

Thermal performance of a skin wall, Alice Springs

February 2007

AIM:

To assess whether a low-cost skin (steel cladding) wall fitted onto a western blockwork wall could significantly reduce heat transfer in a residential building.

DETAILS OF HOUSE AND RETROFIT:

The trial focused on one house in Dalby Court, Alice Springs. This was a new house which was still in construction when the trial was undertaken. The skin wall was added on to the western blockwork wall after the initial construction phase was complete and the home owners had moved in.

No windows were installed before the skin wall was retrofitted, so the inside of the house was not yet enclosed and there was a large air gap in the western wall where glass louvres were later installed. Therefore, the inside and outside air temperatures were expected to be similar during the first stage of monitoring.

Initially the western wall consisted of single layer, Besser Block (with no corefill). The retrofitted skin wall was corrugated steel 'Colorbond' cladding attached to the blockwork via a steel frame (see picture).

METHOD:

Internal and external wall temperatures were measured during summer and autumn 2005 (10 Feb - 28 May), prior to the skin wall retrofit.

Outside west wall (4/03/05)



Outside west wall. Temperature logger inside cover. Receives full sunlight from ~2pm to 5.30pm.

Inside west wall (4/05/06)



Inside west wall. Temperature sensor inside cover. Note inside of house is not yet enclosed.

After the installation of a cladding skin wall on the external western wall, temperatures were measured in summer 2006 (from the 24 Jan to the 10 March) of the:

- Internal house air temperature
- Outside temperature of south block wall
- Inside temperature of west block wall
- Outside temperature of west skin wall

Outside west wall - logger insitu (24/01/06)



Outside west wall (24/01/06)



West skin wall – close up (24/01/06)

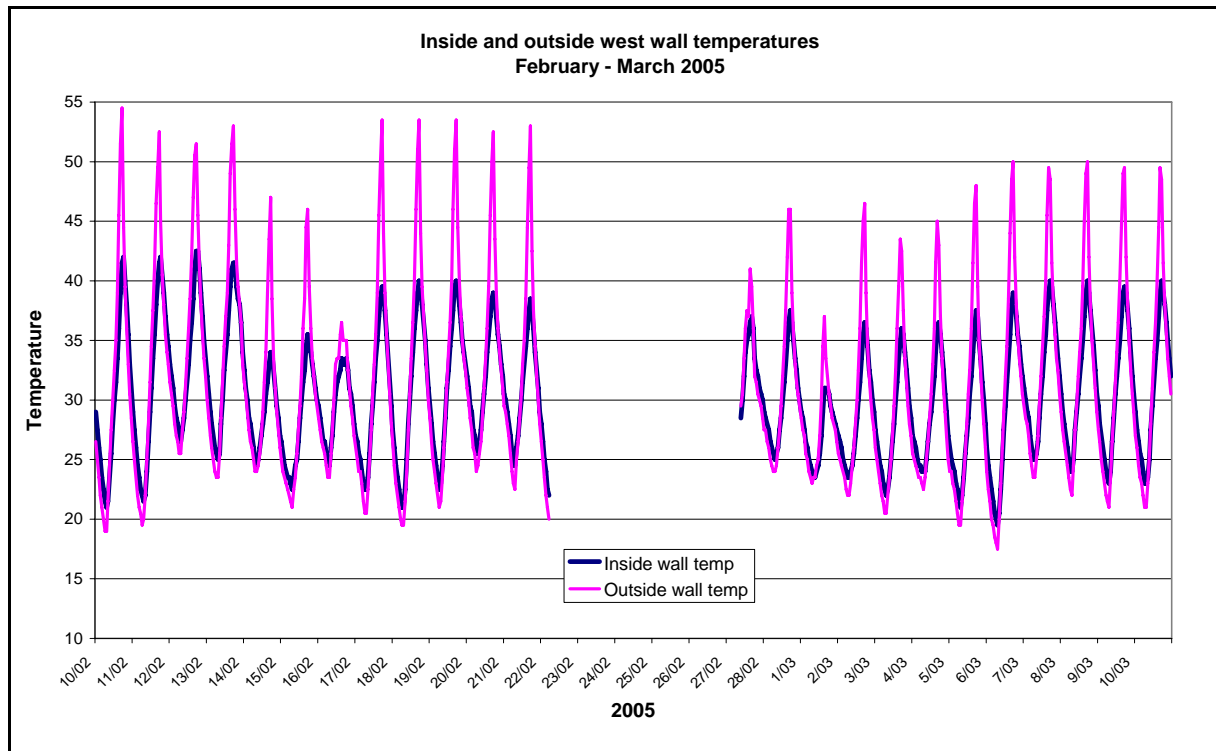


Inside west wall (24/01/06)



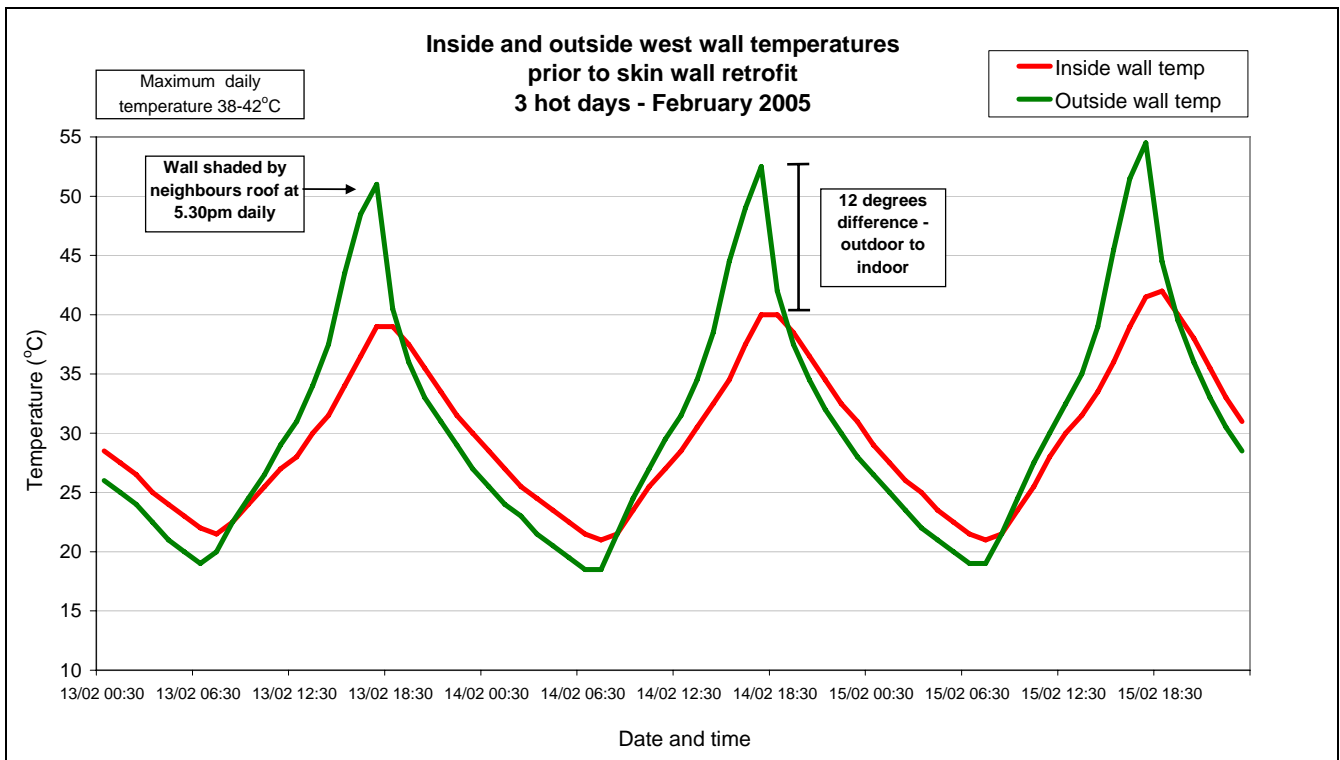
RESULTS:

The graph below shows the difference between the inside and outside west wall temperatures in February and March 2005. Due to the unenclosed nature of the house at this time, the internal west wall temperature was close to ambient air temperatures. There was a difference of around 4 to 15°C between the internal and external west wall temperatures.

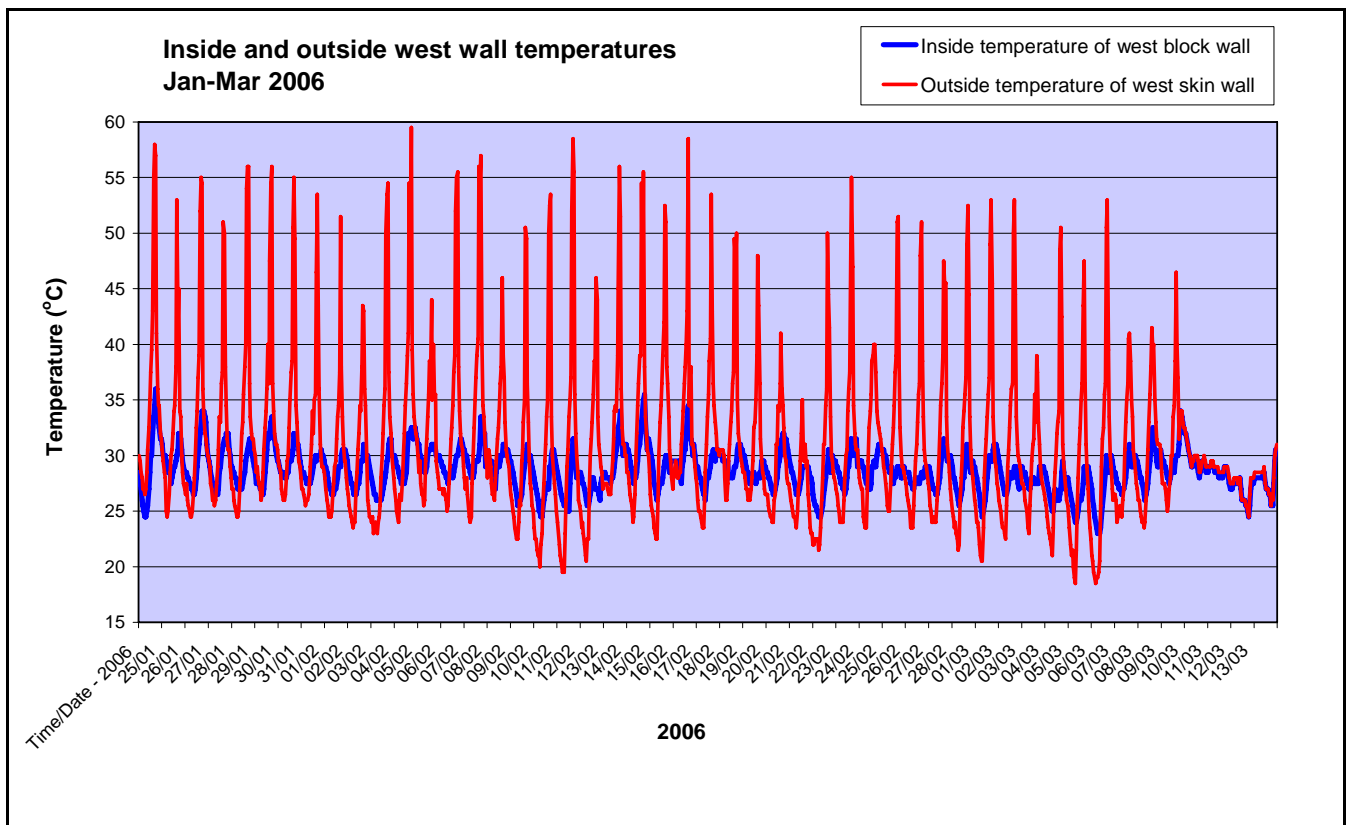


A close up of the temperature profile shows the half hour time lag between temperature changes to the outside of the wall compared to the inside of the wall and the variations in temperature caused by direct sunlight or shading of the

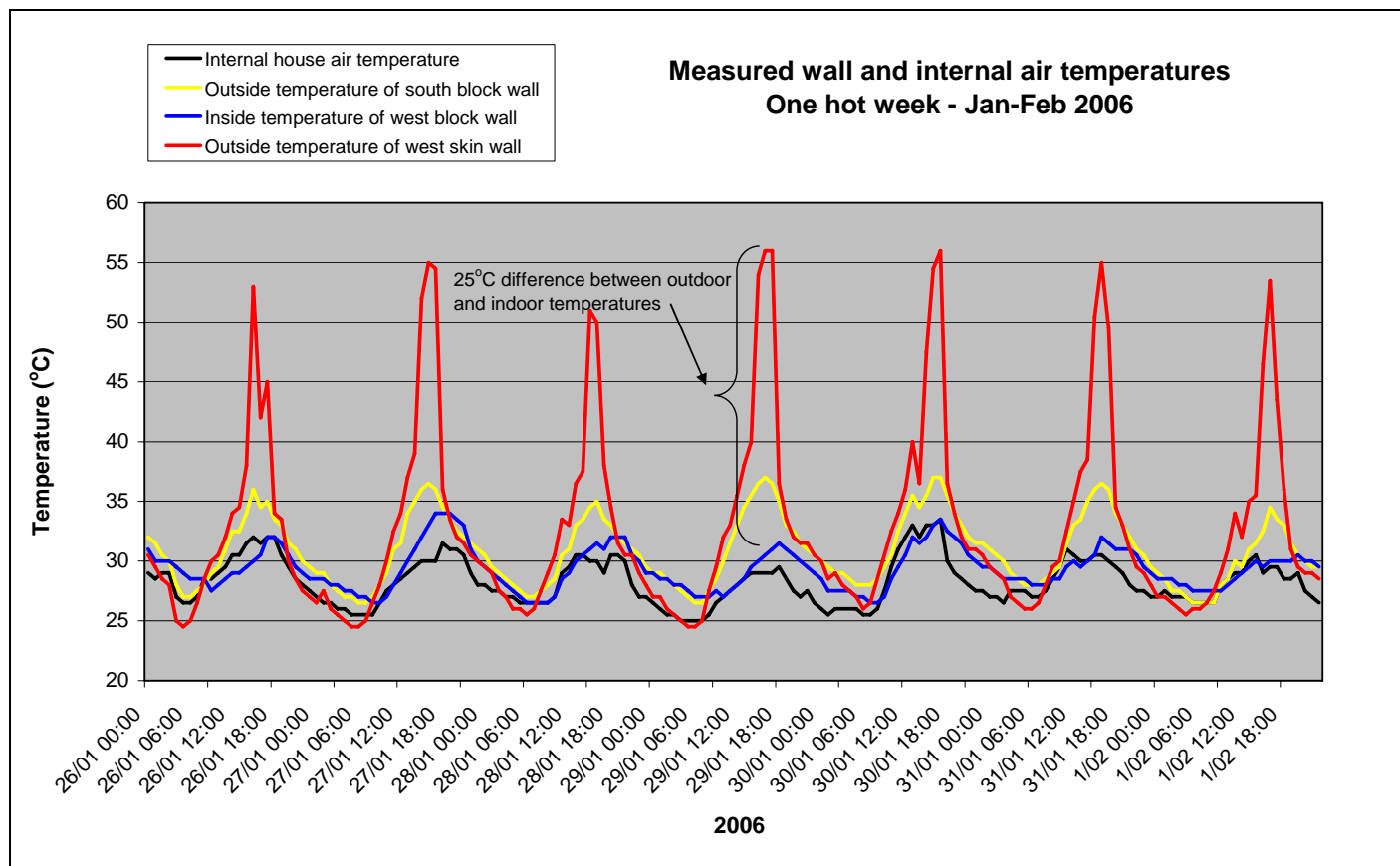
wall. The temperature of the outside wall was observed to escalate when direct sun hit the wall at around 2pm and begin to cool down after 5.30pm when the neighbour's roof began to shade the wall. If there was no direct sun, the temperature peaked at ~43-45°C instead of 53-55°C.



In early 2006, after the skin wall was retrofitted and windows were installed, the temperature variation between the inside and outside west wall was considerably higher than it had been in early 2005. The graph below shows data collected in January and February 2006 with internal wall temperatures of between 23 and 36°C and external wall temperatures of between 18 and 60°C. The maximum external wall temperatures are similar to those observed in 2005.



During a hot week in late January, the temperature difference between the inside and outside of the west wall at the hottest times of the day was as much as 27°C (see graph below). This is a significantly greater relative difference than prior to the skin wall retrofit. However, in the early hours of the morning due to the thermal mass of the wall, the internal west wall temperature was sometimes as much as 6.5°C hotter than the outside temperature for a number of hours. The graph below also shows the outside temperature of the south block wall, which does not experience the same sharp rises in temperature during the hottest times of the day. In addition, the internal air temperature is only marginally lower (2-3°C) than the internal west wall temperatures.



CONCLUSION:

After the skin wall was retrofitted, the internal temperature of the western blockwork wall was significantly lower than the external temperatures on hot summer days. This result indicates that skin walls have the potential to significantly reduce heat transfer on western block walls. Anecdotally, the home owners thought that the skin wall made a lot of difference to indoor temperatures. However, because the data collected in 2005 occurred when the house was not enclosed and therefore the internal wall temperatures were affected by the outside ambient temperature the results cannot be considered conclusive.

RECOMMENDATIONS:

CSAT recommends that further research be done on the effectiveness of retrofitted skin walls in Central Australian conditions. This research could identify an existing house with an exposed western wall. Internal and external wall temperatures should be logged for several weeks. A skin wall should then be fitted and additional temperature logging should be undertaken for several weeks after the retrofit. Where possible, as many conditions as possible should be controlled for ventilation, comparable sun angles, use of mechanical cooling (such as fans and air conditioners) and ambient temperatures.

FUNDING:

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FURTHER INFORMATION:

CSAT website – www.csat.com.au – information on the thermal performance of the Cool Living House