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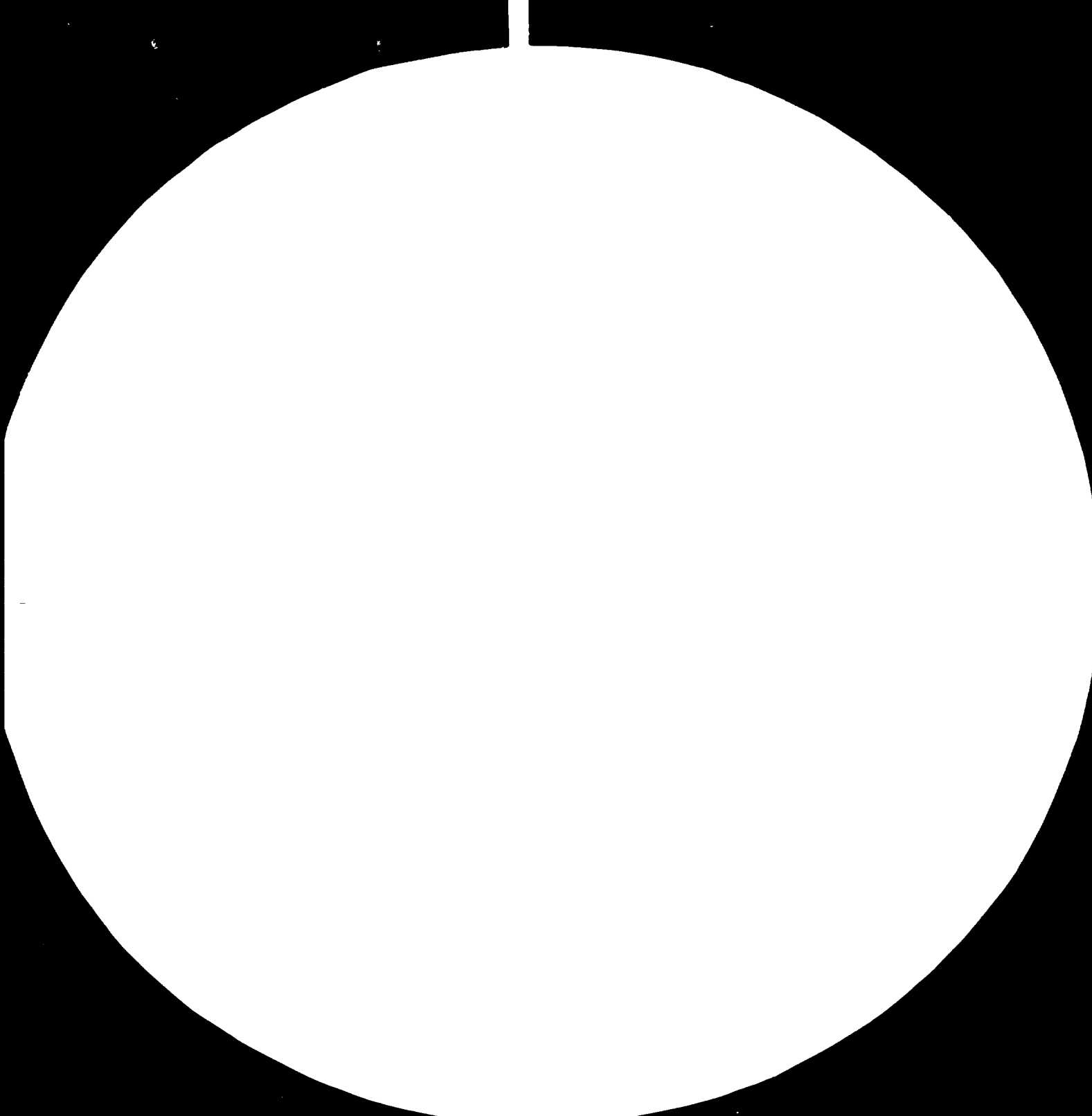

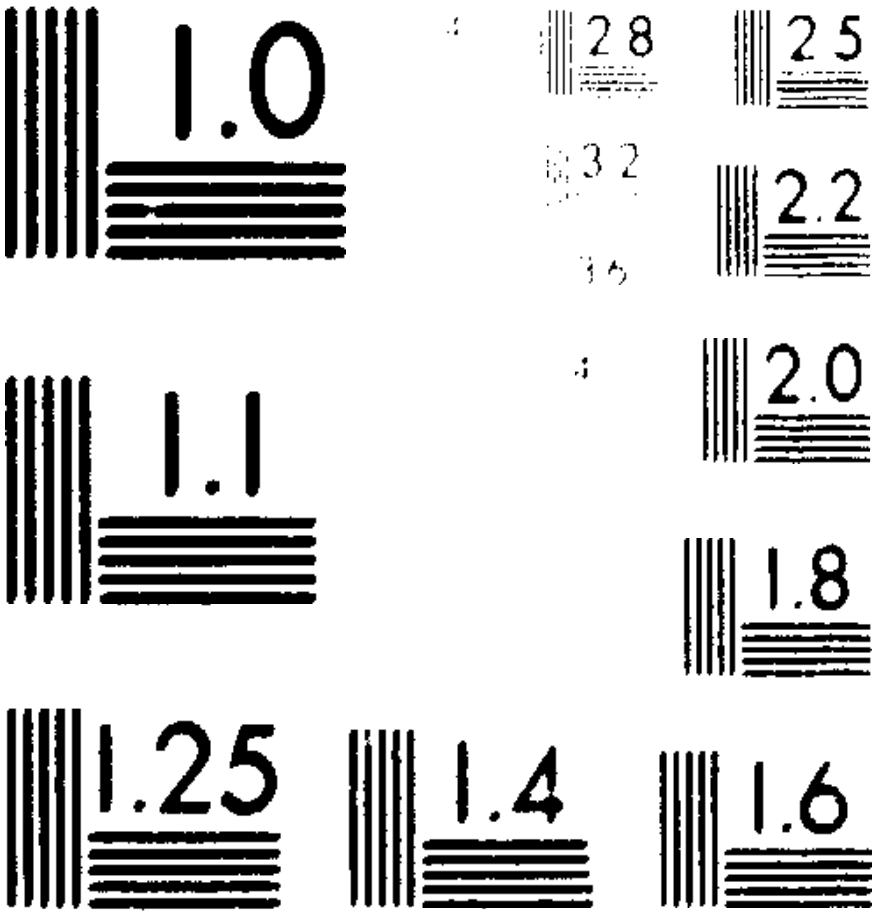
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3 December 1980
English

DEVELOPMENT OF BUILDING MATERIALS INDUSTRY*

SI/UGA/80/801

UGANDA

Terminal report: Situations and Solutions

Prepared for the Government of Uganda
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Jan Knizek, expert in clay and bricks manufacture

United Nations Industrial Development Organization
Vienna

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INTRODUCTION

The Government of Uganda has initiated a national reconstruction and development programme aimed at improving the quality of life of Uganda's low income population in urban and rural areas. The need for this has become even more pressing as a result of the war of liberation in 1979.

In the spirit of the above programme it was deemed that the southwest of Uganda with the important cities of Masaka and Mbarara required priority consideration.

This was due in the first place to the heavy damages this region sustained in the course of the war. Apart from it was also recognized that during the last 8 years social and economic, development in this area was hardly adequate.

In response to this deeply felt need several projects for the rehabilitation of the two districts were prepared by United Nations Centre for Human Settlements. A UNCDF mission identified for financing 10 projects (1) including one for a brickmaking plant in Wabiyinja worth $ 120,000 (2). The UNCDF Mission also stressed the pressing need for assistance in every sector of life in these districts.

The UNCHS strategy was to propose the establishment of a Masaka and Mbarara reconstruction and corporation. The pertinent Project Document UGA/80/003/A/01/56 (3) lists among its outputs under point 14 "Procurement and allocation of building materials and construction equipment." Furthermore under point 24 it will, "Procure, transport, store and allocate buildings materials and construction materials". It also states that the Authority will implement capital development projects in the two towns of Masaka and Mbarara, among them, under point 7 one covering "Brick kiln - in order to ensure adequate supply of bricks at reasonable cost for its projects and for other projects in the region. Accordingly, the Authority will establish and operate in cooperation with the local authorities a semi-automatic brick kiln in the region".

This project, estimated to start May 1980, has not yet been signed yet as apparently the legislation establishing the Authority has not been passed. Nevertheless, anticipating the urgent need for building materials once the Authority starts moving the Government of the Republic of Uganda requested a preparatory mission of a UNIDO Expert in Clay Brick Manufacture under Job Description UGA/80/801/11-01/32.1.B. The UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION appointed Mr. Ian Knizek for the above post.

Specifically, as set forth in the corresponding Job Description, the following were to be his duties:

1. Study the plans for the reconstruction of the towns of Masaka and Mbarara and collect other relevant information with a view to assessing the need in terms of quantity and product variety for brick and tile products in the short and medium term;

2. Study the available information on local brick clay deposits and formulate the requirements for further investigations, if needed;

3. Prepare a detailed industrial profile describing a brick plant of a technology suitable to local conditions complete with layout, equipment speficications etc.

4. Carry out a cost/benefit analysis for the proposed plant and assess its economic viability;

5. Prepare a plan for the future activities, which may comprise the establishment of more than one brick plant, including specifications for equipment to be purchased by the UNCDF and a draft Project Document for the follow-up UNDP/UNIDO assistance.

Mr. Knizek arrived in Uganda on 7 September and departed 20 November 1980. His itinerary within the country as well as his activities are summarized in Annex I. A comprehensive list of his contacts and interviewees is presented in Annex II.

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It was realized however, even before the start of this consultant's mission that the effects of the previously mentioned lack of social and economic development were not confined to the Masaka and Mbarara regions but extended to the whole country. It was thought, therefore, that the approaches developed in connection with Masaka and Mbarara could be mutatis mutandis, extended and applied to the whole country always taking into consideration local and regional differences in the availability of the required inputs, differences that might call for a modification but not fundamental changes in the basic approach.

Consequently, the report which follows also reflects the above pre-occupation with the rest of the country in addition to Masaka and Mbarara.

Summary of Recommendations

1. The economic capacity of the population of Masaka and Mbarara to sustain a building materials industry of an adequate size must be established.

2. It is desirable to establish the reserves of brick clays in the Masaka and Mbarara sub-regions and to determine their characteristics.

3. The same information should be obtained in the rest of Uganda.

4. The employment of agricultural and forestal wastes in field brick kilns should be investigated and adequate technologies developed.

5. A model handicraft brickmaking unit should be established first in Mbarara and then in Masaka.

6. A semi-mechanized brickmaking units should be established in Mbarara.

7. The establishment of handicraft brickmaking units in the rest of Uganda and particularly in the densely populated area north of the Lake Victoria should be promoted.

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8. The implementation of the Wabiyinja Brickmaking Project should be reconsidered after its up-grading with the view of changing its location.

9. More intense utilization of lime should be promoted.

10. This very desirable aim should be approached through an investigation of the country's limestone resources followed by a promotion of adequate small-scale technologies.

11. The possibilities of the manufacture in Uganda of natural cements based on lime and Puzzolanic materials should be investigated and, if found viable, suitable technologies established.

12. The techniques involved in soil-stabilization should be taught and pertinent knowledge amply disseminated.

1.00 THE SITUATION; AN APPRAISAL

1.100 Requirements

MASAKA

A team of officials from the Directorate of Housing, Ministry of Works and Housing, spent 4 days in Masaka and estimated the total demand for housing. Their estimates include not only constructions destroyed or damaged during the war but, also the normal backlog due to past neglect as well as future requirements arising out of the anticipated population increase. This information has been presented in a report which was issued February, 1980 (4) The report gives the total requirement up to 1985. These figures have been extrapolated by the present consultant up to and including 1990. The obtained data are shown in schedule 1A which forms part of Annex V.

In order to estimate the approximate number of bricks corresponding to the amount of dwellings to be built, a typical single-story dwelling unit with an outhouse containing the kitchen and sanitary facilities of 64 square metres, has been devised. This structure has been suggested by the Chief Technical Adviser of the UNCHS in Entebbe.

On the basis of this fundamental structure the total bricks requirements were calculated as shown in schedule 1A which forms part of Annex IV. As indicated the total demand for bricks can be estimated at something like 32 million bricks per year. Here it has been assumed that any project purporting to remedy the situation would be unlikely to start yielding results until 1983. In this case the accrued deficit could not be overcome in less than 8 years.

The report mentioned above estimates that 5,871 dwelling units have been damaged by shelling, fire and looting and must be repaired or re-built. Of this, according to the same report, only 16% were damaged by fire (or shelling?). The number of dwellings, therefore, that must be replaced as the consequence of destruction or irreparable damage and for which bricks are immediately required rises to 940, so that the number of bricks involved in their reconstruction comes to 12-13 million.

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This estimate is to be considered conservative. The reason is that not all the damaged structures will have to be replaced in their entirety. Parts of them could undoubtedly be salvaged and repaired. Furthermore, many bricks are likely to be recuperated from condemned buildings for possible re-use. Occular inspection by the present consultant indicates that much.

MBARARA

The estimates regarding the demand of Mbarara have been calculated on the basis of data secured during a sample survey conducted by members of the Housing sector, Directorate for Housing, Ministry of Works and Housing from February 11 to 15, 1980 and reported in April of the same year (5).

The method used by the present consultant here were the same as in the case of Masaka and the results are shown in schedule 1B forming part of Annex V. The final results indicate a demand of roughly 48-49 million bricks per annum.

It is generally agreed that Mbarara has suffered less in the Liberation War. The initial report (4) estimate the damage at 3 pool houses and less than 10 houses in the private sector. The undated but detailed report, (6) presumably prepared by the Town Clerk's Department gives a total of roughly 44,000 m^3 of construction that have been either destroyed or so severely damaged as to have been condemned. This is in addition to the roughly 20,000 m^2 of housing thought repairable.

The figures regarding the housing needs in Masaka and Mbarara respectively as well as the data extrapolated from them must, however, be used with a degree of caution. Their basic validity is not questioned. What is in doubt is the economic capacity of the two regions to finance a building programme of the envisaged size.

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In the case of Masaka, as indicated in our schedule 1A a total 2,380 dwellings of 64 square meters each are to be built per annum. This means 152,320 square meters. The current construction price is estimated at Shs.2,000 per sq. meters so that the total yearly investment in housing comes to over Shs.300 million. For Mbarara the total is even higher, i.e. close to Shs. 600 million per annum.

There is little doubt that expenditures of that magnitude are beyond the capacity of the two towns. Town authorities interrogated regarding this aspect of the problem left no doubt about it. What this capacity could be is not known at present. Nevertheless some kind of realistic estimate is needed for a down-to-earth and common sensible approach.

OTHER DISTRICTS

Unfortunately there was not enough time for this expert's visit to other districts apart from Masaka and Mbarara, except Kabale. Current need for housing here were estimated by the District Commissioner at 7000. The township is, therefore, in no better position than Masaka and Mbarara inspite of not having suffered war damage. Its needs might be representative of conditions in the rest of the country.

ROOFING (Masaka and Mbarara)

In Masaka 55% of the total number of structures that suffered war damage were affected by looting and presently stand roofless even though the basic structures remain basically sound. This, utilizing our previous rule of thumb, would indicate that 3,230 dwellings now need to be roofed which at $81m^3$ per dwelling would indicate that 261,630 square metres of roofing materials are required as of this time.

Considering the number of dwelling units to be provided as per schedule 1A (Annex V) at 81 square metres per unit the total of roofing materials required per annum is 192.780 square metres.

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The situation in Mbarara is different as apparently there has been less looting. The requirement of roofing for the 3,587 dwellings to be built every year until 1990 amounts to 290.547 square metres.

As to the immediate needs to make good the damage brought by the war it is once more the Town staff's detailed report that provide a good basis for an estimate. The 64,000 square meters of construction either condemned or repairable are the equivalent of about 1000 dwelling units requiring 81,000 square meters of roofing materials.

1.20 PRESENT SUPPLY

MASAKA

A great number of small handicraft operating with rather small-size stove kilns, holding 7 - 8 thousand blocks of the large size common to this region, i.e. roughly 30 x 14 x 12 cm, is in evidence. Three hundred of them are reported to be operating in the area comprising Kiteredde and Kyotera south of Masaka. Not all of them employ the balleclay variety making do with the surface clay. There are, therefore, considerable quality differences between the output of individual units. The total amount turned out by these units is extremely difficult to estimate and this consultant is unwilling to risk a guess, nor would anyone else of those that were interviewed. The Butende Works operates manufacturing equipment of German procedence acquired in 1968. Same is kept in good working conditions. The extrusion capacity is approximately 120 to 130 thousand blocks of the above size per month. This output is dried under sheds and fired in three permanent up-draft kilns holding 50,000 each. They are provided with a roof of structural steel trusses and galvanized iron sheets. The fuel is wood. Information obtained independently indicate that brickmaking equipment of German origin has recently been shipped to Masaka. Same was reported to consist of a box feeder, a double shaft mixer and an extruder with cutter and the corresponding two slat conveyors.

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This means that the facilities of the Butende operation will be duplicated. The combined output of the two mechanized plants will be 250 - 300,000 blocks per month or in equivalents of the 23 x 11.5 x 7.5 cm size brick 8 to 10 million per annum. This output could easily be doubled with the introduction of second shift. Since only field kilns will be involved the investment required for a doubled output would be minimal.

Indeed one wonders why the Butende plant has not increased its output through the introduction of a second production shift. There are at least two possible answers to that querry.

In the first place the reconstruction of Masaka has not been initiated yet because no building permits are being issued at the present. Such construction as is presently going on is illegal.

The second reason might be the high sales price of the Butende blocks. They sell at a price twice that of the handicraft product.

MBARARA

Until recently no fired clay bricks were manufactured around Mbarara. However, extruded bricks were once made at Ruti, a site some 3 km. out of the city. Judging by the appearance of the brick fragments strewn around the bricks manufactured here were of good quality and attractive colour. They were made by extrusion in an extruder the remnants of which may still be seen here. It appears to have been a common-sensible operation, simple enough, probably housed under a shed which has since disappeared. The nearby river Ruizi, which carries water throughout the year, provided the water pumped from it to the operation (not more than 100 metres away). This operation appears to have ceased after the departure of the Asians exploiting it. The manufacture of sand-cement blocks has been introduced in the past but due to the present shortage of Portland cement not many of these blocks are presently turned out.

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The municipality has earmarked 7 - 8 hectares of land, around the ancient brick making site of Butt, for future activities of this kind. Even an attempt at revival was made here and one small brick kiln has already been completed.

OTHER REGIONS

Near Kabale brick-making is practiced principally in the valley of the now drained Kiruruma swamp. A ball clay type of materials occur under a soil overburden of 1 - 2 metres. Same is of light grey colour and fires to a buff to light pink colour. Same appears to be less benign, in the sense that it cracks somewhat more in drying. This, however, could be due to less careful clay preparation causing dry lumps to be present in the moulding slop. The less careful clay preparation observed by the present expert is related to the considerably lower level of wages.

The densely populated regions north of Lake Victoria, dominated by the capital and by Jinja in the east is within the reach from two mechanized brickworks midway between Entebbe and Kampala. The larger of the two, Uganda Clays Limited of which 75% is owned by the National Housing Corporation, a Government dependency, operates presently at 60% capacity. This is exceptionally good. An imposing range of products of fine quality is manufactured here to the tune of 60 tons per day. Pan African Clay Products Limited, the second outfit, smaller in size, operates in the same neighbourhood. Same is at present standing idle, presumably due to lack of spares. The range of products normally turned out here is somewhat smaller.

The Uganda Clays Limited has plans to extend its activities to other centres, particularly Jinja and others.

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1.30 AVAILABLE INPUTS

1.31 CLAYS

MASAKA

Masaka and its environment are very rich in clays. In fact part of the whole country from Kampala to these centres is probably, underlain by good quality clays. There are indication that clay strata continue as far as the Rwandan border in the Kiruruma swamp valley. The clay is sedimentary and occurs under a variable overburden of alluvial clay material 1 - 2 metres thick.

Actually to call the clays occurring around Masaka good is a considerable understatement. These clays can only be qualified as excellent, and not suitable only for brickmaking. They are in fact, ball clays and most clay mineralogists would not hesitate to identify them as such. Their occurring in swamps, actual or past, is typical for such materials. Apart from these buff-firing clays the superficial alluvial materials which cover them are also used in brick making and they fire to a darker red colour. Sometimes, as at the Butende Brick Works, the two materials are blended together and produce darker bricks than the ball clays alone.

The uses to which these clays are put testify to their fine quality. This consultant has yet to see slop-moulded bricks as large as 30 x 14 x 12 cm that would not crack either in drying or in firing, inspite of defficient moulding techniques employed.

What is more the Butende Brick Works that has been mentioned above extrudes 30 x 14 x 11.5 cm solid blocks that show no signs of coring and which dry and fire without cracking of any kind. Such a thing has seldom been achieved in actual practice, at least not with a straight clay body as happens here.

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MBARARA

The situation in Mbarara appears to be different. This consultant has inspected a large stratum of clay at Ruti, two miles outside Mbarara. Same was uncovered in the course of a fair-sized brickmaking operation that has since ceased.

The clay here, grey in colour with fine iron staining is similar to those of Masaka but appears somewhat more "sandy". That does not mean that less sandy clays do not occur in the neighbourhood of Mbarara.

As has been said before, the whole region from the Kenyan border in the East down to the border with Rwanda is probably underlain with clays. Apart from those employed by the two mechanized plants that operate between Entebbe and Kampala and which are very good brick clays, specific informations about clay availability in the rest of the country are scarce. Even though an excellent clay report has been prepared in 1967 (7) same is too fragmentary to be of more use than as a rough guide. Its emphasis is on clays of a quality above that required for bricks and tiles.

Firewood is the source of energy for brick-firing in both Masaka and Mbarara. On glance at our Fig.7 show that as far as the availability of this fuel source is concerned Masaka is in a much better situation than Mbarara.

Wood for Masaka's present brickmaking comes from the forest area to the east. The consultant has been informed that the average distance from which wood has to be gathered has been steadily increasing over the years, precisely because of the drain on the forest resources attributable to the brickmaking activity. It now stands at 17 miles. Ocular inspection indicates, furthermore, that even large diameter logs (up to 30 cm) are now being felled for use as firewood. Such timber could be employed more profitably in sawing boards for export or construction purposes.

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Mbarara is presently obtaining its wood from a government plantation 0 miles from the site. The consultant has been assured that felling in this area is controlled by the Department of Forestry and no more of it is allowed to be extracted than might be replaced by natural regeneration and replantation.

The cost of wood in either areas is, taking it at its face value, comparatively high. It comes to roughly shs. 90 per cu. meter in Masaka and Shs.125 per cu. metre in Mbarara, the later price reflecting probably more efficient Government control here.

In Kabale the fuel wood is trucked-in from a distance of 16 km. Its cost is considerable reflecting its scarcity. It costs presently over Shs. 200 per cubic metre. The average consumption is reported to be 3 to 4 cubic metres per thousand bricks which is to be considered as very high.

Considering that a cubic : metre of wood yields roughly 300 kg. of raw wood the cost per ton will be Shs.270 and Shs.325 for Masaka and Mbarara respectively. This is roughly four times the usual range of costs in developing countries reported by Keddie and Clegharn (8) earlier this year. It is probably related to Uganda's present inflation spiral which the official exchange rate, which was employed to efectuate the conversion, does not reflect.

As to the Kampala region, the smaller of the two mechanized plants, Pan African Clay Products Limited uses wood in chamber kilns whereas its larger competitor across the road fires coffee husks in a Hofmann type kiln.

1.33 LABOUR

The average wage in either of the two regions is roughly Shs.45 per day (or approximately dollars 6.00). It is symptomatic that handicraft brickmaking commands a much higher remuneration at least in Masaka (no information of this kind is available for Mbarara because of the absence of brickmaking in this area). A handicraft brick moulder questioned by the expert claimed to be able to produce 250 blocks per day for which he would be paid Shs.6.00 each or

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Shs. 150 a day. On the other hand average wage at the Butende mission plant was reported to be only Shs.25 per day. This discrepancy was never satisfactorily explained. It was indicated nevertheless, that the moulder does not invariably produce the alleged 250 blocks a day. Apparently he might also spend part of his time in less well remunerated work such as day preparation or he might even fire his own kiln.

Availability of labour too has to be considered. There is little doubt that few problems will be encountered with low-labour mechanized plants with their low-manpower/output ratio. The situation changes with labour intensive operations which may involve 5.7 man days per each thousand bricks.

Taking for instance the extreme case of having to satisfy all the demand of Masaka as arrived at in schedule 1B, 554 people will have to be employed in these activities. In the case of Mbarara the total might rise to 920 people. This does not seem to constitute much of a problem in Masaka where the estimated 300 unit must occupy at least the same number of people.

Mbarara's case was considered more in doubt. Interrogated on this point the Town's authorities thought that attracting that many people to the industry was not impossible provided the jobs could be remunerated at rates above the prevalent wage level of Shs. 1,200 per month or say Shs.47 per day. This suggestion appears consistent with observations made in Masaka where a differential between the general level of wages and average perception in the handicraft brickmaking field has been noted.

It is certainly worth recording that the religious order of the Bannakaroli Brothers whose mission is centred in Kiteredde south of Masaka, have been active in training youngsters of the regions. This consultant has been able to observe some of the trainees engaged in brick laying and was impressed by the degree of proficiency that has already been acquired by them. These training activities appear to be sponsored by U.S.A.I.D. through the agency of an organization called "The Experiment in International Living" of Brattleboro, Vermont, U.S.A. The extremely important point to be made here is that among the very next activities to be undertaken by the order is precisely training in handicraft brickmaking.

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In Kabale a moulder can make as much as Shs.100 per day but labour engaged in other activities as for instance clay winning and slop preparation is paid much less, i.e. Shs.20 or Shs.30. Even less is paid for off-bearing labour especially if children are employed. This happens frequently.

1.34 PRICES

The handicraft blocks approximately 30 x 14 x 12 cm (generally somewhat smaller, however) sell for Shs.3.00. The smaller 23 x 11 x 7.5 cm is not being produced. The Butende large block sells currently at Shs.6.00 where as the 23 x 11 x 7.5 cm is priced at Shs.3.00.

As may be observed the price differential between the industrial and hand-made product is considerable. It may reflect the higher confidence in the machine made product with its much higher strength. Same might not, however, even be required for single-strory application where a crushing strength of no more than 50 kg per square centimeter is needed. Visual examination in Mbarara and Masaka indicate that most to be replaced structures are of this type and Mbarara Town Council's report (6) referred to earlier bears it out.

The above figures may be compared with those obtained in the Kampala region. Uganda Clays Limited's price list shows that the current price of 23 x 11 x 7.5 cm brick (which is actually only 6.5 - 7 cm thick) is only Shs. 1.35. The price obtained, however, from the Pan-African Clay Products Limited for the same brick size was Shs. 4.00. Whether the Shs. 1.35 price reflects actual market conditions is very much in doubt. But in view of the situation that might be observed in the case of other building materials as for instance Portland Cement, the latter price of Shs. 4.00 might be closer to actual reality than one of Shs. 1.35. In view of this situation the Butende price of Shs.3.00 does not appear to be out of line.

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Roofing Tiles

The only roofing tiles that are seen in the Masaka and Mbarara districts were made at either of the two mechanized plants near Kampala.

The current list price at Uganda Clay Limited is Shs.8.50 each and Shs.10 at the Pan African Clay Products Limited (across the road from it). At approximately 10 tiles of this kind per square metre the cost comes to Shs.85 per sq.m. of roof. That does not include the additional expenses of assembling, neither that of the reinforced timber structure which the use of roofing tiles entails. This is considerable.

2.00 APPROACHES

2.10 Financial Capatity

In order to plan for an adequate supply of building materials the ability of the population to sustain a continuous building activity must be known. As regards Masaka and Mbarara same is very much in doubt. If a suitable financial analysis is not forthcoming too ambitious or too conservative manufacturing facilities might be provided. The results may fall short of being disastrous. In the first case an oversize facility operating at less than its rated capacity, will start loosing money whereas an underrated one will not provide the necessary input thus hampering reconstruction efforts.

Mechanized and semi-mechanized operations are especially prone to the above danger. On the other hand certain kind of labour-intensive operations of which the size and output can be increased or decreased without too much difficulties and with little or no financial sacrifice, offer a number of advantages.

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CLAYS

As regards Masaka and Mbarara no problems are anticipated as the available clays appear to be of good quality. However, a development of clay-based building materials of the size envisaged for these two localities cannot and should not be based on an evidence as scanty as the present one. Even though the visual impression is one of ample availability, this is not sufficient for responsible planning. In other words it will be necessary to establish available reserves.

2.20 Energy

Next to clay energy is the most important input. Its importance might even overshadow that of the clay itself, in view of the almost ubiquitos nature of the latter. In fact, clays are found in most places and it's only their quality and consequently their suitability for brickmaking which might be in question.

While this is important these days it is more the availability of energy at adequate cost that has acquired an almost determinant effect on the viability of many brickmaking operations. In fact, the spiralling cost of liquid fossil fuel-derived energy has frequently made its use in countries not possessing sufficient reserves of it, impossible. It is not alone the adverse effect the high cost of fossil fuel-derived energy has on the feasibility of brick-making. Even more important is the negative impact oil imports exert on the overall balance of payment of even the economically most stable countries.

It is therefore the availability of energy that provides the organizing principle for a logical and comprehensive planning of building materials development in Uganda.

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2.21 Wood

At first sight wood, known to be relatively abundant in Uganda. would appear to be the next logical source of energy. The country possesses close to 2.5 million hectares of forest. Of this amount, about 60% is protected whereas close to one million hectares are open to cutting. If allowable cut would be equal to the regenerative power of the forest, the available amounts of wood would be very large.

Uganda Department of Forestry's data indicate a range of 0.4 to 0.60 cubic metres per year per hectare of national forest. This would indicate a yearly yield of between 253 and 280 thousand cubic metres. For soft wood species the regenerating power is much higher i.e. 10 to 35 cu. metres per year with a proportionately larger total yield. Unfortunately the total soft wood area is not known to the expert. Even so however, the above figures indicate an abundant availability of wood.

On the other hand the Annual Allowable Cuts for 17 tropical high forest reserves amounted to only 288,000 cubic metres (9) No comparable information is available for the over 18 thousand hectares of soft wood reserves identified in a 1974 report (10).

Obviously the above quoted annual allowable cut figures do not represent the potential available for cutting in the whole country. Most of it, anyway, would be used for export in form of sawed board, which is its legitimate and eminently desirable purpose. It might be said then that more than sufficient wood is available for brick firing. This is not to say that such a use for it is desirable.

It is therefore not that there is not enough wood in Uganda. The problem is that if felling is not limited to that amount that can be recuperated through the forest's regenerative power or compensated by replantation invariably leads to widespread deforestation. The grouble is that such selective and restrictive felling is difficult to enforce. In fact Forestry Department's officer report that the present vogue of charcoal burning has already depleted large tracts in the country.

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In such a situation it is the use of agricultural wastes that offer a partial solution. Why this solution can only be a partial one will be discussed in a latter context.

2.2 Agricultural and Forestal Wastes

Fortunately as regards such wastes Uganda seems to find itself in a particularly favourable situation as several are available in what at first sight appears to be fair amount. Certainly not at the time of writing when some of the industries and operations that produce them function at much less than normal capacity. Fundamentally four kinds of wastes may be identified.

Coffee husks

The Uganda Coffee Marketing Board identified for this expert 185 hulleries, Fig.2 shows their geographical distribution. Under normal conditions 136.000 tons are produced per annum. Some of it, however, is said to be used by the coffee growers for mulching. This expert has been unable to secure any information regarding the heat value of these husks. According to personal information (11) 100 to 200 kilos are needed to fire 1 ton of clay products in a Hofmann type of kiln operation, the heat value of coffee husks would be between 4000 and 6000 keal per kilo or close to that due to oil content of the husks. At any rate the above amount of coffee husks would be sufficient to burn and fire a tenfold tonnage of bricks, amounting to 340 to 680 million bricks. Presently husks cost nothing. They are given away so the only cost the user has to carry is that of transport.

Bagasse

Under more normal circumstances Uganda would produce 190.000 tons of sugar per annum. Jaggeries, of which there are altogether 30 produce additional 750 tons per year. Both operations would leave roughly 850.000 tons of bagasse. Part of it is used in the sugar mills for steam generating purposes but most of it is a total waste. The heat value of bagasse should be near that of soft wood, that is less than 5,000 keal per kilo, possibly as low

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as 4,000 kcal. But the amounts available and the energy obtainable from them are staggering.

While plans are afoot to industrialize bagasse, which is desirable, it will be a long time before such uses for it are developed. And even so only a small faction will be thus utilized. Our Fig.2 shows the location of Uganda's sugar mills as well as the area of jaggeries.

Rice Husks

Uganda produces a total of approximately one thousand tons per year of rice husks. The largest single producer is the Kibimba Rice Scheme accounting for approximately 300 tons of the above total.

Additional rice producing areas are in Busoga, Bukedi Teso, Lango, Acholi and Semuliki. Their location is shown in our Fig.2. They seem to account for about 700 tons per annum.

The Kibimba Rice scheme alone would probably suffice to burn 600,000 bricks per year. The other rice-producing area possibly close to 1.5 million per year.

As regards the others they appear to be greatly scattered and as far apart as Semuliki (in the West) and Bukedi and Teso in the East. The important point is however that rice is also produced in two of the northern districts (Acholi and Lango). Their individual outputs are not known however.

Sawdust

Sawdust producers are scattered in the east and west of Uganda and in the area north of Lake Victoria. The degree of dispersion, however is higher than that of coffee husks, bagasse, or rice husks. Our Fig.1 shows this. The total production of saw dust has been estimated for this consultant (12) as close to 20,000 cu. metres per annum. This would be sufficient to fire over 13 million bricks. A great number of large sawmills all over the country are planned, however.

.../..

Problems to be solved

There is one, perhaps minor problem linked with the use of agricultural wastes. It concerns technology which their suggested use for firing of bricks involves. Continuous kilns of the general Hofmann type lend themselves splendidly to the burning of coffee-husks, rice husks and saw dust. The use of bagasse appears to be somewhat more difficult.

On the other hand the use of agricultural wastes for firing up-draft kilns of the field type may present certain problems. It might never have been tried before. Nevertheless such kilns are essential to the handicraft operation especially on account of their economy not being output-dependent.

Hofmann type kilns are expensive to build. A good design and specialized labour must both be available. On the other hand up-draft kilns cost nothing. The bricks being fired are the kiln. There is, furthermore, almost no limit to their size. The smallest economically viable field kiln will have just one fire hole furnishing about 5 thousand bricks in one firing. But using the same general principle twenty - or more hole - structures can be built and 300,000 bricks fired at the same time. In fact, only the financial capacity of the operator or of the enterprise involved determines the size of the kiln. This financial capacity must be large enough to allow for the payment of materials and labour while correspondingly large amounts of bricks are moulded, dried and fired and before funds derived from their sale can be used to bankrol further further operations.

It is, therefore of utmost importance for Uganda that proper technology for burning the above agricultural wastes in updraft field kilns be developed.

Another fact hampering a unified approach to the building materials supply problem is the geographical distribution of the agricultural wastes-producing areas. As may be appreciated in our Figs. 1 and 2 and as brought forward in Annex IV 7 districts have only wood, 9 have in addition to wood saw dust, whereas coffee husks are concentrated in 6 of them; Bagasse is produced in one

..../..

and rice husks are obtained in five. Moroto and Kotido produce no agricultural wastes and the wooded area is negligible. Therefore Kitgum, Gulu, Kabale, Rukungiri, Luwero, Mukono and Mubende will depend on wood. The area most blessed with all the wastes are Kamuli, Iganga, Jinja.

Fortunately they are also those exhibiting the highest population density. Only sawdust producing centres show a more favourable degree of scatter. There appears to be several sawmills north of the first parallel in the west of the country.

The unfavourable effect of the geographical concentration of the production of wastes in specific areas are aggravated by the fact that their transport over large distances is undesirable. This is due to their voluminosity which could make them quite expensive unless their transport is properly organized.

As regards those areas of immediate interest, Masaka and Mbarara, the first could probably depend exclusively on coffee husks. The Coffee Marketing Board lists 59 hulleries in this district. There is, furthermore, one sawmill to the east of the town.

Mbarara is less well placed with respect to agricultural wastes. There are however, two hulleries in the Ankole district which under normal circumstances should produce over 4,000 tons of husks per year good for about 20 million bricks. Anything in excess of that will have to be fired with wood. Fortunately there appear to exist several plantations some 15 km east of Mbarara where timber could presumably be felled under government control thus minimizing the damage to the environment.

Outside of the agricultural wastes producing areas the energy situation is less favourable. These areas comprise, however, 70% of Uganda. Whatever bricks are produced here are fired with the soft wood found in the area. The scattered savannah areas provide a better source of firewood. Nevertheless the situation is dangerous because the demand for large amounts of wood which brickmaking requires, leads to deforestation.

.../..

Untouched yet has been left the problem of those entities without any energy resources. Here, stabilized-soil blocks might offer an acceptable, also, a long range solution. It is not an immediate way out because of the chronical shortage of Portland cement in the country. Same will probably last for quite some time.

The situation in these areas must however be investigated in depth. Independently of the conclusions reached above the manufacture of stabilized soil building materials must be demonstrated and the criteria needed to judge the soil's suitability for Portland cement stabilization taught. This should be accomplished as soon as possible.

2.30 Technologies

It is to be expected that three kinds of building materials will be ultimately required. This applies to the whole country and not only to the Masaka and Mbarara regions. While all three of them are clay-based they do, nevertheless, involve different technologies. This three-fold division which is being envisaged is dictated by the income distribution of the population.

It is conceivable that a large part of the population will not be able to afford fired clay bricks. Their needs will have to be satisfied with lower cost building materials. Stabilized-soil blocks commend themselves in this respect, particularly because they lend themselves for the self-help type of construction. At the present Portland cement prices, naturally, the above is not an attractive proposition. Nevertheless this approach is fundamentally correct and will be taken up again in the latter context.

The next income group will probably be able to afford hand-made, fired clay bricks. Only the higher middle and upper income groups are likely to provide the market for machine-made bricks.

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Bricks of this kind could be manufactured at different levels of technology. In fact an almost continuous range of mechanization is feasible. However a completely mechanized plant is hardly conceivable for most developing countries and Uganda is no exception. For the purpose of the present exposition a middle-way solution will be first considered.

Medium Mechanization

Clay winning as well as its hauling is mechanical by excavators and trucks. The fundamental making process here considered is extrusion and wire-cutting. It involves only traditional equipment, i.e. feeders, laminating rolls, double-shaft mixers, de-airing extruders with the requisite number of slat conveyors and finally an automatic cutter with its off-bearing belt conveyor. The last operation is manual and so is the setting for drying and firing. Nevertheless bricks transport to and from driers is by means of gasoline-powered lift trucks. Racks are used for drying. Only that part of the output from which the moisture can be eliminated taking advantage of waste heat from the kiln will be so treated. The remainder is to be dried the natural way under sheds. This is in accordance with energy conservation aims and reflects the favourable climatic conditions in most of Uganda.

Kiln packs are set outside the kiln and setting itself is done by lift trucks. The kiln is of the parallel galleried Hofmann type with open ends for lift truck loading. The fuel is coffee husks. The corresponding pre-feasibility study is shown in Annex V. As may be appreciated, this approach requires rather high capital investment because of the considerable output needed to assure adequate commercial profitability. Investments of this magnitude require safeguards in the form of extensive and costly technical assistance in the design, installation and commissioning of the plant. Expenses connected with this naturally inflate the investment cost causing at the same time high depreciation charges.

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Half-way Mechanization

In the second approach clay winning and hauling is manual. The making process is essential the same but there is no de-airing. This saving is due to the favourable clay characteristics in both Masaka and Mbarara. Off-bearing and transport to and from the drier is manual too. Hand-operated lift-trucks are used here for handling pallet-loaded bricks to drying sheds. The kilns here considered are up-draft, with an outer non-permanent brick shell. Until the technology for the use of agricultural wastes has been developed wood will be the fuel.

The pre-feasibility study presented in Annex VI is based on a 12,000 bricks per day operation compatible with the performance of a single extruder of average size. The rated output can be roughly doubled by installing a second shift but the area of sheds will also have to be doubled.

Handicraft Approach

Last to be considered is the full handicraft approach. Same differs from the kind of brickmaking now practiced around Masaka in many significant respects. In the first place same is conceived as a large scale operation with a division of labour as one of its main features. So for instance brick moulders will not prepare their own slop, nor will they be required to load and fire kilns.

In this way specialized skills will be developed, perfected and maintained. Thus efficiency is improved. Such organization of work will also permit better control of the quality.

Even though the pre-feasibility study shown in Annex VII is based on an output of 10,000 bricks per day, it is to be understood that the scale of operation can be extended almost indefinitely with little change in its economy. With a larger manufacturing scale there will be some saving in supervision, but it will be of minor importance. A tentative layout of a basic unit is shown in Fig.3. Furthermore the profitability of this

.../..

operation is likely to improve considerably once firing with coffee husks becomes practicable.

Conclusions

The three feasibility studies shown in Annexes V, VI and VII more than anything else reflect the prevailing inflation conditions. Above all high prices of the turned-out products. It appears that the brick price used in calculating total revenue, that is, Shs.3.00 per brick, is inflated. Even Uganda Clay Limited's list price of Shs.1.30 is out of line. If for instance the 1972 price of Shs.0.19 were considered and a more normal inflation rate of 20% per year applied, the present price will only be Shs.0.68.

The inflation conditions reflected in the studies also discriminate somewhat against handicraft brickmaking with its relatively high labour component. They favour both the mechanized and semi-mechanized operations. On the other hand their equipment components is kept comparatively low due to the unchanged exchange rate of the national currency. It must be admitted, therefore, that the ultimate value of these studies is ephemeral but they do allow a helpful comparison between costs at different levels of technology and scale.

The mechanized approach, epitomized in Annex V, is not believed to be appropriate. This is above all because of the high investment cost. An additional reason is that the economy of such high investment projects is too vulnerable depending as it does, on output. That is their break-even point is high. Even though the gross profit at present inflated prices is very high it might not necessarily continue to be so under normalized conditions.

The two remaining approaches are believed to be suitable for the conditions of Masaka and Mbarara. Both types of technology have a definite function there. The handicraft approach will provide bricks at comparatively low price more compatible with the means of a larger proportion of the population. The very co-existence of both these technologies in Masaka at the present time is the best proof of their continuing usefulness.

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Employing the Masaka situation as something of a pattern it may be said that the establishment of both a handicraft and a semi-mechanized brickmaking units in Mbarara appears desirable. As to Masaka, with the addition of second semi-mechanized facility referred to in 1.20 only present handicraft operations demand up-grading and expanding as proposed.

It is recommended that Masaka and Mbarara's needs for roofing be met through direct importation of galvanized iron sheeting by the, to be established Authority, and its distribution to the needed at cost price.

2.31 Roofing Materials

As has been already anticipated in 1.34 the need for roofing materials poses an acute as well as a difficult problem. The fact must be faced that the cost of the roofing tile-covered roof bears no comparison with that of the traditional corrugated-iron cover. The recognition of that fact has nothing at all to do with the desirability of clay-tile roof. The clay roofing tile is preferable to tin roof in all respects except cost. The former protects better from the effects of insulation and manages to avoid the unpleasant noise caused by the impact of rain.

In addition to all this galvanized iron sheeting have to be imported thus representing an additional drain on the country's resources of foreign exchange. Roofing tiles on the other hand could be manufactured in the country without outlay of foreign currency except for part of the required capital investment.

At the present it would appear that roofing tiles are accessible only to the more moneyed strata of the society. The reports covering conditions in Masaka and Mbarara referred to before (4,5) give the distribution of the population according to income as follows:

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	Masaka	Mbarara
	%	%
Low income, below Shs. 999 per month	80	59
Middle income, Shs. 1,000 to 2,999 per month	15	22
High income, over Shs. 3,000 per month	5	19

The Mbarara report estimates, furthermore, that the low income group requires dwelling that cost no more than Shs.13,000. For the middle income group the permissible housing cost is Shs.30,000 to Shs.50,000.

As to the high income group the average cost would be Shs.80,000 per dwelling. These figures are based on the assumption that 1% of the construction cost represents a realistic monthly rent which in turn should correspond to 20% of the income. (The report observes, however, that present day building costs do not permit to produce dwelling units of reasonable decency especially with regard to low-income groups). The implications of this are clear. However and regardless of actual building costs it seems that only households of the high income group might be able to afford clay tile-roofed dwellings even in the future.

What has been just said does not mean that the manufacture of roofing tiles in Masaka and Mbarara should not be encouraged. Quite to the contrary, both fully and semi-mechanized brickworks might welcome the additional revenue which could be obtained from their manufacture and sale. More so because with the exception of either a hand-operated press or an automatic one, roofing tiles could easily be manufactured with the type of equipment that would normally be available for brickmaking.

On the other hand a fully handicraft manufacture of clay roofing tiles is not believed to be feasible in Uganda, because of the high labour component involved and low output associated with manual production.

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At any rate Masaka's and Mbarara's needs for roofing are unlikely to be satisfied with clay tiles. Economic reasons which have been advanced clearly show it. Apart from that even if it were a commercially feasible proposition it would still be a long-range solution whereas the needs are very much present. As has been already mentioned the need for roofing is at this time more pressing than for bricks.

2.32 Cementous Materials

Apart from bricks mortar for laying them up is required. In the few structures that are presently being erected in Masaka as well as in those in actual process of repair, ordinary mud mortar is being employed. This is, naturally, far from satisfactory.

The present shortage or better to say unavailability of Portland cement is likely to continue for a considerable time. This will certainly affect the plans for the reconstruction of Masaka and Mbarara, unless this material could be imported.

The use of lime mortar might provide an alternate solution. Same is even considered superior to Portland cement mortar by many. There appeared to have been so far little serious development in this field.

The Uganda Geological Survey and Mines Department has supplied the expert with a list of limestone occurences. Same has been summarized in Annex VIII.

Considering the chronical cement shortage in Uganda, the possibilities of natural cement remain open. In this context some recent volcanics of Kosoro, and Kasekere might become interesting. It is especially the former deposits which deserves particular attention in view of the fact that limestone is also found in the neighbourhood.

Another fact might be significant. A granulated lava from that locality has been employed in the manufacture of light-weight cement blocks. This material might show puzzolonic properties in which case its usefulness will be enhanced a great deal.

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2.33 The Wabiyinja Brickmaking Project

Although a step in the right direction this proposal appears to be somewhat doubtful. At least from the standpoint of logistics. It is generally conceded that structural clay products do not travel well over long distances in the sense that the ratio cost of product/cost of transport is far from favourable. It is generally considered that the maximum distance out which structural clay product may be economically transported is 30 km. The distance from the site of the project Mityana to Masaka is roughly 200 km and to Mbarara about 300 km. Even though the cost of brick transport is external to the brick-work and does not, therefore, enter into least-cost calculation, of the brickwork itself it does affect adversely the cost of construction. And this is what we are concerned with. The added cost to the construction industry might, to an extent, be offset by a possible economy of scale. This is a double-edged weapon. Large-scale projects depend for their continuing profitability on a steady demand. In the opinion of this consultant this condition cannot be depended on in this region.

What the advantages of the Mityana site might is not immediately apparent. Good clays are certainly available both in Masaka and Mbarara. Furthermore, elementary sense of justice demands that the area which would be using and therefore paying for a commodity should also share in the benefits arising from the corresponding manufacturing activity. Such as employment, taxes etc.

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3.00 General Recommendations

Before any effective planning for the supply of building materials for the reconstruction of Masaka and Mbarara is attempted the economic capacity of the population as a whole must be determined. This would normally fall within the scope of activities covered by point 9 of project UGA/80/003/A/01/56 under the direction of the socio-economic planner or one of the consultant provided under the terms of the above project.

Should the above task fall outside the scope of the said project a suitable consultant must be provided within the Building Materials Development Project which constitutes one of the outcome of the present mission.

The available reserves of bricklays in the Masaka and Mbarara sub-regions must be established with reasonable accuracy. This could best be done by drilling using a hand tool of which a model must be provided from the outside. Additional ones could then be fashioned in the country for which only a handy blacksmith and a supply of die steel must be made available.

After completing this task in the sub-regions in the south-west of Uganda this activity would be extended to the rest of the country starting, due to its proximity, with Kabale. The specific regions where the reserve-establishing activities should be continued, will be selected taking into consideration effective needs for housing in each area and the available sources of energy.

The above exploration activity will be supplemented by field testing. Only the most important parameters such as workability and the different consistency and plastic indices will be determined. Firing tests will be performed whenever necessary in samples submitted to a reputable clay-testing institution abroad.

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The use of agricultural wastes in burning clay bricks and lime should be thoroughly investigated and suitable technologies for their utilization in up-draft field kilns developed. This concerns especially the use of coffee husks, saw dust, bagasse and rice husks in that order which accords with their relative importance for the sub-regions Masaka and Mbarara.

A model handicraft manufacturing unit for an output of 10,000 bricks per day should be organized with the view of demonstrating large scale application of up-graded hand-moulding techniques. The first is to be started in Mbarara but as soon as same has been accomplished the next operation of this kind will be started in Masaka after which the principles evolved and established will be applied on selected sites all over the country. The improvements and modifications introduced into the handicraft technology will include evolvement and development of individual skills, operation stream-lining based on motion studies and channelled towards improving efficiencies and productivity while reducing losses. Once technologies for burning agricultural wastes have been developed their use in up-draft kilns will be introduced.

A semi-mechanized brickmaking unit for 12,000 bricks per day should be established in Mbarara. A hand operated roofing tile press should also be included.

Manufacturing equipment for this unit as specified in Annex VI should be supplied. It is recommended in this context that the feasibility of such units in the remaining regions of Uganda be investigated taking into consideration local and/regional needs, availability of the required inputs and means of financing.

As regards the Entebbe, Kampala and Jinja areas, the satisfaction of their needs of building materials for higher income-groups and government's own building activities could probably be best left to private initiative operating at full industrial scale.

Nevertheless the needs of the middle and low income groups will have to be satisfied at the handicraft level possibly with some aid from self-help stabilized soil activity. Handicraft brickmaking units, patterned after the model developed in Mbarara should be established even in these densely populated district. This is most advisable in view of the availability of agricultural wastes here of which advantage should be taken.

The implementation of the Wabiyinja Brickmaking Project should be re-considered with the view of its transferrence to Mbarara. It is also advisable that same be up-graded in keeping with the terms of the pre-feasibility study shown in Annex VI.

The potential of lime production in the country should be investigated after completion of the clay survey in the sub-regions under discussion and plans for more intensive exploitation of available limestone deposits prepared. Lime burning should be actively propoted and suitable scale technologies proposed. Lime mortar technology should also be taught. A search for puzzolanic and other lime-reacting materials should be initiated as soon as possible. Should such materials be identified effective methods for the manufacture of natural cements should be devised.

The possibility of soil stabilization and its relevance for rural and low cost housing in general in Masaka and Mbarara as well as in the country at large should be studied in depth. The techniques involved in soil stabilization and soil selection for this purpose should be taught in order to create a body of instructors capable of imparting instruction at the user's level. Four cinva-ram presses for demonstration purposes should also be supplied.

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3.10 Specific Recommendations

To achieve the above aims the following expert assistance is to be provided by UNIDO.

1	Field Geologist and building raw materials specialist	24 months
1	Fired clay brick technologist	24 "
1	Economist/Statistician and financial analyst	3 "
1	Clay roofing tile specialist	6 "
1	Fired clay brick technologist	24 "
1	Lime production technologist	3 "
1	Lime-mortar specialist	3 "
1	Puzzolanic materials experts	2 "
1	Fuel and kiln engineering expert	6 "
1	Stabilized Soil Expert	3 "

The supply of the following materials and equipment required for the efficient implementation of the proposed proposals is urged:

1 Hand auger for drilling
37 - 40 mm diameter 6 metre long
approx. 50 kg. of flat steel suitable for forging and hardening, 37 - 40 mm x 5 mm.

1 Soil testing Kit (Atterberg, Plastic limits, etc.)

4 Cinva-ram tools

Following the terms of the present report the expert has formulated a Project Document which is also being enclosed.

Annex I

Itinerary and Activities

September 7			Arrival in Entebbe
September 8	-	28	Kampala and Entebbe
September 29		30	Interviews and data gathering in Masaka
October 1	-		Mbarara
October 2	-		Kabale
October 3	-		Mbarara
October 4	-		Return to Entebbe
October 5	-		November 19 Ministry of Housing and Works, Entebbe with weekly visits to Kampala
November 20	-		Departure for Nairobi
November 21	-		UNCHS, Nairobi
November 24	-		Departure for Vienna

Annex II

Contact and Interviewers

Kampala and Entebbe

1 Ministry of Agriculture and Forestry

Mr. P.F. Kunya, Permanent Secretary

Mr J. Kahangirwe, Chief Agricultural Economist

Mr. E.K.B. Mwanga Chief Forest Officer

Mr. C.H. Lyadda, Forest Officer

Mrs. Mary Mududuli, Planning Economist

2. Ministry of Industry

Mr. A.B. Katumba, Chief Economist

Mr. Vincent Ntege, Economist

3. The Coffee Marketing Board

Mr. Z.K.R. Kaheru, Chairman/Managing Director

Mr. Bethuel Nsubuga, Chief Technical Officer

4. Ministry of Land and Water Resources

Mr Grace James Ikaaba, Director of Drilling

Mr. Saul Mboijana, Ag Deputy Commissioner
Geo Geological Survey & Mines Department

Mr Watuwa Bwobi, Acting Principal Inspector of Mines

5 Ministry of Local Administration

Mr. Francis Casasira, Permanent Secretary

Mr. Edward Ssettala, Engineer

Mr. Tom Kisawuzi, Chief Regional Inspector

Mr. Stephene Semugoma, Acting Chief Planner

Mr. James Ziwa, Rural Development Officer

6. Ministry of Planning and Economic Development
Dr. Nathan O Obore, Acting Permanent Secretary

John B. Bulinda, Principal Economist
External Aid Coordination

Mr. Jackson Ntorontyo, Economist Industry Sector

Mr Lutaya Kamya, Chief Government Development Economist

Mr. Francis Wagaba, Economist

7. Ministry of Works and Housing

Dr. A. Lubega, Permanent Secretary

Mr. D. Ntwatwa, Chief Quantity Surveyor

Mr. M. Ejupu, Deputy Chief Building Surveyor

Mr. C.L. Walakira, Principal Building Engineer

Mr. E. Male, Quantity Surveyor

Mr. Sam Kikuba, Ag Senior Architect

8. National Housing Corporation

Mr. R.W. Dronyi, General Manager

Mr. C.D.M. Sirike, Executive Officer

9. Wood Industries Corporation

Mr. B.E. Makoha, Marketing Manager

Mr. M.E. Sisomu Kagolo, Operations Manager

10. Uganda Clays Ltd.,

Dr O. Botti, Manager

111 Pan African Clay Products Ltd.

Mr. Angelo B. Matovu, Plant Manager

12. Masaka

Mr. Isaaca K.K. Muwanga, District Commissioner Masaka

Mr. N. Ruyondo, Town Clerk

13. The Experiment in International Living
Brattleboro, Vermont, USA

George Young, Representative in Uganda
P.O. Box 2831, Kampala

14 Mbarara

Balthazar Mukasa Kateete, District Commissioner

John William R. Banyu, Town Clerk, Mbarara Municipal Council

15. Kabale

Edwin David Mugumya, District Commissioner

Pantaleon Kamugarwire Zine, Treasurer, Kabale District Admin'stration

Annex III

Masonry and Roofing Equivalents

Brick size including joints (1 cm) 24 x 12.5 x 8.5cm	
545 stretcher bricks per course x 26 =	14,170
Total number of Bricks per structure:	14,170
Minus: openings (door and windows	742
Number of bricks per dwelling	13,428

Roofing.

Gabled roof at 20° with 40 cm overhang

81sq. metres per dwelling of 64 sq metres.

Annex IV

Approximate availability of Energy

District	Form E	Forest Area (hc)
Kitgum, Gulu	only wood	68,127
Apach, Lira	only wood; some rice husks	13,916
Kabale, Rukungiri	only wood	55,788
Luwero, Mukono	only wood	101,945
Mbarara, Bushenyi	saw dust; some coffee husks	97,322
Mubende	only wood	75,116
Soroti, Kumi	only savanna; woodland	13,377
Hoima, Masindi	wood; saw dust	157,365
Rakai, Masaka	coffee husks; saw dust, wood	40,585
Kapchorwa	saw dust, wood	47,049
Moroto, Kotido		120
Mpigi	coffee husks	36,787
Mbale	saw dust, wood	39,848
Tororo	rice husks	3,905
Kamuli, Iganga, Jinja	saw dust; coffee husks; rice husks, bagasse	30,373
Kabalole, Kasese, Bundibugyo	saw dust, wood; some coffee husks; rice husks	169,505
Arua, Nebbi, Moyo	some coffee husks; wood	19,337

Annex V

Pre feasibility Study

Mechanized Brickmaking Operation

MB 1 Market and Demand

Projected Demand up to 1990:

Masaka: 32,000,000 bricks 24 x 11 5 x 7.5 cm per annum

Reference: Schedule 1A

Projected demand 1990

Mbarara: 48,500,000 Bricks 24 x 11 5 x y.5 cm per annum

Reference: Schedule 1B

MB 2 Supply of Material Inputs:

Clay: locally available

Fuel: Coffee husks locally available

Estimated heat value: not known but each ton to fire 0 5. to 1 ton of bricks.

Alternate source of fuel: wood available around Masaka

Estimated heat value· 4,300 keal per kg of dry wood

or 670,800 keal per 1 cu metre

of fresh wood containing 156 kg of dry of dry substance

a) Subject to establishing reserves

Annex V

Pre-Feasibility Study

Mechanized Brickmaking Operation

MB 3 Project Engineering

Anticipated Capacity

Annual Capacity:

25,000,000 bricks

57,500 tons of fired products

Daily capacity:

83,300 bricks 24 x 11.5 7.5 cm

192 tons of fired product

MB 4 Manufacturing process:

Wet preparation

Medium soft extrusion

Drying: 7.5 million bricks by waste heat

17.5 million bricks matural (sheds)

Firing: Hofmann type kiln

Pre-feasibility Study

Mechanized Brick-making Operation

MB 5 Manpower and Management

Administrative	8
Technical	3
Clay pit	7
Manufacturing plant	48
	66

Schedule 2.

Annex V

Pre-Peasibility Study

Mechanized Brickmaking Operation

MB 6 Project Scheduling

Total planning and construction time: about 2 years

MB 7 Financial Analysis

Investment

Land and Site preparation (schedule No.3)	shs.	26,750
Civil Works (Sch. No.3, 6)	shs.	6,020,000
Total equipment cost (sch. 4e)	shs	19,394,900
Pre-investment expenses (sch. 7)	shs	385,400
Salaries and expenses during construction (sch 8)	shs.	237,250
Clay pit development (sch 9)	shs	97,920
Project expenses and fees (sch.4 e)	shs.	370,000
Office furniture and business equipment	shs.	140,000
Total	shs.	27,252,220
Contingency (10%)		2,725,222
Working capital (Anex 23)		1,502,562
	shs.	31,480,004

Annex V

Pre-feasibility Study

Mechanized Brickmaking Operation

			000'
MB 8	Production Costs		
	Operating Costs (schedule 10)	shs	6,077
	Depreciation (schedule 11)		2,240
			8,317
MB9	Operating Profit		000'
	Sales revenue, (schedule 12)	shs	75,000
	Operating cost (schedule 10)		6,077
	Depreciation, (schedule 11)		2,240
	Operating profit/Gross Profit before tax	shs	66,683

Schedule 1A

(to Annexes)

Market and Demand

Position MB 1 A	SMB 1	HB 1
Annexes: V	VI	VII

Masaka

		No of Dwelling
Total number of dwelling required as of 1990		5,871
Additional demand due to projected increase of population up to 1990		13,030
Replacement		138
Total		19,039
No of years to overcome deficit		8
No. of dwelling to be built per annum		2,380
No of Bricks required per dwelling of 64 m^3*		13,428
No. of Bricks required per annum		31,958.640
	Say	32,000,000

*See Annex III

Schedule 1B

(to Annexes)

Market and Demand

(MB 1, SMD 1 HB 1)
V VI VII

Mbarara

	Minimum	Maximum
	No. of Dwellings	
Current backlog	1,452	3,654
Additional demand due to projected increase of pol population up to 1990	23,147	26,556
Replacement	1,291	1,291
Total to be	25,890	31,501
Average	28,696	
No. of years to overcome deficit	8	
No. of dwellings to be built p.a	3,587	
No. of bricks required per dwelling of 64 m^3 •)	13,428	
No. of bricks required per annum	48,166,236	
Say	48,500,000	

•) See Annex III

Schedule 2 A

Mechanized Brickmaking Operation

Personal requirement for Manpower

Plant	S	SS	NS	I
Manufacture and loading of racks	2	-	6	8
Setting packs for Kiln	2	10	-	12
Drier Foreman	1	-	-	1
Fork-lift driver (drier)	2	-	-	2
Fork-lift driver (Kiln)	5	-		5
Mechanics	3	-		3
Electricians	2	-	-	2
Kiln Foreman	4	-	-	4
Yard foreman	1	-	-	4
Night Watchman	-		4	4
Laboratory hand	-	1	-	1
Kiln Foreman	4	-	-	4
Yard foreman	1	-	-	4
Night Watchman			4	4
Laboratory hand	-	1	-	1
Common Labour	4	-	-	4
Janitor	-	-	1	1
Clay pit				
Pit Foreman	1	-	-	1
Excavator operation	1	-	-	1
Truck Drivers	3	-	2	2
Common Labour				
Totals	31	11	13	55

Schedule 2B

Mechanized Brickmaking Operation

Personal requirement for manpower and Management; Wages and Salaries

Administration:		Salaries per annum	
Managing Director	1	shs	84,000
Sales Manager	1		66,000
Accountant	1		66,000
Cashier	1		35,000
Secretary	1		30,000
Invoicing	1		16,000
Time Keeper	1		16,000
Storekeeper	1		16,000
		shs.	329.000

Technical Management			
Plant Superintendent (Engineer)	1	shs.	66,000
Chief of Controls	1		35,000
Maintenance Engineer	1		48,000
Production Foreman	1		30,000
Total	4		179,000

Schedule 3

Mechanized Brickmaking Operation

	M^3	shs/M^3		shsTotal
Land	51,000	2.25	1)	114,750
Site preparation	51,000	12		612,000
Civil Work				
Covered area a)	15,000	3,000	2)	4,500,000
Covered area b)	350	4,000		1,400,000
			shs.	6,626,750

a) Concrete columns 6 m high, wooden trussed roof, concrete floor 10 cm, galvanized iron roof

b) Solid walled, wooden rafters, galvanized tin roof false ceiling; 75 m^2 sanitary installation comprise 6 showers 6 washing, 6 bowls, 6 urinals, 55 steel lockers.

1) based on estimate secured in the field varies with location

2) supplied by Ministry of Works and Housing

Schedule 4a

Mechanized Brickmaking Operation,Cost of Equipment

Preparation and production equipment		
2 Box feeders		
4 Apron conveyors		
4 High speed rolls		
2 Screening mixers		
2 Extrusion machines with vacuum pump		
4 extrusion dies		
2 rolls grinding machines		
Total	shs	5,500,000
utting, loading and unloading equipment		
2 automatic brick cutters		
2 belt conveyor		
2 separating belt conveyor		
24 meter roller conveyor for racks		
Total	shs	500,000

Schedule 4b

Mechanized Brickmaking Operation , Cost of equipment

Drying:				
1 Waste heat - 4 chambers drier				
Imported equipment	shs	1,000,000		
Local material & labour		800,000	shs	1,800,000
2 fork-lift trucks			shs	400,000
Drying racks			shs	1,500,000
Total				3,7000,000

Schedule 4c

Mechanized Brickmaking Operation , Cost of Equipment

Firing			
2 Hofmann - type kilns,			
open heads for fork - truck loading			
Imported equipment		1,700,000	
Building materials & Labour	shs	600,000	shs 2,300,000
5 Fork-lift trucks			shs 1,000,000
			shs 3,300,000
Machine shop equipment a)			180,000
Utilities			shs 750,000
Water well b)		shs 100,000	
Water pump b)		50,000	
400 K V A substation		300,000	
Electrical wiring c)		180,000	
Piping and ducting d)		120,000	

a) 3% of ex-factory cost of equipment

b) Personal information, Water Development Dept

c) 3% of ex-factory cost of equipment

d) 2% of shs 6,000,000 as per schedule 4 d

Schedule 4 d

Cost iof Equopment

Mechanized brickmaking equipment

Winning and hauling equ'pment

1 - 60 tons per hour excavator/loader	shs 858,000
3 - 10 tons diesel trucks	shs 632,000
Total	shs1,490,000

Schedule 4 e

Mechanized Brickmaking Operation

Total Equipment Cost

Winning and transport equipment (schedule 4d)		1.490,000
Preparation and production equipment (schedule 4a)		5,500.000
Cutting and loading equipment (schedule 4a)		500,000
Drying equipment (schedule 4b)		3,700,000
Firing equipment (schedule 4c)		3,300,000
Utilities (schedule 4c)		750,000
Installation expenses, Local (sch.5)		257,400
Installation cost, foreign (sch.22)		1,620,000
Spare parts (sch. 17)		264,500
Freight and delivery (schedule 17)		2,013,000
Total	shs	19,394,900
Project expenses (Final drawings for construction and installation)		220,000
Civil engineering fees		150,000
	shs	370,000

Schedule 6

Mechanized Brickmaking Installation

Installation Expenses:

Concrete foundations for equipment and kilns

(2% of ex-factory cost as per schedule 4.) shs 120,000

Schedule 6

Mechanized Brickmaking Operation

Installation of equipment: Labour

		Period man months	Salary shs	Total shs
1	Counterpart engineer (later plant superintendent)	12	5,000	60,000
1	Manufacturing foreman	12	2,500	30,000
2	Mechanics	24	2,000	48,000
2	Electrican	24	2,000	48,000
1	Hofmann Kiln foreman	6	1,500	9,000
2	Skilled labour	24	1,500	36,000
2	Unskilled Labour	24	1,100	26,400
				shs257,400

Schedule 7

Mechanized Brickmaking Operation

Pre-investment and preparatory expenses

	Period man months	Salary shs/month	Total shs
1 Managing Director	12	6,000	72,000
1 Secretary	12	2,500	30,000
1 Cashier - Book-keeper	12	4,000	48,000
1 Draftsman/engineer	12	3,000	36,000
Consultation fees			75,000
Rent of office space	12 months)		14,400
Incidental expenses			40,000
Foreign Travel expenses			70,000
Total		shs	385,400

Schedule 8

Mechanized Brickmaking Operation

Salaries and expenses during the Consturction period

	Man month	Salary	Total
1 Managing Director	12	7,000	84,000
1 Secretary	12	2,500	30,000
1 Cashier/book-keeper	12	4,000	48,000
1 Draftsman	12	3,000	36,000
1 Store Keeper	12	1,500	18,000
1 Electric Energy used during construction (a)	12		21,250
Total			237,250

(a) 125,000 KWH x shs 0.17 = $21.250

Schedule 9

Mechanized Brickmaking Operation

Clay pit development expenses

	Man months Total	Salary shs	Total shs
1 Clay pit foreman	6	2,000	12,000
2 Unskilled labour	12	1,200	14,400
1 Truck driver	6	1,500	9,000
1 Excavator operator	6	2,000	12,000
Fuel for Truck and Excavator a) 12,000 litres at shs 4.21			50,520
Total			97,920

a) Trunk: 20 l diesel per day x 150 = 3,000 litres

Excavator: 60 l diesel per day x 150 = 9,000 litres

Total 12,000

Schedule 10

Mechanized Brickmaking Operation

Operating Cost	
Clay, (schedule 13)	314,000
Fuel (sch.14)	2,587,000
Power (sch.15)	635,375
Water (sch.16	8,250
Spare parts & supplies (sch.17 a)	304,175
Labour (sch. 18	1,170,600
Administration expenses(schd 2B)	329,000
Technical Management (sch 2B)	179,000
Oil and Diesel oil for trucks and excavators (sch 21)	382,850
Amortization of Clay pit development expenses (sch.9)	4,896
Office supplies and stationary	100,000
Amortization of pre-investment and construction period expenses c) sch7,8)	62,229
Total Operating Cost	6,077,375

a) plus 15% for freight and delivery

b) 5% per annum on shs 97,920 (sch 9)

c) 10% per annum on shs 622,900 (sch 7,8)

Schedule 11

Depreciation

10% per annum of shs 19, 394, 900 (schd.4 e) equipment	shs	1,939,490
5% per annum of shs 6,020,000 (Civil Work, Sch 3)		301,000
	shs	2,240,490

Schedule 12

Mechanized Brickmaking Operation

Sales Revenue

25,000,000 bricks per annum x shs 3 = shs 75,000,000

25,000,000 bricks per annum x shs 1.35 = shs 33,750,000

25,000,000 bricks per annum x shs 0.68 = shs 17,000,000

Schedule 13

Mechanized Brickmaking Operation

Clay:

25,000,000 Bricks per annum x 3.14 m^3 per 1000 =
78.500 m^3 x sh 4 per m^3 a) = shs 314,000

a) assumed rayalty of sh.8 per m^2 and 2m depth of clay stratum

Schedule 14

Mechanized Brickmaking Operation

Fuel (Coffee husks)

57,500 tons of bricks of 150[a] kg

of husks = 8,625 tons of husks

8,625 x shs 300[a] = shs 2,587,500

a) Personal communication, Mr. O. Botti, Uganda Clay, Ltd. Kampala (The actual figure given was 1 - 2 tons of husks per ton of fired product)

Schedule 14 A

Mechanized Brickmaking Operation

Fuel (wood)(alternate source)

57,500 tons of brick x 780,000 = $\frac{800\text{'Calories}}{44,850}$

$\frac{780,000 \text{ Keal}}{4,300 \text{ Keal/Kg}}$ = 181,395 Kg dry wood per ton of bricks

$\frac{780,000 \text{ Keal per ton of Brick}}{670,800 \text{ Keal per } 1M^3 \text{ of raw wood}}$ 1.163 m^3 per ton of product

57,500 tons x 1.163 m^3 = 66,676 m^3 raw wood

66,873 x shs 90•) = shs 6,018,525

•) Masaka Cost

Schedule 14 B

Mechanized Brickmaking Operation

Fuel (oil)		(000' calories)
57,500 tons of bricks x 780,000	=	44,850,000
780,000 keal per ton of bricks / 9,200 keal	=	85 litres oil per ton of bricks

57,500 tons x 85 = 4,887,500 litres

4,887,500 x 3.50 = shs 17,106,250

$$\frac{\text{shs } 17,106,250}{25,000} = \text{shs } 684,25/1000 \text{ bricks}$$

Schedule 15

Mechanized Brickmaking Operation

Power:

65 Kwh per ton of fired product

57,500 tons x 65 = 3,737,500 KWh per

3,737,500 KWh x shs 0.17 = shs 635,375

Cost of power at usual Third World rate of $0 035 per KWh

shs 0.2566 KWh

Schedule 16

Mechanized Brickmaking Operation

Water:

1 cu. metre per 1000 green bricks

27,500,000 green bricks x $1m^3$ =

27,5000 m^3 per annum x shs 0.3 [a)] = shs 8,250

a) only running expenses considered, maintenance, depreciation considered elsewhere

Schedule 17

Mechanized Brickmaking Operation

Spare parts

2% of ex-factory price of making equipment(sh6,000,000)	sh	120,000
5% of ex-factory price of winning and transport equipment (shs 2,890,000)	sh	144,500
Total		264,500

Freight and Delivery of Equipment 15% of ex-factory prices a)

Winning and hauling equipment (sch.4 a)	shs.	1,490,000
Making equipment (sch. 4 a)		6,000,000
Cutting, etc. equipment (sch. 4a)		500,000
Drying equipment (sch. 4B)		2,200,000
Hofmann kiln equipment (sch.4c)		2,700,000
Machine shop equipment (sch 4c)		180,000
Substation and Water pump (sch.4 c)		350,000
		13,420,000

shs 13,420,000 x 0 15 = shs2,013,000

Schedule 18

Mechanized Brickmaking Operation

Labour

As per Schedule 2

		Wages per day shs.	Wages per annum shs	Totals shs
31	Skilled labour	85	25,500	790,500
11	Semiskilled labour	62	18,600	204,600
13	Un-skilled labour	45	13,500	175,500
				1,170,600

300 days/annum

Schedule 19

Mechanized Brickmaking Operation

Administration Expenses

Office Supplies and Stationary	shs 100,000

Schedule 21

Mechanized Brickmaking Operation

Fuel and Oil for Excavator

diesel trucks and fork-lift trucks

	Amount litres	Unit Cost, shs.	Total
Excavator/loader			
60 litre diesel oil/day x 250	15,000	4,21	63,150
Trucks			
20 litres/day x 250	15,000	4,21	63,150
Fork-lift trucks			
20 litres gasoline per day x 7 x 250	35,000	7,33	256,550
Total		shs	382,850

Schedule 22

Mechanized Brickmaking Operation

Erection by foreign technicians	Period(Months)
1 Technician for total erection, start-up and testing	12
1 Technican for the installation of making equipment	6
1 Mechanic for the installation of drier and kiln	4
1 Electrican	2

Total cost of foreign personnel shs	1,500,000
Travel expenses (4 round-trip tickets Europe - Uganda	120,000
	1,620,000

Schedule 23

Mechanized Brickmaking Operation

3 months of operating cost

Working Capital

Total Operation Cost (Sch.10)	shs	6,077,375
Less Ammortizations	shs	67.125
		6,010,250

$$\frac{\text{shs } 6{,}010{,}250 \times 3}{12} = \text{shs } 1{,}502{,}562$$

Annex VI

Pre-feasibility Study

Semi-Mechanized Brickmaking Operation

SM B1 Market and Demand

As MB1, Annex V

SM B2 Supply of Material Inputs

Same as MB 2, Annex V

SM B3 Project Engineering

Annual Capacity:

3,600,000 bricks 23 cm x 11 5 cm x 7.5 cm 9900 tons

Daily capacity:

12,000 bricks 23 cm x 11.5 cm x 7 5 cm 33 tons

SM B4 Manufacturing process:

Wet preparation

Soft extrusion

Drying: natural in sheds

Firing: Up-draft scove kilns

ANNEX VI

Pre-feasibility Study

Semi-Mechanized Brickmaking Operation

SMB 5 Manpower and Management

Administrative	4
Technical	3
Clay winning	14
Manufacturing	22
	43

As per schedule 2

SMB 6 Project Scheduling

Total planning and installation time: about 18 months

Annex VI

Pre-feasibility Study

Semi-Mechanized Brickmaking Operation

SMB 7 Financial analysis

Investment

Land and site preparation(sch. 3)	shs	57,000
Civil Works (sch.3)		607,260
Equipment (sch.3)		3,360,510
Wooden Pallets		424,000
Pre-investment and preparatory expenses (sch. 6)		309,600
Wages and Salaries during construction (sch.7)		120,000
	shs	4,878,370
Contingency (10%)		487,837
Working capital (sch.20)	shs	706,932
	shs	6,073,139

Annex VI

Pre-feasibility Study

Semi-Mechanized Brickmaking Operation

			000'
SMB 8	Production Cost:		
	Operating Cost (sch. 9)	shs	2,877
	Depreciation (sch. 1A)		447
	Production Cost		3,324

Operating Profit

	Sales revenue (sch. 1)		10,800
	Operating Cost (sch.9)		2,877
D	Depreciation (sch.1 B)		447
	Operating profit/Gross profit before tax	shs	7,476

Schedule 1

Semi-Mechanized Brickmaking Operation

Total Yearly Revenue 000'

3,600,000 bricks x shs 3 = 10,800

Schedule 1A

Depreciation

Equipment as per schedule 4 b (less shs 5,740 for tools) shs 3,354,770 10% per annum	shs.	335,477
Pallets, shs 424,000 (sch.4a) 20% p.a.	shs	82,800
Buildings, shs 575,000, (sch.3) 5%p.a.	shs	28,750
	shs	447,027

Schedule 2

Semi-Mechanized Brickmaking Operation

Personnel requirement for Manpower

	S	NS	T
Clay winning	-	14	14
Clay preparation	1	-	1
Moulding and off-bearing		1	1
Transport to Driers		4	4
Transport to kiln		2	2
Hacking	2	6	8
Firing and fuel carrying	4	2	6
Total			
Maintenance and Supervision			
Electrician/Mechanic	2	-	2
Foreman	1	-	1
Total	10	29	39

Administration	
Manager	1
Cashier/Accountant	1
Secretary/Invoicing	1
Time keeper/Store keeper	1
	4

Schedule 3

Semi-Mechanized Brickmaking Operation

Land and Site preparation

Land		
$4{,}000m^2$ x shs 2.25	=	shs 9,000
Site preparation $4{,}000m^2$ x shs 12	=	48,000
Total		shs 57,000

Civil Works		
Drying sheds $1300m^2$ x shs 200	=	shs260,000
Manufacturing building 550 m x 300	=	165,000
Works offices 100 m^2 x aha 1,500	=	150,000
		shs575,000

Foundations and Supports	
(2% of ex-factory costs shs. 1,613,000 as per schedule 4)	shs 32,260
Total Civil Engineering	shs607,260

Schedule 4a

Semi-Mechanized Brickmaking Operation

Equipment

Making Equipment

1 Box feeder	shs	220,000
1 Roller		62,000
1 Double-shaft mixer		191,000
1 Extruder, (non-dearing)		515,000
1 Cutter		154,000
3 Slat conveyors		396,000
1 off-bearing belt conveyor		75,000
	shs	1,613,000

Drying equipment

6 lifting pallet transporters	shs	250,000
800 wooden pallets x shs 530 80 x 100 cm		424,000
	shs	674 000

Office equipment and business machines

	shs	100,000
Machine Shop equipment	shs	100,000

Equipment Cost (summary)

Making equipment	shs	1,613.000
Drying equipment		250 000
Office equipment		100.000
Machine shop equipment		100,000
Water pump		70,000
Substation		100,000
Spare parts		44,260
Tools		5,740
Installation, Local (sch 5)		135,060
Installation, foreign (sch 5)		603,000
Freight and delivery (sch 14)		339,450
	shs	3,360,510

Schedule 5

Semi- Mechanized Brickmaking Operation

Installation Cost (local)

Labour:

	Period Man months	Salary shs	Total shs
1 Engineer	6	5,000	30,000
1 Mechanic	6	4,000	24,000
1 Electrician	6	4,000	24,000
2 Skilled labour	6	3,000	18,000
			96,000

Installation Cost (foreign)

1 Engineer 6 month	shs	375,000
1 return air ticket	shs	30,000
Living expenses, shs. 1100 x 180	shs	198,000
		603,000

Electric Energy used during Construction

40,00 KWH x shs 0.17 =	shs	6,800

Materials and tools used in erection

2% of ex-factory cost of equipment shs 1,613,000 (sch 4a)	shs	32,260

Schedule 6

Semi-Mechanized Brickmaking Operation

	Period man month	Salary shs	Total shs
1 Manager	12	6,000	72,000
1 Secretary	12	2,500	30,000
1 Cashier - Bookkeeper	12	4,000	48,000
1 Draftsman/Engineer	12	4,000	48,000
1 Storekeeper	6	2,000	12,000
Consultation fees			35,000
Rent of office space	12		9,600
Foreign Travel			35,000
Incidental expenses			20,000
			309.600

Schedule 7

Semi-Mechanized Brickmaking Operation

Wages, Salaries and expenses during con-Construction period

	man months	salary shs	Total shs
1 Manager	6	6,000	36,000
1 Secretary	6	2,000	15,000
1 Cashier/Bookkeeper	6	4,000	24.000
1 Draftsman	6	3,000	18,000
1 Storekeeper	6	2,000	12.000
Office supplies etc.			15.000
			120,000

Schedule 8

Semi-Mechanized Brickmaking Operation

Utilities

Water pump and piping a)	shs 70,000
100 K V A Substation	shs 100,000
Electrical wiring b)	shs 48,000

a) No well necessary, river nearby

b) 3% of ex-factory cost of equipment ($1,613,000)

Schedule 9

Semi-Mechanized Brickmaking Operation

Operating Cost

Clay (sch. 10)	shs 45,216
Fuel (sch. 11)	1,757,250
Power (sche.12)	92,565
Water(sch. 13)	1,296
Spare parts (sch.14)	44,260
Labour (sch 15)	570,000
Administration (sch.16)	178,000
Technical Management (sch 17)	90,000
Office supplies and stationary (sch.18)	50,000
Ammortization of pre-investment and construction period expenses a)	42,960
Tools (sch.19)	5,740
	2,877,287

a) 10% on a total of shs 429,600 (schedule 6,7)

Schedule 10

Semi-Mechanized Brickmaking Operation

Clay

3,600 thousand bricks per annum
x 3 14 m^3 of clay per 1000
11,304 m^3 x shs 4 [a] per m^3 = shs 45,216

a) assumed royalty shs 8 per m^2
and 2 m depth of clay strata.

Schedule 11

Semi-mechanized Brickmaking Operation

Fuel (Wood)

9,900 tons per annum
x 1.42 m^3 wood per ton of product
14.058 m^3 x shs 125 = shs 1,757,250

Schedule 12

Semi-Mechanized Brickmaking Operation

Power

55 KWH per ton of fired product per annum
9,900 tons x 55 KWH = 544,500 KWh x shs 0.17 = shs 92,565

Schedule 13

Semi-Mechanized Brickmaking Operation

Water

1 cubic metre per 1000 green bricks
4,320 [a] thousand x 1 = 4.320 m^3 x shs0 3 [b] = shs 1,296

a) 20% over production due to losses
b) only running cost estimate:maintenance and depreciation considered elsewhere

Schedule 14

Semi-Mechanized Brickmaking Operation

Spare parts (2% of ex-factory cost)

Making equipment	shs	1,613,000
Drying equipment		250,000
Office equipment		100,000
Machine shop equipment		100,000
Water pump		50,000
Substation		100,000
		2,213,000

shs 2,213,000 x 0.02 = shs 44,260

Freight and delivery (15% of ex-factory cost)

Cost of equipment as above	shs	2,213,000
plus: spare parts		44,260
Tools		5,740
	shs	2,263,000

shs 2,263,000 x 0.15 = shs 339,450

Schedule 15

Semi-Mechanized Brickmaking Operation

Cost of Labour

(according to schedule 2)

	Wages per day shs	shs per annum	Total shs
7 Skilled workers	85	25,500	178,500
29 Non-skilled workers	45	13,500	391,500
		shs	570,000

Schedule 16

Semi-Mechanized Brickmaking Operation

Administration

(as per schedule 2

	Salary per annum
Manager	shs 72,000
Cashier/Accountant	60,000
Secretary	30,000
Time keeper/Storekeeper	16,000
	178,000

Schedule 17

Technical Management and Supervision

(as per schedule 2)

	Salary per annum shs
1 Electrician	30,000
1 Mechanic	30,000
1 Foreman	30,000
	shs 90,000

Schedule 18

Office supplies and stationery

SHS 50,000

Schedule 19

Semi-Mechanized Brickmaking Operation

14 Picks	shs	840
14 Shovels		1,400
10 Wheel barrows		3 500
	shs	5,740

Schedule 20

Semi-Mechanized Brickmaking Operation

Working Capital (3 month operating cost)

Total operation cost (Schedule 9	Shs. 2,877,287
less: Ammortizations (schedule 9) -	42,960
	Shs. 2,834,327

$$\text{Shs. } \frac{2,834,327}{12} \times 3 = \text{Shs. } 708,582$$

Annex VII

Pre-feasibility Study

Handicraft Brickmaking Operation

HB 1 Market and Demand

Same as per MB1 in Annex I

HB 2 Supply of Material Inputs

Same as per MB 2 in Annex V

HB 3 Project Engineering

Annual Capacity

basic unit 3,000,000 bricks per year
10, 200 tons per year

Daily Capacity

basic unit 10,000 bricks per day
34 tons per day

HB 4 Manufacturing process

Slop-moulding by hand
natural drying in sheds
Firing in up-draft scove kilns

...../..

Annex VII

Pre-Feasibility Study

Handicraft Brickmaking Operation

MH 5 Manpower and Management

Administrative	3
General Labour	54
Total	57

Schedule 1

.../..

Annex VII

Pre-Feasibility Study

Handicraft Brickmaking Operation

HB 6 Project Scheduling

Total planning, Site-preparation and training time 6 months

HB 7 Financial analysis

Investment Cost

Land and site preparation (Schedule No.2)	Shs.	114,000
Buildings (Schedule No.3)	Shs.	184,560
	Shs.	298,560
Contingency (10%)		29,856
	Shs.	328,416
Working cpital *)	Shs.	737,780
Total Investment cost	Shs.	1,066,196

*) 3 months operating cost = Shs. $\frac{2,951,200}{12} \times 3$

.../..

Annex VII

Pre-Feasibility Study

Handicraft Brickmaking Operation

HB 8 Commercial Profitability

Sales Revenue

3,000,000 bricks per annum x Shs. 1.40 =	Shs.	4,200,000

Operating Cost

Clay (Schedule 5)	37,680
Fuel (Schedule 6)	1,810,500
Labour (Schedule 7)	1,068,400
Water (Schedule 8)	10,000
Tools and implements (Schedule 4D)	24,620
Amortization of Training Expenses, Shs. 198,177 (Schedule 4) at 20% per annum	39,635
Amortization of site preparation cost (Schedule 2) at 10% per annum	9,600
Production loss (Schedule 9)	295,120
	3,295,555
Depreciation *)	
Shs. 184,560 (Schedule 3) x 0.05 -	9,228
Operating Profit Shs.	895,217

*) 5% per year

Schedule 1

Handicraft Brickmaking Operation

Personnal requirement for manpower

	Number
Clay winning	14
Clay preparation	6
Clay transport to moulders	2
Moulding	12
Stacking-up for firing	2
Trar ort to kilns	4
Hacking	8
Firing	3
Fuel carriers	3
Total	54

Total Labour per 1000 bricks = 43.2 man hours

Administration and Supervision

Administrator/Shipment Clerk	1
Foreman	1
Time-keeper and Payroll Clerk	1
Total	3

Schedule 2

Annex VII

Handicraft Brickmaking Operation

Land and Site Preparation:

Land:	8000 m^2 X Shs.2.25	=	Shs. 18,000
Site Preparation:	8000 m^2 x Shs.12	=	Shs. 96,000
			Shs.114,000

Schedule 3

Handicraft Brickmaking Operation

Buildings

192 m^2 of Sheds x Shs. 180	=	Shs. 34,560
50 m^2 of works offices x Shs.3000	=	150,000
		Shs.184,560

Schedule 4

Handicraft Brickmaking Operation

Preparatory and training period expenses

Summary:

Wages, trainees and instructors (Schedule 4 A)	Shs.	198,800
Clay (Schedule 4B)		7,536
Fuel (wood) Schedule 4C)		380,125
Tools and molds (Schedule 4D)		12,310
Total	Shs	598,771
Total revenue from brick sold 400,000 x Shs.1.00		400,000
Operating loss	Shs.	198,771

Schedule 4A

Handicraft Brickmaking Operation

Training period expenses:

Trainees:

	Number	Period/months	Total man-months
Moulding	12	4	48
Hacking	8	3	24
Firing	3	2	6
Clay winning	6	4	24
Clay preparation	2	4	8
General Labour	3	4	12
Total manpower			122

Wages of instructors:

Moulding	1	4	4
Hacking	1	3	3
Firing	1	2	2
Foreman	1	5	5
			14

122 man-months at Shs. 1,400	Shs.	170,800
14 man-months at Shs. 2,000		28,000
	Shs.	198,800

Schedule 4 B

Handicraft Brickmaking Operation

Training period expenses:

Clay

Calculated total output	=	400,000 bricks
To be manufactured	=	600,000
600 x 3.14 m^3	=	1,884 m^3
1,884 x Shs.4	=	Shs.7,536

Schedule 4 C

Handicraft Brickmaking Operation

Training Period Cost

Fuel

Estimated number of bricks to be burned during training period	600,000
Total weight of burned product	2040 tons

Total heat required:

2.040 x 1,000,000 K cal = 2,040,000 Kcal

Heat value of wood:

156 kg. x 4,300 Kcal = 670,800 Kcal per m^3

Cost of wood per m^3 = Shs. 125

Total cost of wood per 600,000 bricks

3,041 m^3 x Shs.125 = Shs. 380,125

Schedule 4D

Handicraft Brickmaking Operation

Training period expenses:

Tools

6 Buckets (Shs. 200)	Shs. 1,200
12 Picks (Shs 60)	720
12 Shovels (Shs. 100)	1,200
10 Wheelbarrows (Shs.350)	3,500
240 wooden molds (Shs.50)	12,000
Polythene sheet	6,000
Total	Shs.24,620

Estimated life 12 months.

Schedule 5

Handicraft Brickmaking Operation

Cost of Clay

3,000,000 Bricks x 3.14 = 9,420 m^3 x Shs. 4.00

= Shs. 37,680

Schedule 6

Handicraft Brickmaking Operation

Fuel

10,200 tons of brick per annum

1.42 m^3 wood per ton of product

14,484 m^3 x Shs.125 = Shs. 1,810,500

Schedule 7

Handicraft Brickmaking Operation

Labour Cost

54 workmen x Shs. 62 x 300	=	Shs. 1,004,400	
1 Administrator/Shipment Clerk		Shs. 24,000	
1 Foreman		Shs. 24,000	
1 Time-keeper and payroll Clerk		Shs. 16,000	Shs.64,000
Total manpower		Shs. 1,068,400	

Schedule 8

Handicraft Brickmaking Operation

Cost of water

1 cu.mt. at Shs. 10 *) per thousand bricks

3,00 x Shs.10 = 10,000

*) For water carried in drums etc.

Schedule 9

Handicraft Brickmaking Operation

Cost of production losses

Total loss = 10% of production	=	300,000 bricks
Clay = Shs $\frac{37,680 \times 300}{3,000}$	= Shs.	3,768
Fuel = Shs. $\frac{1,810,500 \times 300}{3,000}$	= Shs.	181,050
Labour = Shs. $\frac{1,068,400 \times 300}{3,000}$	= Shs.	106,840
Water = Shs. $\frac{10,000 \times 300}{3,000}$	= Shs.	1,000
Tools = Shs. $\frac{24,620 \times 300}{3,000}$	= Shs.	2,462
Total	Shs.	295,120

Annex VIII.

Lime and Limestone in Uganda

Location	District	Mineral Observation	Observation
1	2	4	5
Bufumbo	Bugisu	Secondary Limestone Calcareous tuffs	
Buyobo	Bugisu (Mbale)	Secondary Limestone Calcareous tuffs	
Dura River	Toro	Tufas and travertines	Small scale Lime production
Lwenkorebe	Toro	Tufas and travertines	
Hima	Toro	Lake limestone	Big Lime Producer
Kigezi crater	Ankole	Limestone and Marbles	
Kisoro	Kigezi	Secondary Limestones	Lime works by small scale workers
Kyamwiga Lake	Ankole	Secondary Limestones	
Moroto	Karamoja	Marbles	
Moroto Lokintanyala Road	Karamoja	Marbles	
Muhokya	Toro	Calrete and Tufas	Lime is produced by small scale mines
Napak	Karamoja	Carbonatite	
Ndorwa Village	Kigezi	Tufas	
Ogili Mountain	Acholi	Kunkars	

Annex VIII. (Cont'd)

Lime and Limestone in Uganda

Location	District	Mineral Identification	Observation
1	2	4	5
Gweri Hill	Madi	Limestone Dolomite	Dolomites predominant Lime manufacture
Rubabo	Kigezi	Tufas	
Tororo	Karamoja	Carbonatite	
Sukulu	Bukedi	Carbonatite	
Tororo	Bukedi	Carbonatite	Cement manufacture
Kabale	Kigezi	Secondary limestones	Lime manufacture
Kaf. River Bridge	Mengo	Kunkars	
Katinda Crater	Ankole	Siliceous limestones	
Pududa (Pukiribo Hill	Bugisu	Carbonatite	Potential producer

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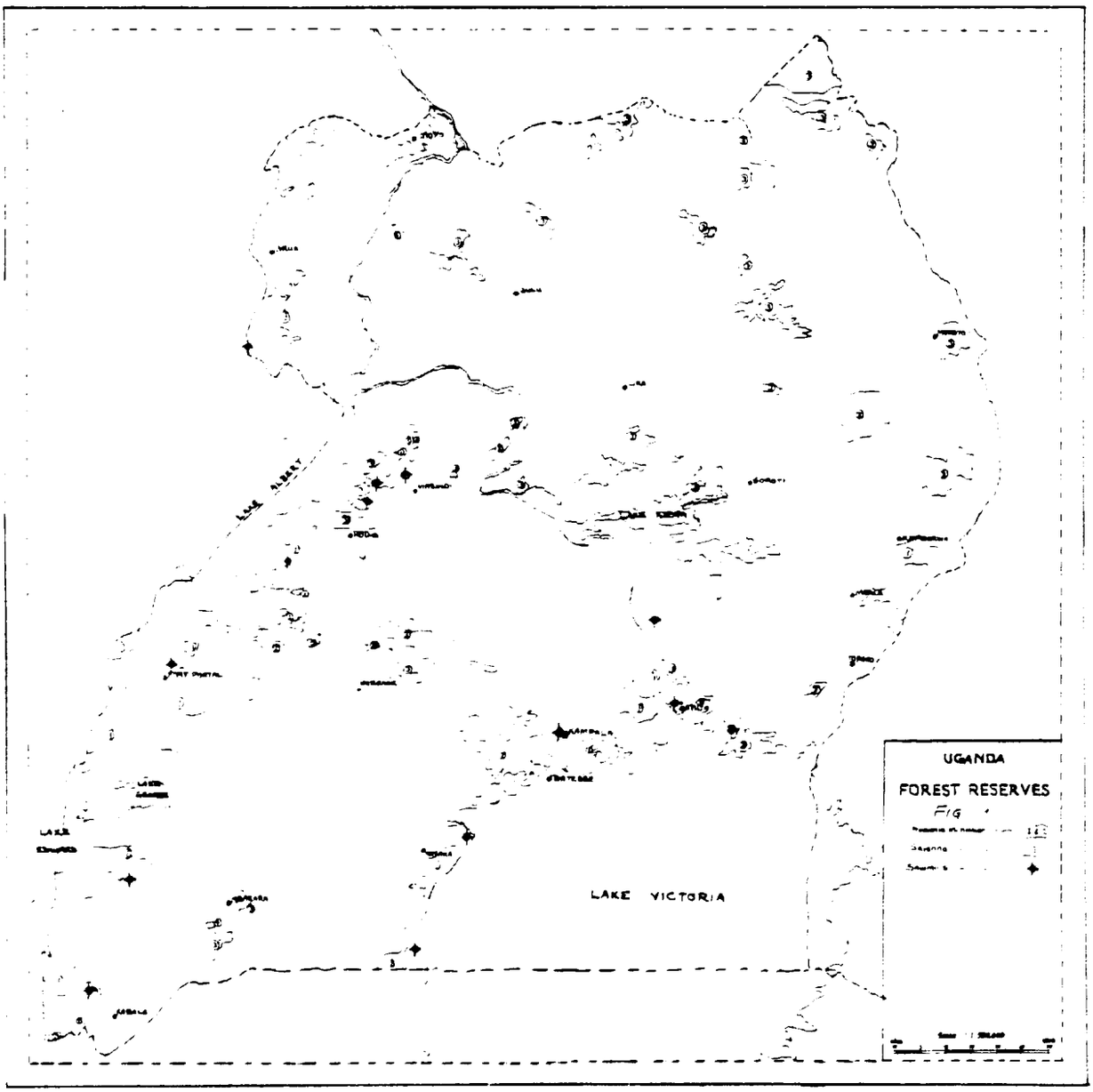
UGANDA
FOREST RESERVES
FIG
LAKE VICTORIA

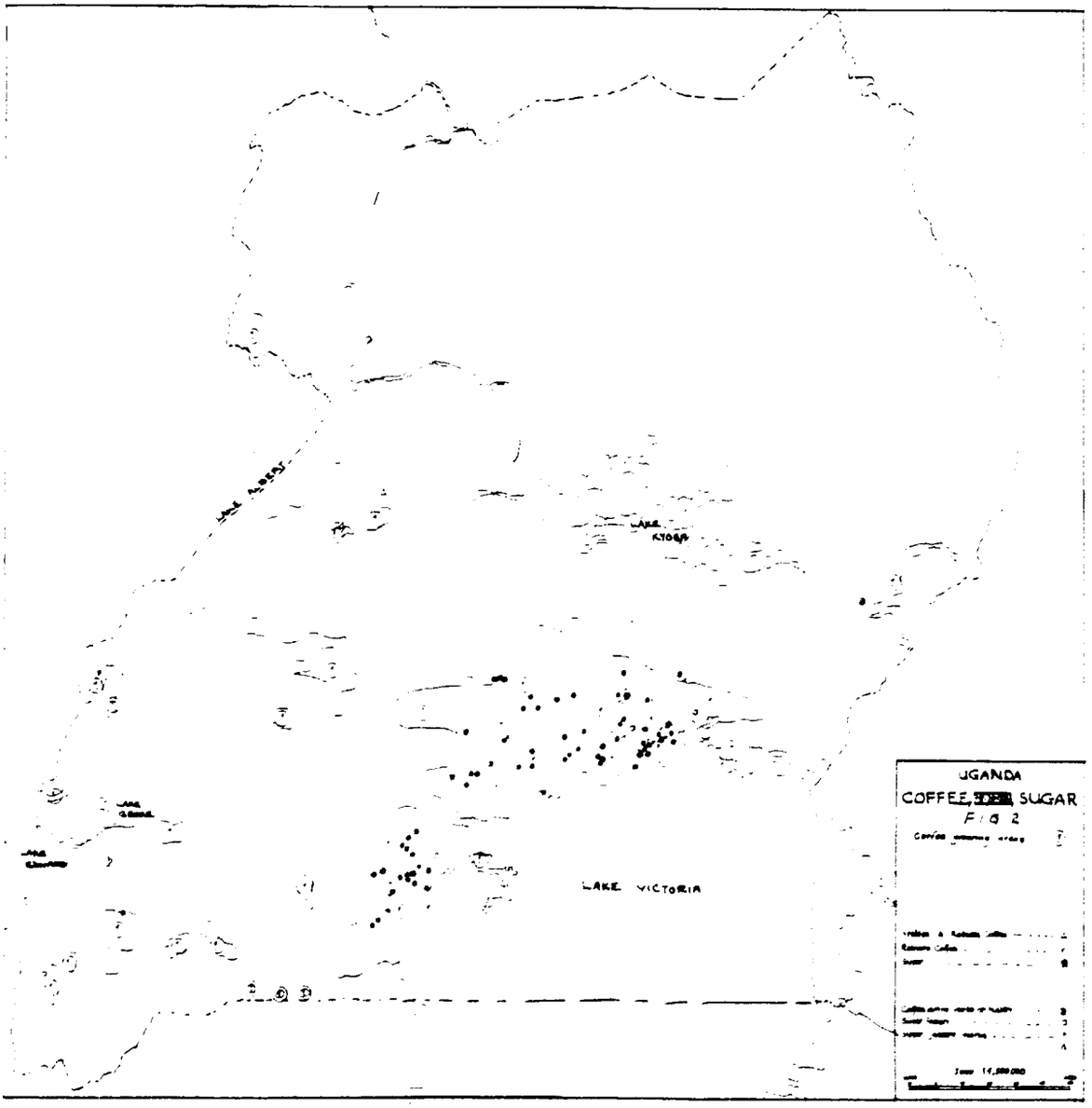
LAKE VICTORIA
UGANDA
COFFEE, SUGAR
FIG 2

FIG. 3

HANDICRAFT BRICK YARD LAYOUT