Note on
BUILDING BLOCKS MADE OF STABILISED LATERITE

A cost analysis to evaluate the applicability of a production of low-cost lime-laterite building blocks in Kenya.

Nairobi
The cost figures shown in the table on page 1 refer to the cost of lime only. It seems a fair assumption that the actual cost of the blocks will be 120 - 130% of the cost of the lime only. Blocks in stabilised laterite will then range in cost from approximately 110 to 180 shs per m², or from 10 to 30% higher in cost than 'ordinary' concrete blocks made from crushed stone aggregate and Portland cement.

The above sketched state of affairs will, of course, be more favourable in countries where the cost of powdered lime is only a fraction of the cost of Portland cement.

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Building Blocks Made of Stabilised Laterite

Reference: Paper on production of building stone in developing countries by Ole Kihlerich and others, published by the National Union of Danish Students, Kaastrupade 5, 1210 Kopenhagen K, Denmark.

The process described in the above paper may lead to the production of low-cost lime-laterite building blocks in some developing countries. However, a simple cost analysis shows that the process, when applied in Kenya, would produce blocks which cannot, economically, compete with concrete blocks.

The price for concrete blocks in the Nairobi area is approximately 100.- shs. per m$^2$. Price of Portland cement (locally produced) is app. 280.- shs. per ton, whereas the cost of cement represents app. 60% of the cost of the blocks.

The retail price of powdered lime (locally produced in Mombasa) is 375.- shs. per ton, or about 33% above the price of Portland cement. It can be assumed that this price could be lowered by about 20% in case of large scale demand.

Proper experiments would be required to ascertain the actual volume of blocks which could be produced out of a certain weight of laterite with a certain weight of lime and water added, but it seems a fair assumption that the density of the blocks produced will be in the range of 1800 to 2000 kg/m$^3$ (light to medium compaction).

Based on these assumed densities the calculations given in detail in the Appendix show the following results of quantities and cost of lime only per m$^2$ of blocks:

<table>
<thead>
<tr>
<th>Percentage (weight) of lime added to laterite</th>
<th>Block density in kg/m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800</td>
</tr>
<tr>
<td>16%</td>
<td>240 kg</td>
</tr>
<tr>
<td></td>
<td>90 shs</td>
</tr>
<tr>
<td>24%</td>
<td>332 kg</td>
</tr>
<tr>
<td></td>
<td>124 shs</td>
</tr>
</tbody>
</table>

Obviously the density of the blocks will depend on the rate of compaction. The density of 1800 kg/m$^3$ can be expected for lightly compacted blocks, whereas heavy compacting (heavier pressing of the blocks) will probably result in densities well above 2000 kg/m$^3$. When the density goes up the weight of lime per unit of volume increases and the cost goes up proportionately.

*) Mombasa No. 1 lime retail price in Nairobi: Shs 6/- per bag of 16 kgs.
Calculations of weights and costs (lime only)

Specific gravities:
- powdered lime: 1.4 - 1.66
- most earth types (including laterite?): 2.65

Density of dry earth: 1.60

I. Minimum mix 16% (weight) powdered lime added to laterite

\[
\begin{align*}
& \text{laterite} + \text{lime} + \text{water} \\
\to & \quad \text{blocks} \\
& \text{1000 kg} + \text{160 kg} + \text{app. 1200 kg}
\end{align*}
\]

a. density of compacted blocks: 1800 kg/m³ (light compacting)

\[
\begin{align*}
1000 \text{ kg laterite} + 160 \text{ kg lime} \to 1200 \text{ kg blocks} \\
\frac{1200}{1800} = 0.666 \text{ m}^3 \text{ blocks}
\end{align*}
\]

weight of lime per m³ of blocks: \( \frac{160}{0.666} = 240 \text{ kg} \)

cost of lime per m³ of blocks: \( 0.240 \times 375 = 90 \text{ shs.} \)

b. density of compacted blocks: 2000 kg/m³ (medium compacting)

\[
\begin{align*}
1000 \text{ kg laterite} + 160 \text{ kg lime} \to 1200 \text{ kg blocks} \\
\frac{1200}{2000} = 0.600 \text{ m}^3 \text{ blocks}
\end{align*}
\]

weight of lime per m³ of blocks: \( \frac{160}{0.600} = 270 \text{ kg} \)

cost of lime per m³ of blocks: \( 0.270 \times 375 = 102 \text{ shs.} \)

II. Maximum mix 24% (weight) powdered lime added to laterite

\[
\begin{align*}
& \text{laterite} + \text{lime} + \text{water} \\
\to & \quad \text{blocks} \\
& \text{1000 kg} + \text{240 kg} + \text{app. 1300 kg}
\end{align*}
\]

a. density of compacted blocks: 1800 kg/m³ (light compacting)

\[
\begin{align*}
1000 \text{ kg laterite} + 240 \text{ kg lime} \to 1200 \text{ kg blocks} \\
\frac{1200}{1800} = 0.724 \text{ m}^3 \text{ blocks}
\end{align*}
\]

weight of lime per m³ of blocks: \( \frac{240}{0.724} = 332 \text{ kg} \)

cost of lime per m³ of blocks: \( 0.332 \times 375 = 124 \text{ shs.} \)

b. density of compacted blocks: 2000 kg/m³ (medium compacting)

\[
\begin{align*}
1000 \text{ kg laterite} + 240 \text{ kg lime} \to 1200 \text{ kg blocks} \\
\frac{1200}{2000} = 0.650 \text{ m}^3 \text{ blocks}
\end{align*}
\]

weight of lime per m³ of blocks: \( \frac{240}{0.650} = 370 \text{ kg} \)

cost of lime per m³ of blocks: \( 0.370 \times 375 = 138 \text{ shs.} \)