TECHNICAL NOTE #03

Condensation & Mould in affordable housing in the Western & Southern Cape

A review of reports on condensation and mould problems found in affordable housing in the Western and Southern Cape winter rainfall regions of South Africa. These locations often experience severe condensation on the inside surface building shell which results in mould growth and other health issues.

TECHNICAL CONTRIBUTOR

CBA Technical Committee

EXECUTIVE SUMMARY

This technical note reviews various reports and research on the state of repair of a sample of subsidised houses in the Western Cape. (The Southern Cape Condensation Problem Area or SCCPA). The objective was to identify if follow-up research is indicated, in the interests of improving the standard of walling in affordable housing in South Africa.

- The Report to the Human Settlements Portfolio Committee of the Cape Town Metropolitan Council dated August 2011
- The underlying research report entitled '*Housing conditions, sanitation status and associated health risks in selected subsidized low-cost housing settlements in Cape Town, South Afr*ica' by T Govender, J M Barnes and C H Pieper,
- The TEMMI report to the Agrément Board of South Africa in 2000 which defines the boundaries of the SCCPA, and reports on the extent of condensation problems, are reviewed.

The report of structural damage to 86% of the houses sampled begs the question - are the design and construction materials and methods used appropriate? The incidence of mould growth appears to follow the prevalence of cracks and water leaks, rather than condensation being the root cause. The improved design of houses with addition plaster and paint and roof insulation as per the Agrément SA recommendations will result in newer houses having less mould growth problem.

While this provides useful information for members and the CBA in promoting the use of double leaf cavity walls, the CBA Technical Committee recommends that it is not the place of the CBA to formally intervene or propose clay brick solutions to the problem.

CONTRIBUTING FACTORS AND IMPACT

The Southern Cape Condensation Problem Area is the winter rainfall region stretching from Malmesbury and Ceres in the west and south of the coastal mountain ranges and escarpment though the Western Cape into the Eastern Cape. (See Annexure C). This area is prone to prolonged periods of cold and rainy weather.

Building elements (particularly concrete block walls and fibre-cement roofs) are likely to become water-logged by rain ingress and interior surface condensation to the extent that it may be possible that mould growth occurs on the damp surfaces. Respiratory health problems, including TB, have been reported and connected to the prevalence of such mould growth, and the associated air borne spores carried in homes in this region.

A further issue is the health risk resulting from the poor state of repair and inadequate design of affordable housing in the area. This is reported to the Human Settlements Portfolio Committee of the Cape Town Metropolitan Council dated August 2011.

CONDENSATION RISKS IN RELATION TO WALLS

The TEMMI report to the Agrément Board of South Africa *'Defining new condensation boundaries in the Southern Cape'* concludes that the major condensation within the low cost housing is that which is occurring on the underside of roofs, and that the condensation occurring on walls is relatively minor.

The report states that the main areas in houses where mould occurs are those areas adjacent to taps, leaking pipes in kitchens and bathrooms, and around cracks in the walls. Mould is reportedly not found under-roof, and not often on walls. The mould growth in walls will be as result of structural cracks and consequent rain penetration, in the view of the authors.

From these and other comments it might be presumed that the condensation is occurring preferentially on the underside of the roofs, and that which may be occurring on the walls is within the interstitial wall cavities and is not visible.

SPECIFICATION CHANGES

The Agrément SA recommendation to address the above issues has been to advise the use of thermally insulated ceilings, the ventilation of roof spaces and the external plastering of walls.

These recommendations will result in reduced dripping of moisture from the underside of roofs, and will cause an increase in interior wall temperature (due to increased heat passage via the walls), and a raising of the temperature of those surfaces, such that dew point is not reached on the interior surface. The extra plaster should have a dual effect of increasing the thermal resistance of the walls and the resistance to moisture transfer.

These recommendations have been adopted by the Western Cape Provincial government and are currently implemented within the housing specifications in that province.

ISSUES IN WALLING OF SURVEYED CAPE TOWN HOUSES

The research report entitled *Housing conditions, sanitation status and associated health risks in selected subsidized low-cost housing settlements in Cape Town, South Africa* by T Govender, JM Barnes and CH Pieper reports"

"A large proportion of the study participants reported that their houses were not structurally complete upon (*sic* taking) occupancy. The vast majority of the main houses had two (38%) or three (48%) structural problems."

The integrity of the walls of the dwelling structure was problematic, showing large visible cracks (Table 3). None of the walls were plastered causing rainwater to penetrate during rainstorms. Damp was visible on the walls in many dwellings. (See Annexure A).

The construction and design of these houses were found to vary between sites, and common to all houses surveyed is the report that houses were not plastered and a high proportion were not painted.

The prevalence of cracks in the walls of the houses surveyed is some 68% of the sample.

COMMENTARY & RECOMMENDATIONS

The high prevalence of cracks may be indicative of a major problem with the construction system or materials in use. In view of the survey being conducted over a number of sites (four) it is unlikely that the common denominator is the quality of workmanship.

The view of the CBA and recommendation regarding appropriate walling for low cost housing is that the single course hollow concrete block is inadequate and that masonry walling should comprise of two courses of (clay) brick.

It was recommended by the CBA Technical Committee that the CBA not be involved in any extension of the UCT research.

Note 2016: SANS 10400–XA: ENERGY USAGE IN BUILDINGS makes it compulsory for all **NEW** buildings to be insulated as of November 2011. There are specific roof insulation requirements for the Temperate Coastal climatic zones of the western and southern cape, which will have an influence on condensation problems.

ANNEXURE A

EXTRACT FROM THE GOVENDER REPORT

A large proportion of the study participants reported that their houses were not structurally complete upon occupancy. The vast majority of the main houses had two (38%) or three (48%) structural problems. The integrity of the walls of the dwelling structure was problematic, showing large visible cracks (Table 3).

None of the walls were plastered causing rainwater to penetrate during rainstorms. Damp was visible on the walls in many dwellings. Home owners commonly using softened bar soap to fill up holes in leaking roofs which washed out at tile next rain episode, causing white streaks down the inner walls.

Ninety-nine per-cent of the home owners in the survey reported that they could not afford repairs to their home. Various households had reported problems *ta* the City Council but noted that they eventually "fixed the problems themselves or learn to live with it." Note: The construction and design of these houses were found to vary between sites (Table 2).

Table 3 Housing Quality Indices of Main Houses

Independent variable	Number (n=173)	%
Outside walls not painted	82	47
Inside walls not painted	88	51
Cracked walls	117	68
Door not well fitted	103	60
Broken windows	60	35
Toilet not operational	101	58
Toilet leaking	69	40
Tap leaking	63	36
Roof leaking	136	79
Structural damage	11	6

The main houses in these communities showed poor structural integrity and damp interiors. Together with overcrowded conditions, this is conducive to the spread of TB. The association between the overcrowding of dwellings and the spread of TB is well known (Darbyshire, 1995; Singh, Upshur, & Padayatchi, 2007). In excess of 400000 cases of TB require treatment annually in South Africa with cure rates hardly reaching 50% and mortality rates at an all-time high (WHO, 2006).

ANNEXURE B

EXTRACT FROM THE TEMMI REPORT FOR AGREMENT ON THE SCCP

The preliminary objective of establishing a more reliable condensation boundary has now been achieved. Where does the forward path lie?

Obviously, the final objective is to enforce more stringent building standards, especially in those towns included in the SCCP area. However, establishing the *motivation* for these standards (in order to convince the relevant authorities) will require much further work.

During this project, interviews with occupants and general observations seemed to indicate that neither condensation nor rain penetration were large culprits in encouraging mould growth. The presence of mould was almost always found in kitchens, bathrooms, near leaking taps and other damp areas of the house.

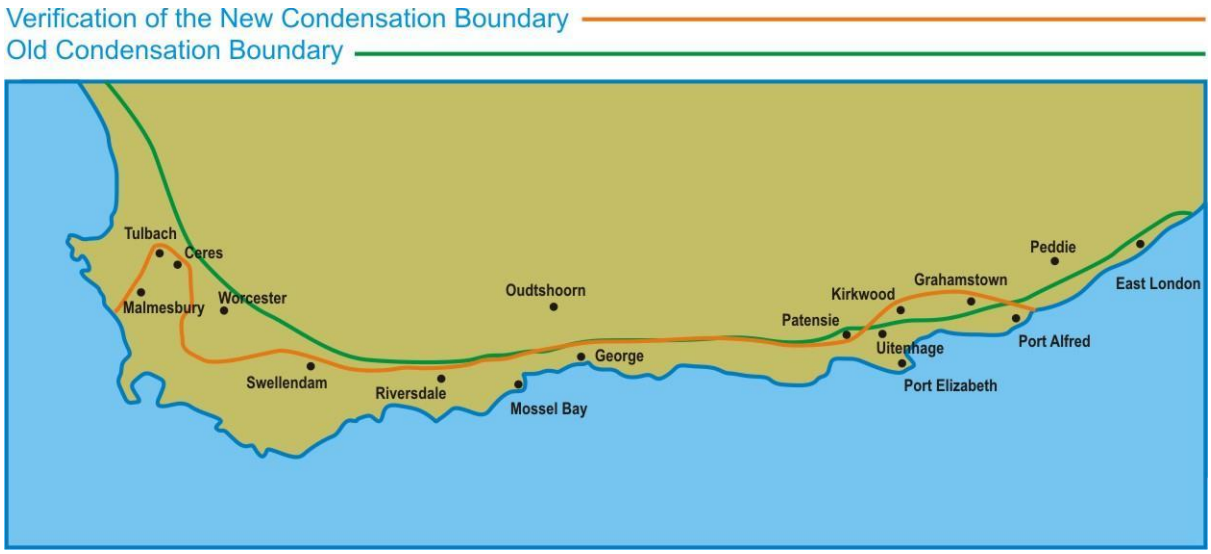
Furthermore, condensation mostly occurred on the roof, a place where mould was never found. On the odd occasion that mould was seen on the walls, it could usually be attributed to rain penetration or factors other than condensation. The presence of condensation therefore seemed to have very little effect on mould growth and only a few cases were as a result of rain penetration.

Future studies should look more closely at the *causes* of mould growth in low-cost houses. One factor that deserves specific attention is the time of wetness. An automatic connection between condensation and mould growth can therefore *not* be assumed. Designing a house that prevents condensation and/or rain penetration will be of little use if, for example, leaking taps providing all the water that the mould needs!

Specific health issues related to condensation itself also need to be conducted. For example, condensation on the inside of roofs causes water to drip on floors and beds at night. The effect of this constantly damp environment on the health of occupants during winter must be examined more closely

ANNEXURE C

CONDENSATION BOUNDARY AS PER TEMMI REPORT



For further information:
The Clay Brick Association of South Africa
Website: www.claybrick.org