THE CASE
FOR
IMPROVING THE PERFORMANCE
OF
INDIGENOUS EARTH DWELLINGS
IN
RURAL SOUTH AFRICA

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STATISTICS

According to the 1996 census, more than 1,6 million households live in traditional dwellings constructed from traditional materials within South Africa. At that time these dwellings represented 18% of the housing stock. Informal dwellings and shacks in backyards and in squatter settlements represented another 18%. Of the traditional dwellings, earth structures such as those that are indigenous to many parts of rural South Africa form the majority.

INDIGENOUS EARTH CONSTRUCTION - THE PROBLEM

Financial constraints mean that traditional earth buildings are erected by the rural population to serve the need for shelter of people who do not have a great deal of choice in how they build and in what they build with. To achieve and maintain an adequate performance level in a well-built earth dwelling requires a high level of maintenance, generally on an annual but often on a more frequent basis. However many of these structures are built in ignorance of those rules of good building practice that could be applied to earth construction and the maintenance regime required by buildings produced in this way is by necessity, more onerous.

Another problem relating to indigenous earth construction is its vulnerability to damage from the elements and the need for repair or replacement following exposure to extreme weather, as witnessed in 1999/2000 when approximately 21 000 traditional houses were destroyed or rendered uninhabitable by storms and floods in four provinces – Northern, Northwest, Mpumalanga and KwaZulu/Natal.

Given the above, it is not surprising that among many rural dwellers there is:

- resentment regarding the maintenance burden imposed by the traditional dwellings
- a desire for modern buildings of bricks [or more frequently blocks] and mortar,
- a perception that their traditional houses do not qualify as real houses .

In neighbouring Lesotho, this perception has resulted in the traditional stone and thatch rondavels [which require far less maintenance than earth structures] that are indigenous to that region, being increasingly supplanted by rectangular concrete block structures surmounted by steel sheet roofing. The aesthetic appeal of these modern structures is normally much less than that of the traditional buildings. More importantly in an area of climatic extremes the thermal performance of the new structures is markedly inferior to that of the traditionally constructed homes, leading to:

- higher internal temperatures in summer,
- lower internal temperatures in winter,
- condensation dripping from the underside of the steel roof sheeting when the temperature falls below dew point,
- the possibility of consequent health problems.

Despite these circumstances, the residents of the modern dwellings feel that they have “moved up in the world”.

Poverty, endemic to the rural areas of South Africa means that the vast majority of households wishing to make the transition from traditional to modern dwellings will be able to do so only if they are allocated a dwelling under the Government’s subsidised housing scheme. However replacing the traditional dwellings counted in the 1996 census with houses attracting the basic government subsidy of R 16 000, would cost in excess of R26 billion.

Economic constraints on the fiscus and capacity constraints in the building industry dictate that a problem of this proportion cannot be resolved in the short term. It is therefore likely that new and existing traditional dwellings will continue to represent a substantial percentage of South Africa’s housing stock for many years to come.

PROPOSAL

In view of the circumstances outlined above, it seems sensible to examine ways in which:

1. new dwellings can be constructed using traditional materials and building techniques, that will have improved performance with regard to weatherproofness, durability, structural strength and stability and have a required maintenance regime closer to that of conventional construction;

2. the aesthetics, performance, durability, and life span of much of the existing stock of traditional buildings can be improved and the maintenance burden reduced to an acceptable level for the occupants of these dwellings.

Work in addressing these problems is ongoing within Agrément South Africa and CSIR Building and Construction Technology [BOUTEK].

WHAT HAS BEEN DONE

New Buildings

To date this work has resulted in the publication of a Boutek guide and an open Agrément certificate relating to earth block construction. These are;

Building Houses with Earth Blocks *A guide for upgrading traditional building methods using handmade earth blocks*,

Agrément Open Certificate No OC-1/2001 - The BESA[1] Building System

The information in these documents can be used to:

- improve the performance and durability of new earth buildings,
- reduce the amount of maintenance that is required by these structures,
- create a practical and affordable alternative to conventional construction based on local practice,
- facilitate the erection of earth buildings that comply with the *National Building Regulations [NBR],* meet the requirements of the *Housing consumers protection measures act* and are eligible for mortgage finance.

AusAID provided financial and technical assistance for both documents. Reference is made to the Boutek guide throughout the certificate, where information regarding the basics of earth construction is useful to both documents.

Agrément Open Certificate No. OC – 1/2001 is freely available and may be downloaded from Agrément South Africa's web site at http://www.agrement.co.za. Look under *Directory of certificates.*

Building houses with earth construction and another relevant document by Boutek ***A guide to good thatching practice*** can be obtained by contacting Helene Bekker at CSIR on + 27 12 841 2626. Both of these documents can also be ordered or bought on-line at http://www.csir.co.za. Look under *Products for sale*.

Existing earth buildings

A potential methodology for upgrading existing earth buildings was dealt with in two reports prepared for the National Department of Housing, viz.

1. Proposed strategy for replacement of storm damaged earth houses in rural South Africa – 18 May 2000
2. Cost of earth building for houses – 17 July 2000.

The following excerpt from Report No 1 applies.

> ***Repairs and preventative upgrading***
>
> *Houses that have been destroyed and those that have been so damaged that they are unsafe to live in must be replaced. This leaves the question of the extent to which damaged houses must be repaired. Should they simply be brought back to their original condition e.g. should cow dung and mud plaster be renewed or should a more durable and weathertight rendering be used?*
>
> *The performance of traditional houses that are structurally sound can be improved in several ways such as:*
>
> *a. Replace or cover existing rendering with mesh-reinforced plaster,*
> *b. ensure that the adjacent ground levels are well below floor level and that surface water is shed away from the building,*

[1] **BESA** = **B**itumen **E**mulsion **S**tabilised **A**dobe

c. cast a 900 mm wide concrete plinth around the building at least 150 mm below floor level
d. replace inadequate roof members and if necessary , the roof covering,
e. install a ring beam at eaves level where movement of roof timbers is evident,
f. install window cills with DPCs,
g. secure door and window frames,
h. paint the wall surfaces.

These measures could also be used to improve the habitability of undamaged traditional housing and to reduce the maintenance burden that many of the homeowners find onerous and unaffordable.

In June 2001 the Independent Development Trust [IDT] tested the techniques outlined above when it upgraded the walls of two existing thatched earth rondavels typical of those built in the Eastern Cape.

The two adjacent rondavels are located six kilometres from Umtata just north of the Port St John's road. Both were at least 10 years old when treated. The wall surfaces were degraded but structurally sound. It was not necessary to carry out any work to the roofs or to install ring beams. Indentical work was carried out on each dwelling except for the treatment of the external walls.

The external face of the wall of one dwelling was covered with galvanised steel chicken mesh, fixed at 300 to 400 mm centres by serrated nails driven into the existing walls. A 5:1 sand/cement plaster mix was applied to the mesh by trowel and smoothed off in the normal manner.

The wall of the second dwelling was coated with a bonding liquid and sheathed with a polypropylene mesh soaked in *Stipplecrete*[2] [a cement-based wall finish]. The soaked mesh was applied like wallpaper and tacked at the top of the wall to the projecting roof timbers. The mesh was carried straight over the window and door openings then cut and trimmed to fit into these. The following day a finishing coat of *Stipplecrete* was applied using a block brush.

The sand:cement plaster was applied by tradesmen working under the supervision of Eastern Cape Appropriate Technology Unit [ECATU]. The mesh reinforced *Stipplecrete* was applied by local labour under the supervision of the manufacturer's representative in the Eastern Cape. The work was completed in June 2001. Between then and 24 January 2002, no treatment of any kind was carried out on the walls.

The dwellings were inspected on 24 January 2002. The inspection took place during a day-long, torrential downpour. The occupants of both of the dwellings reported that the dwellings were performing well and that water ingress [once a problem in driving rain], was no longer a problem.

The plaster surface showed numerous minor hair cracks which could be obliterated by the application of an external quality acrylic emulsion paint. The *Stipplecrete* surface showed no cracks.

[2] Cemcrete Stipplecrete - Agrement certificate 2000/279

The remedial measures are judged a success. However much of the information regarding the plaster wall finish was lost due to changes in personnel and the fact that the IDT did not proceed with the rest of the work.

The *Stipplecrete* solution was more cost effective than the mesh and plaster. The *Stipplecrete* and the bonding liquid came prepacked requiring only the addition of water. The bonding liquid, the soaked mesh and the final coating could be applied by unskilled labour. In addition the mesh clung to the original wall surface reflecting the natural irregularities that are part of the character of a mud plastered earth wall.

The wire mesh took longer to fix in place than the soaked polypropylene mesh. The plaster had to be a correctly proportioned mixture of cement and sand. Ideally the sand should comply with **SABS 1090: Sand for plaster and mortar**. No sand complying with the specification was available. That used did not comply. The plaster was applied by tradesmen. These tradesmen insisted on “straightening” the plaster to present a smooth, vertical and workmanlike surface. This used up a considerable quantity of plaster as the original walls were neither smooth nor vertical.

This exercise has shown that appropriate upgrading measures can effectively improve the weather-proofness and the durability of the walls of an earth built rondavel. Both systems reduce the maintenance required to the external face of the wall to that required by more conventional buildings.

It is essential that any upgrading or remedial measures carried out take cognisance of the behaviour of earth construction. In this case it was important that any system tested allow the earth walls to breathe and maintain a fairly constant moisture content. Similarly the technology chosen to upgrade the floor would depend very much on the make-up of the subsoil – a dung floor breathes and prevents a moisture build up under the floor - a modern concrete slab on a damp-proof membrane encourages that build up. Where the dwelling is founded on soil with a significant clay content, the installation of such a floor would increase the level of moisture in the subsoil causing the clay to expand and possibly destabilise the building.

AFFORDABILITY AND ACCEPTABILITY

Traditional earth building can be adapted and improved to provide adequate and appropriate buildings for a variety of purposes. This initiative is designed to encourage this and in so doing make use of a natural resource, earth, and the indigenous skills of people familiar with earth construction. However it is essential that the rural people who are the potential beneficiaries are happy with the finished buildings.

In development it is essential that the solutions offered are not only affordable but that they are also acceptable. There is no point in building what is affordable if the potential beneficiaries will not accept it. At the same time, the funding authorities cannot build what is deemed acceptable by the beneficiaries, if the end result is patently unaffordable.

Unless the rural people clearly understand the potential benefits that can be derived from upgraded earth construction, whether the end product is an improved existing dwelling or a new dwelling with a performance that meets the requirements of the National Building Regulations, the product may be affordable but remain unacceptable.

The solution requires consultation and agreement as a prerequisite to development. Agreement can be expedited by information and example and by showing that the modifications that are proposed to the traditional building methods move these into the realm of acceptable modern building techniques.

Agrément South Africa regards this project as a work in progress. Further investigation, testing and development work will follow as funds become available.

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19 March 2002