107	1.303	105	1.190	95	1.023	90	934	86
Norway	226	100	227	105	146	74	144	79	127	74	133	83
Sweden	381	100	329	89	207	61	207	65	182	62	168	59
United Kingdom	2.108	100	1.856	93	1.424	78	1.331	72	1.092	63	1.025	62
United States	149	100	166	113	125	92	124	96	111	89	115	92

Note: Single bricks, each weighing 3.5 kgs.

TABLE 7

Brick consumption per $1,000 of investment applied to construction

Number of single bricks per $1,000

	1964	1970	1975	1980
Algeria	620	623	590	483
Libya	168	234	200	200
Morocco	188	220	230	244
Tunisia	294	292	368	400
UAR	1.012	670	540	425
Sudan	168	160	180	190

Note: Single bricks, each weighing 3.5 kgs.

On the basis of these deductions, the direct method may be selected to project the future of the brick industry in North Africa and for the period under consideration, brick consumption may be accepted to be as follows:

TABLE 8

Proposed brick consumption in North Africa up to 1980

In 1000s of tons

	Existing capacity	Brick consumption			
		1964	1970	1975	1980
Algeria	560 (handicraft)	275	430	730	1.050
Libya	20 + 40 (hand.)	50	240	255	350
Morocco	135	112	250	390	630
Tunisia	215 (handicraft)	105	190	360	560
UAR	4.000	1.650	1.690	2.070	2.620
Sudan	45 (handicraft)	566	80	150	250

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The growth rate of brick consumption compared with the growth rate of construction work is shown below:

TABLE 9

Growth rates of construction work and brick consumption in North Africa during the period 1964-1980

As a percentage

	Construction work			Brick consumption		
	1964/70	1964/75	1964/80	1964/70	1964/75	1964/80
Algeria	7.6	9.8	10.4	7.8	9.3	8.7
Libya	20.5	12.8	10.8	30.1	15.9	13.0
Morocco	11.2	10.0	9.6	14.2	12.0	11.4
Tunisia	10.3	9.5	8.8	10.2	11.7	11.0
UAR	7.5	8.1	8.7	0.4	2.1	2.9
Sudan	8.8	8.5	9.2	6.5	9.1	9.8
Maghrib	12.4	10.5	9.9	12.8	11.1	10.2
UAR and Sudan	7.5	8.2	8.8	0.6	2.4	3.3
Sub-region	9.9	9.3	9.3	4.2	5.2	5.7

It should be noted that brick consumption comprises all types of bricks, such as solid bricks, hollow bricks, gypsum products and hollow ceiling tiles. Consumption of tiles, flooring tiles, drain-pipes and other similar burnt red-clay products is not included.

In Annex III, Table 3, statistics relating to cement and brick consumption, as well as the indicators of that consumption will be found. These statistics and indicators are compared with projectio of cement and brick consumption up to 1980, and with the statistic of some countries of the world. The consumption of single bricks,

for every $1,000 of investment applied to construction as indicated in this Table, shows us that the development of brick consumption advanced in this report would appear to be well-adapted to the development of construction work envisaged in North Africa.

In Libya, it is necessary to take into account the local specialty of manufacturing blocks of limestone, characteristically very white in colour, which are sawn into blocks measuring 40 x 28 x 18 cms. Mechanization of this operation is proceeding. At present, production by local craftsmen amounts to 17.5 million blocks, or 350,000 cu.m., which quantity provides a substitute for half-a-million tons of red bricks. This production is of major importance and complements brick imports and the handicraft production of bricks. It must be anticipated that this production will develop, and we may estimate that it will double by 1980.

6. Tiles and other brickworks products

According to the statistics, tile consumption represented approximately 28 per cent of the consumption of bricks, tiles and related products in Algeria in 1963, and about 3 per cent of that consumption in Morocco and Tunisia. In future, it must be expected that in Algeria there will be keen competition from other more modern and more economical roofing materials; and it may be estimat that the tile requirements of Algeria for new roofing and for the maintenance of existing roofs will amount to about 225,000 tons in 1980. In the other countries of North Africa, it may be estimated that this future consumption will amount to roughly 4 per cent of brick consumption. As far as other products are concerned, such as, for example, drains, setts used for wall tiling and the like, production of the order of 5 per cent of brick production may be anticipated. Requirements of bricks, tiles and other products manufactured by the brickworks are as follows:

7. Existing capacity and requirements in new capacity

In Algeria, estimated production capacity is shown in the official documents as follows:

	Bricks	Tiles	Total
Algiers	317,500	91,000	408,500
Oran	162,000	48,000	210,000
Constantine	82,000	23.500	105,500
Total Algeria :	561,500	162,500	724,000

TABLE 10

Complete breakdown of the consumption of bricks, tiles and related products in North Africa

In 1000s of tons

		Bricks	Hollow ceiling tiles	Tiles	Other	Total
Algeria	1970	373	59	160	22	614
	1975	632	100	190	37	959
	1980	894	158	225	53	1.330
Libya	1970	185	58	19	12	274
	1975	192	62	23	13	290
	1980	266	86	32	18	402
Morocco	1970	228	20	9	12	269
	1975	360	30	10	20	420
	1980	580	50	15	32	677
Tunisia	1970	130	58	6	9	203
	1975	277	80	9	18	384
	1980	455	105	13	28	601
UAR	1970	1.654	36	-	84	1.774
	1975	1.990	82	-	104	2.176
	1980	2.440	178	-	130	2.748
Sudan	1970	74	7	2	4	87
	1975	133	13	3	7	156
	1980	221	32	5	13	271

In Morocco, production capacity for bricks and tiles was assessed at about 135,000 tons per year, and production at 110,000 tons. This represented a value of $1,32 million, and the labour force employed numbered 1,400 persons. Production by local craftsmen is assessed at $480,000, with those employed numbering 3,000 persons. This represents a production of 40,000 tons per year, and production capacity of approximately 50,000 tons. The total production capacity of Morocco may be evaluated at 185,000 tons per year.

In Tunisia, present capdcity, with the brickworks that are in process of construction, amounts to about 215,000 tons per year.

In Libya and Sudan, the only form of production that exists at present is handicraft production, and there are no statistics enabling us to evaluate its level. At Ondurman, in Sudan, a bricworks with a capacity of 15 million bricks - in other words, 45,000 tons of bricks and 8,000 tons of drains per year, totalling 53,000 tons - is in process of construction. The investment involved amounts to £225,000, or about $646,000, and there will be twenty-six persons employed.

Note: Production of 53,000 tons per year with twenty-six persons employed represents productivity of 2,040 tons per worker. More modern enterprises will attain still higher productivity: the Wienerberger brickworks in Austria, for instance, produces 3,100 tons per year per worker, and the Biland brickworks in Yorkshire 1,500 tons per year[1] per worker, and so on. In view of the conditions prevailing in North Africa, however, productivity of 2,000 tons per year per worker must be deemed high, and new brickworks should be constructed in which productivity will not exceed 800 to 1,000 tons per year per worker.

With these plants under construction, the requirements in new capacity are as follows:

1/ This figure appears to be incorrect

TABLE 11

Required new brickworks capacity in North Africa

in 1000s of tons

		Brick and tile requirements	Existing capacity	New capacity required
Algeria	1970	610	-	-
	1975	960	725	235
	1980	1.330	-	605
Libya	1970	270	-	250
	1975	290	20	270
	1980	400	-	380
Morocco	1970	270	-	85
	1975	420	185	235
	1980	680	-	495
Tunisia	1970	200	-	-
	1975	380	215	165
	1980	600	-	385
Sudan	1970	90	-	30
	1975	160	60	100
	1980	270	-	210
UAR	1970	1.780	-	1.780
	1975	2.180	-	2.180
	1980	2.750	-	2.750

8. Inputs and proposals for new brickworks

In the manufacture of bricks, tiles and related products, it is necessary to consider the question of raw materials, fuel, energy, workers and investment, as well as other factors. As far as raw

materials are concerned, it may be noted that deposits are to be found in virtually all the countries. In the United Arab Republic, after completion of the High Dam, brick production by local craftsmen will be progressively reduced; and a start will have to be made with using clays of different origin such as, for example, clay from Aswan and clay from the sea etc... which resources are at present in process of being investigated. In Map N° 1,[1/] where both existing and abandoned brickworks are shown, it may be seen that relatively widespread clay deposits exist, especially in the Maghrib countries.

In future, reliance will have to be placed on fuel oil and natural gas as the fuels to be used in brick and tile manufacture. It may be reckoned that, by 1980, approximately 75 per cent of production will be carried out using fuel oil, 20 per cent using natural gas and 5 per cent using other types of fuel. The calorific value of fuel oil is 9,500 kcal/kg.; that of natural gas 10,000 kcal/cu.m.; and that of other fuels 5,000 kcal/kg. Fuel requirements may be estimated at 550,000 kcal. per ton of burnt products, that is, 60 kgs. of fuel oil per ton, or 55 cu.m. of natural gas per ton.

It is necessary to reckon with the following minimum energy requirements:

Preparation and manufacture	18 kwh/ton of burnt products
Drying	6 " " " " "
Burning and miscellaneous	8 " " " " "
Total:	32 kwh/ton of burnt products

At present, average productivity is as follows. In Algeria, 3,522 workers account for a production of 440,000 tons, which is

1/ This Map is missing

the equivalent of 125 tons per year per worker. In Morocco, 600 workers account for a production of 110,000 tons per year, which amounts to 183 tons per year per worker. At the new brickworks of the Union Générale in Tunisia, with an initial capacity of 90,000 tons per year and a final capacity of 140,000 tons per year, the labour force amounts to 205 workers, which represents productivity of 440 to 692 tons per year per worker. In order to establish levels of productivity, it is necessary first of all to determine the dimensions of the brickworks, as productivity depends upon those dimensions.

In Algeria, four brickworks, each with a capacity of 140,000 tons per year, and an additional plant to produce 40,000 tons annually, may be proposed in order to provide an ultimate capacity of 600,000 tons per year. In Libya, to attain a final capacity of 380,000 tons per year, the proposal is for three brickworks with a capacity of 80,000 tons per year, one with a capacity of 140,000 tons and three with capacities of 40,000 tons. In Tunisia, to attain a capacity of 390,000 tons per year, five brickworks each producing 80,000 tons annually are proposed. In Sudan, five brickworks producing 40,000 tons per year each will bring final capacity to 210,000 tons per year. In the United Arab Republic, twenty brickworks, each with a capacity of 140,000 tons per year, are proposed in order to attain final capacity of 2,750,000 tons per year. These proposals are naturally not absolutely precise, as it is impossible to specify a project in exact detail without studying raw material deposits, location of plants and other necessary data. At the presen time, it is only possible to give approximately the main specifications of the plants; and this is the aim as regards proposed capacities and other indicators. We have chosen relatively large-scale capacities, as it is easier to effect economies in large modern plants; and it is necessary for the brickworks to effect such economies in order to compete with plants producing other building

materials. It may be noted that in the North African countries there already exist a number of enterprises of small capacity, ranging from 2,000 to 40,000 tons per year. Finally, the example of Tunisia shows us how to attain our ends. In Tunisia, brickworks have been constructed with capacities of 60,000, 90,000 and 140,000 tons, whereas in Morocco and in Algeria the plants have a maximum capacity of 40,000 tons per year. Tunisia is the only country in which an uninterrupted increase in brick consumption, with a growth rate of 8.6 per cent per year in the period 1960-1965 may be noted, whereas in Algeria a decline from 490,000 to 320,000 tons may be observed. Morocco likewise experienced a reduction from 116,000 to 96,000 tons in the same period. The uninterrupted development of brick consumption is, inter alia, occasioned by modernization of the brick industry and by the erection of modern plants with large-scale capacity, because greater capacity renders brickworks more economic.

Productivity

With the following scales of capacity at the proposed plants, future productivity may be estimated as follows:

Capacity	(1000 tons per year)	40	80	140/15
Productivity	(tons per year per worker)	410	500	580

Investment

In Tunisia, a brickworks having a capacity of 140,000 tons per year was completed on the basis of an investment amounting to two million Tunisian dinars, the equivalent of $3.8 million. This represents a unit investment of $27/ton. In West Africa, unit investment lay between $24/ton and $35/ton. For North Africa, a unit investment scale can be specified as follows:

Capacity	(1000 tons per year)	40	80	140
Investment	($/ton capacity)	32	28	26

Amortization in brickworks is of the order of 7.5 to 8 per cent. When brickworks are highly mechanized, maintenance accounts for approximately 3.5 per cent. To establish the main economic features involved in manufacture, the interest on capital employed, amounting to some 3.5 per cent, must be added.

The cost of fuel varies widely as between the North African countries. The world price of fuel oil is approximately $14/ton. At present, fuel oil costing $26.7/ton is being used in Tunisia. For the purposes of our calculations, we must reckon with the following prices based on the foreign trade statistics:

Algeria	$25.5/ton
Libya	$15.5/ton
Morocco	$18.8/ton
Tunisia	$26.7/ton
Sudan	$18.2/ton
UAR	$16.0/ton

In future, lower prices not exceeding $16/ton must be reckoned with. The cost of electricity has been determined, according to a United Nations document entitled "Report of the Industrial Mission to Algeria, Libya, Morocco and Tunisia", on the following basis for consumers with a maximum consumption of the order of 49 MWh:

Algeria	17.20 centimes NF/kWh or	$34.4/1000 kWh.
Morocco	20.80 centimes NF/kWh or	$41.6/1000 kWh.
Tunisia	18.10 centimes NF/kWh or	$36.2/1000 kWh.
Libya		$40.0/1000 kWh estimated
Sudan		$50.0/1000 kWh "
UAR		$35.0/1000 kWh "

9. The main economic features of the new brickworks

Having established these indicators, we are able to calculate the main economic features of the brickworks as shown below (in Tables 12 and 13)

TABLE 12

Analysis of production costs exclusive of charges

Capacity	(1000 tons per year)	40	80	140
Unit investment	($/ton)	32	28	26
Numbers employed:	total	97	160	240
of whom:	managerial staff	2	2	2
	- technical staff	6	8	10
	- foremen and overseers	8	10	11
	- employees	7	9	10
	- workers	52	104	173
	- other staff	22	27	34
Productivity	(tons/year per capita)	410	500	580
Per capita wages and salaries:				
- managerial staff	($/year per capita)	5,000	5,100	5,150
- technical staff	" " "	3,600	3,700	3,750
- foremen & overseers	" " "	2,700	2,800	2,850
- employees	" " "	1,800	1,840	1,860
- workers	" " "	1,100	1,120	1,130
- other staff	" " "	550	560	565
- all wage & salary earners	" " "	1,390	1,350	1,300
Wages and salaries: total	($1000/year)	135.1	216.0	312.5
Investment: total	($1000)	1,280	2,240	3,640
Fuel	(tons/year)	2,400	4,800	8,400
Electricity	(1000 kWh/year)	1,280	2,560	4,480
Amortization (8% of investment)	($1000)	102.4	179.2	291.2
Maintenance (3.5% of investment)		44.8	78.4	127.4
Interest (3% of investment)		38.4	67.2	109.2
Insurance & miscellaneous (1% of invest.)		12.8	22.4	36.5
Charges and holidays (10% of wages and salaries)		13.5	21.6	31.3
Gross profit (14% of investment)		179.2	313.6	509.6

TABLE 13

Analysis of the manufacturing costs of bricks, tiles and related products in North Africa

(turnover excluding charges)

		Algeria	Libya	Morocco	Tunisia	UAR	Sudan	Maghrib	UAR & Sudan	Sub-region
Proposed brickworks	No.x capacity	4x140 1x 40	1x140 3x 80	1x140 3x 80 3x 40	5x 80	20x140	5x 40	6x140 11x 80 4x 40	20x140 5x 40	26x140 11x 80 9x 40
New capacity	1000 tons per year	600	380	500	400	2.800	200	1.880	3.000	4.880
Investment	$1000	15.840	10.360	14.200	11.200	72.800	6.400	51.600	79.200	130.800
Wages & sal.	"	1.385	961	1.366	1.080	6.250	676	4.792	6.926	11.718
Charges and holidays	"	139	96	137	108	625	68	480	693	1.173
Amortization	"	1.267	829	1.136	896	5.824	512	4.128	6.336	10.464
Maintenance	"	554	363	967	392	2.548	224	2.276	2.772	3.924
Interest	"	475	311	426	336	2.184	192	1.548	2.376	3.924
Insurance and miscellaneous	"	158	104	142	112	728	64	516	792	1.308
Fuel	"	918	353	564	641	2.688	218	2.476	2.906	5.382
Electricity	"	661	486	666	463	3.136	320	2.276	3.456	5.732
Gross profit	"	2.218	1.450	1.988	1.568	10.192	896	7.224	11.088	18.312
Gross turnover	"	7.775	4.953	7.392	5.596	34.175	3.170	25.716	37.345	63.061
Value added	"	5.009	3.336	4.627	3.652	22.891	2.152	16.624	25.043	41.667
Value added	percentage	64.4	67.3	62.5	65.2	67.0	67.9	64.6	67.1	66.1
Cost of single brick	$ per ton	13.0	13.0	14.8	14.0	12.2	15.9	13.7	12.5	12.9

10. Summary and conclusions

In this report, the consumption and manufacture of bricks, tiles and other related products in North Africa have been studied. As far as these products are concerned, we may conclude that foreign trade plays no essential part and involves only insignificant quantities. The entire production is consumed locally. Nevertheless, it must not be inferred that all the North African countries are self-sufficient in burnt clay products. An unrequited demand most certainly exists. It will be expedient to assess that demand in order to develop the industries producing cement and clay materials, so that they may become complementary, thus meeting the requirements of the construction sector.

In this report, an attempt has been made to find a method of projecting future demand up to 1980; and the results of that projection enable us to put forward proposals for development of the brick industry. As an approximate initial estimate, we must envisage construction of the following brickworks:

In Algeria:	Four plants with a capacity of 140,000 tons per year, and one plant with a capacity of 40,000 tons per year;
In Libya:	Three plants with a capacity of 80,000 tons per year, and one with a capacity of 140,000 tons per year;
In Morocco:	One plant with a capacity of 140,000 tons per year; three plants with a capacity of 80,000 tons per year; and three with a capacity of 40,000 tons per year;
In Tunisia:	Five plants, each with a capacity of 80,000 tons per year;
In Sudan:	Five plants, each with a capacity of 40,000 tons per year;
In the United Arab Republic:	Twenty plants, each with a capacity of 140,000 tons per year.

These proposals represent only an initial approximate estimate for assessment of the main economic features of brick manufacture in the future.

The aggregated figures relating to these new plants may be found in Table 14, and they demonstrate that the brick industry in North Africa has good future prospects.

TABLE 14

Projection of brickworks in North Africa by country up to 1980

	Existing capacity in 1965 in tons/year	Total capacity in 1980 in tons/year	Proposed new capacity in 1980 in tons/year	The proposed new brickworks				
				Number & capacity of new brickworks in tons/year	Numbers employed	Investment in $1000	Gross turnover in $1000a/	Value added in $1000
Algeria	725.000	1.325.000	600.000	4 x 140.000 1 x 40.000	1.055	15.840	7.775	5.009
Libya	20.000[1]	400.000	380.000	1 x 140.000 3 x 80.000	720	10.360	4.953	3.336
Morocco	175.000[2]	675.000	500.000	1 x 140.000 3 x 80.000 3 x 40.000	1.010	14.200	7.392	4.627
Tunisia	215.000	615.000	400.000	5 x 80.000	800	11.200	5.596	3.652
Sudan	45.000[3]	245.000	200.000	5 x 40.000	485	6.400	3.170	2.152
UAR	4.000.000[1]	3.800.000[4]	2.800.000	20 x 140.000	4.800	72.800	34.175	22.891
Maghrib	1.135.000	3.015.000	1.880.000		8.870	51.600	25.716	16.624
UAR + Sudan	4.045.000	4.045.000	3.000.000			79.200	37.345	25.043
Sub-region	5.180.000	7.060.000	4.880.000			130.800	63.061	41.667

a/ excluding charges

1/ handicraft production only

2/ handicraft production of 40,000 tons included

3/ handicraft production not included

4/ handicraft production in the UAR will be decreasing

ANNEX I

TABLE 1

Industrial bricks, tiles and related products - production, foreign trade and consumption in North Africa (in metric tons)

		ALGERIA		LIBYA		MOROCCO	TUNISIA	UNITED ARAB REPUBLIC			SUDAN	
		Bricks (tons)	Tiles (tons)	Bricks (tons)	Tiles (tons)	Bricks tiles Hollow ceiling tiles	Bricks Hollow ceiling tiles	Tiles (tons)	Bricks (tons)	Drains (tons)	(tons)	
Production	1960	489.216	66.135	-	-	119.000	78.576	1.827	2.800.000	15.000	-	-
	1961	486.131	78.867	-	-	124.000	84.259	1.786	2.566.000	16.000	-	-
	1962	143.395	43.875	-	-	134.000	90.048	2.282	2.625.000	21.000	-	-
	1963	194.093	64.957	-	-	138.000	99.484	3.254	3.318.000	22.000	-	-
	1964	274.487	103.897	-	-	115.192	105.411	3.008 1/	3.605.000	23.000	-	-
	1965	320.281	119.271	-	-	95.805	113.443 1/	3.405 1/	3.973.000	23.000	-	-
Imports	1960	1.300 1/	30.000 1/	NA	NA	45	-	3	-	-	-	-
	1961	1.343	32.659	NA	NA	4	-	-	21	-	-	-
	1962	800 1/	12.000 1/	NA	NA	30	-	3	-	-	-	-
	1963	110	12.593	NA	NA	9	-	-	-	-	69	14
	1964	... 1/	12.000 1/	32.647	7.453	12	46	47	-	-	166	1
	1965	... 1/	12.000	51.492	2.082	5	115	4	-	-	-	-
Exports	1960	NA	NA	-	-	2.661	-	-	82	-	-	-
	1961	...	-	-	-	3.533	-	60	107	-	-	-
	1962	NA	NA	-	-	258	-	-	-	-	-	-
	1963	-	-	-	-	-	-	-	-	-	-	-
	1964	NA	NA	-	-	-	320	94	-	-	-	-
	1965	NA	NA	-	-	-	1.897	180	-	-	-	-
Consumption	1960	490.516	96.135	-	-	116.456	78.576	1.830	2.800.000	15.000	-	-
	1961	497.474	111.526	-	-	120.460	84.259	1.726	2.566.000	16.000	-	-
	1962	144.195	55.875	-	-	133.772	90.048	2.285	2.625.000	21.000	-	-
	1963	194.203	77.550	-	-	137.973	99.484	3.254	3.318.000	22.000	69	14
	1964	274.487	115.897	32.647	7.453	115.221	105.342	2.961 1/	3.605.000	23.000	166	1
	1965	320.281	131.271	51.492	2.082	95.809	111.661 1/	3.229 1/	3.973.000	23.000	-	-

1/ estimated

Source: Nationsal statistics

ANNEX I (contd)

TABLE 2

Production of industrial bricks, tiles and related products in North Africa

	ALGERIA		LIBYA	MOROCCO	TUNISIA	UNITED ARAB REPUBLIC			SUDAN
	Bricks tons	Tiles 1000 pcs. tons	Handi-craft produc-tion only	Bricks, tiles, hollow ceiling tiles tons	hollow ceiling tiles, bricks 1000 pcs. tons	Tiles 1000 pcs.	Bricks 10^6 pcs.	Drains 1000 tons	Handi-craft produc-tion only
Production									
1960	489.216	26.453 66.135	-- --	119.000	4.247 32.252	571	800	15	-- --
1961	486.131	31.546 78.867	-- --	124.000	4.564 33.776	558	733	16	-- --
1962	143.395	17.550 43.875	-- --	134.000	5.056 33.337	713	750	21	-- --
1963	194.093	25.982 64.957	-- --	138.000	6.170 29.134	1.017	948	22	-- --
1964	274.487	41.558 103.897	-- --	115.192	5.797 36.712	940	1.030	23	-- --
1965	320.281	47.708 119.271	-- --	95.805	--	--	1.135	23	-- --
Source: national statistics									
	Tons	tons		tons	tons	tons	tons	tons	
1960	489.216	66.135	-- --	119.000	78.576	1.827	2.800.000	15.000	-- --
1961	486.131	78.867	-- --	124.000	84.259	1.786	2.566.000	16.000	-- --
1962	143.395	43.875	-- --	134.000	90.048	2.282	2.625.000	21.000	-- --
1963	194.093	64.957	-- --	138.000	99.484	3.254	3.318.000	22.000	-- --
1964	274.093	103.897	-- --	115.192	105.411	3.008	3.605.000	23.000	-- --
1965	320.281	119.271	-- --	95.805	--	--	3.973.000	23.000	-- --

A N N E X II

Brick and tileworks in Algeria

ORAN REGION		Bricks 1965		Tiles 1965		
		Capacity	Production	Capacity	Production	Numbers employed
1. Modern brickworks at Saf-saf	Tlemcen	6,000	4,785			35
2. Leonis	Sidi Bel Abbas	8,000	3,546	2,000	1.647	40
3. SABO	Mers el Kebir	40,000	19,025	15,000	14,398	210
4. Andreoli	Mers el Kebir	12,000	4,982	12,000	9,119	85
5. Grosjean	Noisy les Bains	12,000	2,747	3,000	1,713	50
6. Arbal brickworks	Oran	9,000	2,300			22
7. Chenine Bachir	Mostaganem	12,000	4,768	2,000	1,043	72
8. Ammi Mokhtar	Tlemcen	25,000	11,430	10,000	1,360	75
9. Hacine brickworks	Mascara	8,000	4,002	4,000	1,421	36
10. Emir Abdelkader Cooperative.	Sidi Bel Abbas	12.000	2,078			-
11. SCCC	Arzew	10,000				
12. Ivanez Bich	Arzew	8,000				-
13. Brituser	Tiaret					-
14. Senam	Colomb Béchar					-
					Total:	625

A N N E X II (contd.)

Brickworks and tileworks in Algeria

CONSTANTINE REGION		Bricks 1965		Tiles 1965		
		Capacity	Production	Capacity	Production	Numbers employed
15. Sonena	Constantine	14,000	7,981	6,000	6,184	123
16. Tulestal	Bougie	2,000	560	12,000	11,811	118
17. Socalfuc	Algiers	16,000	3,665			73
18. Oued Ghir and St.Louis	Bougie	17,000	12,948	3,000	3,124	165
19. Beltramelli	Batna	2,000	556	500	58	15
20. Messaoudi	Satif	2,000	90	500	18	9
21. Hamrouche Hamoudi	Skikda	12,000	7,980	1,500	1,210	100
22. Ex Yacond	Annaba	6,000	1,956			19
23. Sablettes brickworks	"	6,000	1,412			20
24. Hippone (Bône) brickworks	"	6,000	1,457			19
25. Boudjenah	"					-
					Total:	661

ANNEX II (concd.)

Brickworks and tileworks in Algeria

ALGIERS REGION		Bricks 1965		Tiles 1965		
		Capacity	Production	Capacity	Production	Numbers employed
26. Coste	Baraki	10,000	2,866	5,000	4,850	80
27. Bri-Tui du Gué de Constantine	Kouba	8,000	6,817	8,000	9,083	155
28. Torelli	El Harrach	10,000	8,782	2,000	1,168	70
29. Bri de l'Oued Boutan	El Khamis	6,000	3,604	5,000	4,611	102
30. Sipcan	Tizi Ouzou	10,000	5,438	2,000	329	40
31. Senam	Reghata	12,000	3,755	8,000	3,418	65
32. Altairac	El Harrach	35,000	21.485	20,000	17,893	435
33. Botella Bri du Parc	"	8,000	8,502	2,000	1,140	75
34. Rivet brickworks	Rivet	12,000	9,766	4,600	1,061	49
35. En-Nasr brickworks	Rouiba	9,000	6,369	4,500	5,206	84
36. Sayah Benali brickworks	El Khemis	10,000	8,648	5,000	5,016	129
37. Tahraoui Ben Mira	" "	10,000	6,343	5,000	6,042	120
38. Derradji Omar	Rouiba	18,000	11,018	4,500	4,414	103
39. Sahel	El Biar			12,000	-	-
40. Loumi Ahmed brickworks	Baba Ali	14,500	7,430			63
41. Bouzegza Bx Mas	Alma	18,000	17,371			93
42. Colonel Amirouche Bx Snab	"	25,000	15,571			62
43. L'Emir Abdelkader	Rouiba	15,000	10,072			55
44. La Mitidja brickworks	Boufarik	12,000	5,447			35
45. Boulouh ex Beryl	Kouba	15,000	11,347			62

ANNEX II (contd)

Brickworks and tileworks in Algeria

ALGIERS REGION (contd.)		Bricks 1965		Tiles 1965		
		Capacity	Production	Capacity	Production	Numbers employed
46. Brickworks de la Gare ex Torelli	Alma	20,000	19,438			74
47. Algérienne et Populaire brickworks	Mazafran-Koléa	8,500	8,527			55
48. Douadi Ahmed brickworks	Koléa	8,000	6,472			43
49. L'Oued Smar brickworks	El Harrach	10,000	10,856			47
50. Kolla	El Attaf-El Asnam	6,500	1,738			46
51. Hadjout Ould Hacine Rmah brickworks	Hadjout		2,058			20
52. Ouest Mitidja	"					-
53. Ex-Salhi	Tizi Ouzou	7,000	4,470			64

ANNEXE II (contd.)

The ceramics industry in Morocco

1.	Les Produits Céramiques du Maroc (Aïn-Sebaa brickworks and tileworks)	Aïn-Sebaa
2.	Fedala brickworks and tileworks	Mohammedia
3.	Société Briqueterie Tuilerie Nord-Africaine	B.Rabat - B.Oujda - U. Oujda
4.	Cago brickworks	Salé
5.	Salé potteries (J. Laurent)	Salé
6.	Sebou brickworks (A. Maurand)	Kénitra
7.	Etablissements du Maghreb (E.J. Satge)	Meknès
8.	Tuiles, briques et céramiques de Fès	Fès
9.	Ben-Slimane brickworks and tileworks	Ben-Slimane
10.	Société Tuileries et Briqueteries de Marrakech	Marrakech
11.	Ceramica Tanger	Tangier
12.	Sociedad Urbanizadora del Norte de Africa	Tetuan
13.	Ceramica Moderna "Cemosa"	Tetuan
14.	Manuel Dessa Saez	Nador
15.	Juan Marin Fernandez	Nador

ANNEX III
TABLE 1

Basic figures for the projection of construction and consumption of building materials in North Africa

	ALGERIA				LIBYA				MOROCCO			
	1964	1970	1975	1980	1964	1970	1975	1980	1964	1970	1975	1980
1. Total population (in millions)	11.3	13.7	15.9	18.3	1.6	1.9	2.2	2.5	12.6	15.0	17.3	20.0
2. Gross Domestic Product (in $ millions)	2.170	2.950	3.760	4.910	940	2.160	3.000	4.200	2.270	2.870	3.660	4.900
3. GDP per capita (in $)	192	215	236	268	590	1.135	1.365	1.680	180	191	212	245
4. GDFCF[1/]	281	440	710	1.130	333	540	640	840	270	520	810	1.270
5. Percentage of construction in GDFCF	45	45	50	55	29	55	57	60	63	62	60	5
6. Percentage of dwelling houses in GDFCF	12	12	14	15	11	21	21	22	14	13	12	12
7. Percentage of buildings other than dwelling houses in GDFCF	11	11	13	14	6	11	12	13	11	13	15	16
8. Percentage of other construction and work in GDFCF	22	22	23	26	12	23	24	25	38	36	33	30
9. Investment in construction (in$ millions)	127	198	355	622	97	297	365	504	170	322	486	737
10. Investment in dwelling-houses (in $ millions)	34	53	100	170	37	113	134	185	37	67	97	153
11. Investment in buildings other than dwelling-houses (in $ millions)	31	48	92	158	20	59	77	109	30	69	121	203
12. Investment in other construction and work (in $ millions)	62	97	163	294	40	125	154	210	103	188	268	381

Source: " The Construction Industry in the Development Programmes of North Africa", and "ECA Study on Industrialization and Economic Cooperation for North Africa".

1/ Gross Domestic Fixed Capitation Formation

TABLE 1 (contd.)

	TUNISIA				U.A.R.				SUDAN			
	1964	1970	1975	1980	1964	1970	1975	1980	1964	1970	1975	1980
1. Total population (in millions)	4.3	5.1	5.9	6.8	12.5	15.4	17.9	20.7	28.4	33.3	38.0	43.3
2. Groos Domestic Product (in $ millions)	820	1.140	1.550	2.150	1.170	1.540	1.970	2.640	4.340	5.980	8.010	11.230
3. GDP per capita (in $)	190	224	263	316	94	100	110	128	153	180	210	260
4. GDFCF[1/]	160	270	420	620	150	230	370	610	740	1.140	1.720	2.810
5. Percentage of construction in GDFCF	64	68	66	64	63	63	63	63	63	63	63	63
6. Percentage of dwelling houses in GDFCF	14.5	13	13	13	10	10	15	15				
7. Percentage of build. other than dwelling *	20	20	20	20	23	23	22	22				
8. Percentage of other construction and work in GDFCF	29.5	35	33	31	30	30	26	26				
9. Investment in construction (in $ millions)	102	184	277	397	95	145	233	384	466	720	1.100	1.770
10. Investment in dwelling-houses (in $ millions)	23	35	55	81	15	23	56	92				
11. Investment in buildings other than dwelling-houses (in $ millions)	32	54	84	124	35	53	81	134				
12. Investment in other construction and work (in $ millions)	47	95	138	192	45	69	96	159				

* houses in GDFCF

Source: " The Construction Industry in the Development Programmes of North Africa", and "ECA Study on Industrialization and Economic Cooperation for North Africa".

1/ Groos Domestic Fixed Capitation Formation

ANNEX III

Evaluation of brick consumption by various countries of the world

AUSTRIA	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	196
Construction (in $ millions)	256,9	429,4	475,4	521,4	544,4	601,9	686,3	789,8	797,5	881,8	1.012
Consumption of single bricks (in millions)	471	799			804	873	940	1.016	991	1.006	
Consumption of single bricks per $1000 invested in construction	1.832	1.862			1.477	1.450	1.370	1.286	1.241	1.140	
Brick consumption as a percentage of base year 1953	1,00	1,02			0,81	0,79	0,75	0,70	0,68	0,62	
Index of construction costs compared with costs for base year 1953	100	107			121		131	139	143	152	
Index 4 multiplied by index 5	100	109			98		98	97	97	94	
BELGIUM											
Construction (in $ millions)	748	858	976	1,028	966	1.096	1.224	1.376	1.412	1.476	1.81
Consumption of single bricks (in millions)	2.212	2.433			2.210	2.155	2.250	2.349	2.057	2.100	2.10
Consumption of single bricks per $1000 invested in construction	2.957	2.835			2.287	1.966	1.838	1.707	1.456	1.423	
Brick consumption as a percentage of base year 1953	1,00	0,96			77	67	62	58	49	50	
Index of construction costs compared with costs for base year 1953	100	97			110						
Index 4 multiplied by index 5	100	93			85						

	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	196
FINLAND											
Construction (in $ millions)		517	579	616	670	707	790	898	944	1,037	1.124
Consumption of single bricks (in millions)		189			152	132	130	144	161	167	
Consumption of single bricks per $1000 invested in construction		365			226	186	164	160	170	161	
Brick consumption as a percentage of base year 1953		1,00			0,62	0,51	0,45	0,44	0,47	0,44	
Index of construction costs compared with costs for base year 1953	100	102			116		121	127	131	139	
Index 4 multiplied by index 5		102			72		55	56	62	61	
FRANCE											
Construction (in $ millions)	2.632	3.148	3.664	4.413	5.061	5.810	6.134	6.923	7.794	8.887	10.567
Consumption of single bricks (in millions)	1.565	2.048			2.072	2.044	2.040	2.090	2.251	2.447	
Consumption of single bricks per $ 1000 invested in construction	594	650			409	351	332	301	288	275	
Brick consumption as a percentage of base year 1953	1,00	1,09			0,69	0,59	0,56	0,51	0,48	0,46	
Index of construction costs compared with costs for base year 1953	100	100			139		142	145	152	167	
Index 4 multiplied by index 5	100	109			96		80	74	73	77	

	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
FEDERAL REPUBLIC OF GERMANY											
Construction (in $ millions)	3.500	4.775	5.375	5.700	6.200	7.400	8.750	10.000	11.350	12.350	14.400
Consumption of single bricks (in millions)	5.082	5.812			5.409	6.114	6.222	6.223	6.326	5.929	
Consumption of single bricks per $1000 invested in construction	1.452	1.217			872	826	711	622	557	480	
Brick construction as a percentage of base year 1953	1,00	0,84			0,60	0,57	0,49	0,43	0,38	0,33	
Index of construction costs compared with costs for base year 1953	100	108			116		131	141	154	163	
Index 4 multiplied by index 5	100	91			70		64	61	59	54	
ITALY											
Construction (in $ millions)	2.152	2.678	2.806	3.142	3.382	3.760	3.994	4.253	4.600	4.838	4.838
Consumption of single bricks (in millions)	2.008	2.801			3.344	3.579	3.580	3.992	2.328		
Consumption of single bricks per $1000 invested in construction	933	1.045			988	951	896	938	506		
Brick construction as a percentage of base year 1953	1,00	1,12			1,06	1,02	0,96	1,01	0,54		
Index of construction costs compared with costs for base year 1953	100	105			113		114	117	130	143	
Index 4 multiplied by index 5	100	118			120		109	118	70		

	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
NETHERLANDS											
Construction(in $ millions)	764	892	1.047	1.193	1.164	1.269	1.357	1.460	1.545	1.707	2.266
Consumption of single bricks (in millions)	1.336	1.439			1.517	1.542	1.615	1.578	1.582	1.596	
Consumption of single bricks per $1000 invested in construction	1.748	1.613			1.303	1.215	1.190	1.080	1.023	934	
Brick consumption as a percentage of base year 1953	1,00	0,92			0,75	0,70	0,68	0,62	0,59	0,53	
Index of construction costs compared with costs for base year 1953	100	116			140		140	143	153	163	
Index 4 multiplied by index 5	100	107			105		95	89	90	86	
NORWAY											
Construction(in $ millions)	445	480	492	558	573	597	629	686	770	690	898
Consumption of single bricks (in millions)	101	109			84	86	91	93	98	92	93
Consumption of single bricks per $1000 invested in construction)	226	227			146	144	144	135	127	133	104
Brick consumption as a percentage of base year 1953	1,00	1,00			0,65	0,64	0,64	0,60	0,55	0,59	
Index of construction costs compared with costs for base year 1953	100	105			114		124	130	136	140	
Index 4 multiplied by index 5	100	105			74		79	78	74	83	

	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
SWEDEN											
Construction(in $ millions)	984	1.144	1.237	1.325	1.454	1.617	1.753	1.917	2.103	2.406	2.730
Consumption of single bricks (in millions)	375	377			301	353	363	361	383	405	
Consumption of single bricks per $1000 invested in construction	381	329			207	218	207	188	182	168	
Brick consumption as a percentage of base year 1953	1,00	0,86			0,54	0,57	0,54	0,49	0,48	0,44	
Index of construction costs compared with costs for base year 1953	100	103			112		120	124	130	135	
Index 4 multiplied by index 5	100	89			61		65	61	62	59	
UNITED KINGDOM											
Construction(in $ millions)	3.413	3.858	4.239	4.446	4.522	4.892	5.471	6.166	6.670	6.961	8.436
Consumption of single bricks (in millions)	7.195	7.163			6.440	6.967	7.283	7.414	7.289	7.139	
Consumption of single bricks per $1000 invested in construction	2.108	1.856			1.424	1.424	1.331	1.202	1.092	1.025	
Brick consumption as a percentage of base year 1953	1,00	0,88			0,68	0,68	0,63	0,57	0,52	0,49	
Index of construction costs compared with costs for base year 1953	100	106			115		114	118	122	126	
Index 4 multiplied by index 5	100	93			78		72	67	63	62	

ANNEX III (contd.)

	1953	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
UNITED STATES											
Construction (in $ millions)	39.400	47.500	50.300	51.100	51.900	57.100	55.600	57.100	61.500	64.400	67.900
Consumption of single bricks (in millions)	5.874	7.902			6.489	7.336	6.943	6.682	6.886	7.427	
Consumption of single bricks per $1000 invested in construction	149	166			125	128	124	117	111	115	
Brick consumption as a percentage of base year 1953	1,00	1,11			0,84	0,86	0,83	0,79	0,75	0,77	
Index of construction costs compared with costs for base year 1953	100	102			110		115	116	118	120	
Index 4 multiplied by index 5	100	113			92		96	92	89	92	

ANNEX III

TABLE 3

Evaluation of cement and brick consumption in North Africa, by country

ALGERIA

Year	Construction ($ millions)	Population (1000)	Cement consumption (1000 tons)	Brick consumption (1000 tons)	Cement consumption (kgs. per capita)	Brick consumption (1000 pcs)	Brick consumption (pcs./per capita)	Cement (Kgs./ $1000)	Bricks (pcs. $1000)
1955	170,6	9.715	776	342	80,0	98	10,1	4.549	574
1956	193,8	-	777	329	78,0	94	95,0	4.009	485
1957	229,0	10.143	854	330	84,0	94	93,0	3.729	410
1958	360,2	10.390	1.129	380	109,0	109	10,5	3.134	302
1959	565,9	10.605	1.397	453	132,0	129	12,2	2.469	227
1960	682,4	10.784	1.585	490	147,0	140	13,0	2.323	205
1961	704,7	10.750	1.439	487	134,0	140	13,0	2.042	198
1962	441,0	10.710	755	144	71,0	41	3,8	1.712	92
1963	-	10.670	893	194	84,0	55	5,2	-	-
1964	127,0	10.975	585	274	53,0	78	7,1	4.606	614
1965	184,4	11.290	629	320	56,0	91	8,1	3.411	493
1970	198,0	13.700	960	430	67,9	123	9,0	4.848	621
1975	355,0	15.900	1.300	730	78,0	209	13,2	3.662	588
1980	622,0	18.300	1.800	1.050	92,9	300	16,4	2.894	482

ANNEX III (contd.)

TABLE 3

Evaluation of cement and brick consumption in North Africa, by country

TUNISIA

Year	Construction ($ millions)	Population (1000)	Cement consumption (1000 tons)	Brick consumption (1000 tons)	Cement consumption (Kgs. per capita)	Brick consumption (1000 pcs)	Brick consumption (Pcs./per capita)	Cement (Kgs./ $1000)	Bricks (pcs./ $1000)
1955		3.901	202		52,0				
1956			83		20,0				
1957		4;003	86		21,0				
1958		4:050	121		30,0				
1959		4:107	147		36,0				
1960	92,3	4:232	179	78	42,0	22	5,1	1,939	238
1961	109,8	4:310	222	84	52,0	24	5,6	2,021	218
1962	125,5	4:396	181	90	41,0	26	5,9	1,442	207
1963	142,8	4.494	284	100	63,0	29	6,5	1,988	203
1964	151,6	4.565	333	105	73,0	30	6,6	2.196	197
1965	183,0	4.675	429	112	92,0	32	6,8	2.344	174
1970	184,0	5.100	510	190	98,0	54	10,5	2.771	293
1975	277,0	5.900	730	360	122,0	103	17,5	2.635	371
1980	397,0	6.800	1.060	560	154,4	160	23,5	2.670	403

ANNEX III (contd.)

TABLE 3

Evaluation of cement and brick consumption in North Africa, by country

LIBYA

Year	Construction ($ millions)	Population (1000)	Cement consumption (1000 tons)	Brick consumption (1000 tons)	Cement consumption (Kgs./per capita)	Brick consumption (1000 pcs)	Brick consumption (pcs./per capita)	Cement (Kgs./ $1000)	Bricks (pcs./ $1000)
1955		1.129	50		45,0				
1956			51		46,0				
1957		1.210	60		50,0				
1958		1.255	74		59,0				
1959		1.301	97		75,0				
1960		1.349	141		105,0				
1961		1.399	157		112,0				
1962		1.451	241		166,0				
1963		1.504	288		191,0				
1964	97	1.559	329	50	211,0	14	9,0	3.391	144
1965		1.617	473	67	293,0	19	11,7		
1970	297	1.900	860	240	394,7	69	36,3	2.895	232
1975	365	2.200	1.200	255	477,3	73	33,2	3.287	200
1980	504	2.500	1.610	350	560,0	100	40,0	3.194	198

ANNEX III (contd.)

TABLE 3

Evaluation of cement and brick consumption in North Africa, by country

SUDAN

Year	Construction ($ millions)	Population (1000)	Cement consumption (1000 tons)	Brick consumption (1000 tons)	Cement consumption (Kgs./per capita)	Brick consumption (1000 pcs)	Brick consumption (pcs./per capita)	Cement (Kgs./ $1000)	Bricks (pcs./ $1000)
1955	41,3	10.500	66		6,0			1.598	
1956	52,0		57		5,0			1.096	
1957	75,0	10.834	122		11,0			1.626	
1958	69,5	11.146	103		9,0			1.482	
1959	66,6	11.756	109		9,0			1.636	
1960	76,9	11.770	146		12,0			1.898	
1961	92,2	12.109	155		13,0			1.681	
1962	125,5	12.470	295		24,0			2.350	
1963		12.831	37	56	30,0	16	1,3		
1964	95,0	13.180	427	60	32,0	17	1,3	4.494	
1965		13.540	132		10,0				
1970	145,0	15.400	400	80	29,9	23	1,5	2.758	158
1975	233,0	17.900	540	150	35,8	43	2,4	2.403	185
1980	384,0	20.700	850	250	48,3	71	3,4	2.313	185

ANNEX III (contd.)

TABLE 3

Evaluation of cement and brick consumption in North Africa, by country

MOROCCO

Year	Construction ($ millions	Population (1000)	Cement consumption (1000 tons)	Brick consumption (1000 tons)	Cement consumption (Kgs./per capita)	Brick consumption (1000 pcs)	Brick consumption (pcs./per capita)	Cement (Kgs./ $1000)	Bricks (pcs./ $1.000
1955	112,6	10.113	762	216	75,0	62	6,1	6.767	550
1956	102,8		602	120	61,0	34	3,3	5.856	330
1957	90,9	10.688	431	100	40,0	29	2,7	4.741	319
1958	96,8	10.987	504	98	46,0	28	2,5	5.206	289
1959	104,7	11.350	499	109	44,0	31	2,7	4.765	296
1960	110,7	11.626	550	116	47,0	33	2,8	4.968	298
1961	128,4	12.030	614	120	51,0	34	2,8	4.781	264
1962	144,3	12.360	684	134	55,0	38	3,1	4.740	263
1963	161,0	12.665	772	138	61,0	39	3,1	4.795	242
1964	170,0	12.959	906	115	70,0	33	2,5	5.329	194
1965	171,9	13.323	762	96	57,0	27	2,0	4.432	157
1970	322,0	15.000	1.040	250	71,3	71	4,7	3.229	220
1975	486,0	17.300	1.400	390	83,2	111	6,4	2.880	228
1980	737,0	20.000	2.000	630	102,0	180	9,0	2.713	244

A N N E X III

TABLE 4

Projection of construction and of the consumption of bricks, tiles and related products in North Africa up to 1980

	ALGERIA				LIBYA			
	1964	1970	1975	1980	1964	1970	1975	1980
Investment in construction ($ millions)	127	198	355	622	97	297	365	504
Invest. in const. of buildings ($ m.)	56	101	192	328	57	172	211	294
Ditto, less 30% for services and amenities ($ m.)	59	71	134	230	40	120	148	206
Dwelling houses ($ m.)	20	37	70	119	26	79	94	130
Industrial buildings ($ m.)	8	14	26	45	6	16	22	31
Buildings for education & health purposes ($ m.)	7	13	25	44	5	16	21	30
Other build.($ m.)	4	7	13	22	3	9	11	15
Floor area (m.sq.m)	0,661	1,208	2,273	3,900	0,694	2,064	2,548	3,550
Roofing " (" ")	0,595	1,087	2,046	3,510	0,625	1,857	2,293	3,195
ceiling " (" ")	0,562	1,027	1,932	3,315	0,590	1,754	2,166	3,018
Volume of walls of dwelling-houses (m.cu.m.)	0,146	0,270	0,506	0,854	0,190	0,573	0,682	0,945
Ditto of ind.buid .	0,042	0,074	0,137	0,238	0,032	0,084	0,116	0,164
Ditto of Build.for educ.purp.	0,029	0,053	0,104	0,182	0,020	0,066	0,087	0,124
Ditto other build.	0,009	0,016	0,030	0,051	0,007	0,021	0,025	0,035
Ditto - total	0,226	0,413	0,774	1,325	0,249	0,744	0,912	1,268
% of brick walls	54	50	48	45	10	10	15	15
% of tiled roofs	80	70	70	65	25	25	25	25
% of ceilings of hollow ceil.tiles	60	60	55	50	35	35	30	30
Brick requirements (million cu.m.)	0,122	0,204	0,372	0,596	0,025	0,074	0,137	0,190
Ditto (1000 tons)	244	373	632	894	37	185	192	266
Tile req.(mil.sq.m)	0,476	0,760	1,430	2,280	0,156	0,464	0,573	0,800
" " (1000tons)	19	30	57	90	6	19	23	32
Requ.in hollow ceil.tiles(mil.sq.m)	0,337	0,616	1,063	1,658	0,207	0,614	0,650	0,905
Ditto (1000tons)	32	59	100	158	20	58	62	86
Requ.in bricks, tiles & related prod. - Total (1000 tons)	286	449	765	1,101	63	262	277	384

TABLE 4

Projection of construction and of the consumption of bricks, tiles and related products in North Africa up to 1980

	MOROCCO				TUNISIA			
	1964	1970	1975	1980	1964	1970	1975	1980
Investment in construction ($ millions)	170	322	486	737	102	184	277	397
Investment in construction of buildings ($ millions)	67	134	218	356	55	89	139	205
Ditto, less 30% for services & amenities ($ mil.)	47	94	154	249	38	62	97	143
Dwelling houses ($ mil.)	26	47	68	107	16	24	38	57
Industrial build. ($ mil.)	9	19	34	57	9	15	24	35
Build.for educat. & health purposes ($ mil.)	8	19	34	57	9	15	24	34
Other buildings ($ mil.)	4	9	17	28	4	8	12	17
Floor area (mil.sq.m.)	0,806	1,597	2,572	4,175	0,640	1,022	1,633	2,373
Roofing area (mil.sq.m.)	0,725	1,437	2,315	3,757	0,576	0,920	1,470	2,135
Ceiling area (mil.sq.m.)	0,685	1,357	2,186	3,549	0,544	0,869	1,388	2,017
Volume of walls of dwelling houses (mil.cu.m.)	0,189	0,344	0,496	0,779	0,117	0,174	0,279	0,413
Ditto of industrial build. (million cu.m.)	0,048	0,100	0,180	0,300	0,048	0,079	0,127	0,185
Ditto of build.for education purposes (mil.cu.m.)	0,033	0,078	0,140	0,236	0,038	0,061	0,098	0,139
Ditto of other buildings (mil.cu.m.)	0,009	0,021	0,039	0,065	0,009	0,018	0,028	0,039
Ditto - Total	0,279	0,543	0,855	1,380	0,212	0,332	0,532	0,776
Percentage of brick walls	26	30	30	30	21	30	40	45
Percentage of tiled roofs	15	15	10	10	13	15	15	15
Percentage of ceilings of hollow ceiling tiles	15	15	15	15	88	70	60	55
Brick requirements (mil.cu.m.)	0,073	0,163	0,257	0,414	0,045	0,100	0,213	0,350
Brick requ.(1000 tons)	102	228	360	580	58	130	277	455
Tile requ.(mil.sq.m.)	0,109	0,215	0,232	0,376	0,075	0,138	0,220	0,320
Tile requ.(1000 tons)	4	9	10	15	3	6	9	13
Requ. in hollow ceil.tiles (million sq.m.)	0,103	0,204	0,328	0,532	0,480	0,608	0,833	1,110
Requ. in hollow ceil.tiles (1000 tons)	10	20	30	50	46	58	80	105
Requ. in bricks, tiles and related products - Total (1000 tons)	116	257	400	645	107	194	366	573

TABLE 4

Projection of construction and of the consumption of bricks, tiles and related products in North Africa up to 1980

	U.A.R.				SUDAN			
	1964	1970	1975	1980	1964	1970	1975	1980
Invest. in construction ($ millions)	466	720	1.100	1.770	95	145	233	384
Invest. in construction of build.($ millions)	247	380	580	940	50	76	137	220
Ditto, less 30% for services & amenities ($mil.)	173	265	405	660	35	53	96	150
Dwelling houses ($ mil.)	69	106	162	264	10,5	16	39	64
Industrial build.($ mil.)	42	64	97	158	10	15	23	39
Build.for education and health purposes ($ mil.)	42	64	97	158	10	15	23	39
Other buildings ($ mil.)	20	31	49	80	4,5	7	11	19
Floor area (mil.sq.m.)	2.870	4.420	6.760	10.990	0,578	0,876	1,602	2,678
Roofing " (" " ")	2.583	3.978	6.084	9.890	0,520	0,788	1,442	2,400
Ceiling " (" " ")	2.440	3.757	5.746	9.342	0,491	0,745	1,362	2,274
Volume of walls of dwelling houses (mil.cu.m.)	0,495	0,772	1,181	1.916	0,076	0,118	0,282	0,468
Ditto of industrial build. (million cu.m.)	0,222	0,339	0,513	0,836	0,053	0,079	0,121	0,200
Ditto of build.for education purposes(mil.cu.m.)	0,174	0,265	0,402	0,654	0,041	0,062	0,095	0,157
Ditto of other build. (million cu.m.)	0,046	0,072	0,113	0,185	0,010	0,016	0,025	0,037
Ditto - Total	0,937	1,448	2,209	3,591	0,180	0,275	0,523	0,862
Percent. of brick walls	80	60	50	40	15	15	15	15
" of tiled roofs					5	5	5	5
" of ceilings of hollow ceiling tiles		10	15	20	5	10	10	15
Brick requirements (million cu.m.)	0,750	0,870	1,105	1,436	0,027	0,041	0,078	0,130
Brick requ.(1.000 tons)	1,650	1,654	1,990	2,440	54	74	133	221
Tile requ.(mil.sq.m.)					0,026	0,039	0,072	0,120
Tile requ.(1000 tons)					1	2	3	5
Requ.in hollow ceil. tiles (mil.sq.m.)		0,375	0,862	1,870	0,025	0,075	0,136	0,340
Requ.in hollow ceil. tiles (1000 tons)		36	82	178	2	7	13	32
Requ. in bricks, tiles and related prod - Total (1000 tons)	1,650	1,690	2,072	2,618	57	83	149	258