Conditions behind overcladding

Measurements behind the ventilated overcladding on a multi-storey block of flats indicate that the temperature of the cladding has a major influence on the environment behind the cladding. *Charles Stirling* reports.

Insulated overcladding systems are being used extensively to improve and protect the external fabric of many multi-storey buildings, particularly dwellings. However, concern has been expressed about the risk of interstitial condensation and the consequent risk of corrosion in the metal components of such systems.

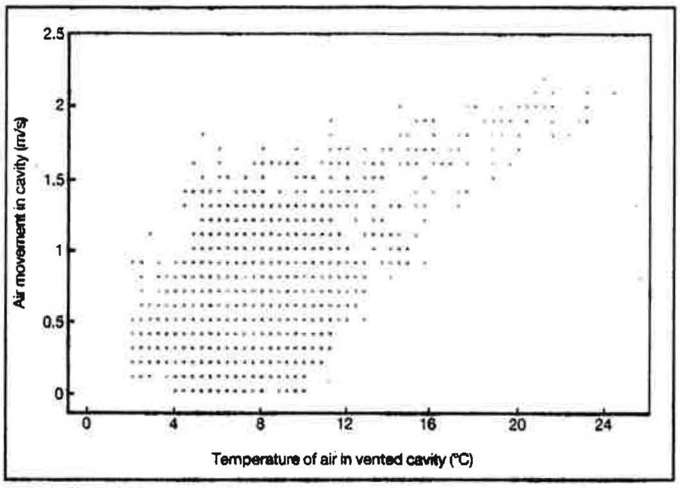
BRE has commenced a study to determine the environmental conditions within such cladding systems and this article briefly summarises the results obtained from a four month monitoring period during the winter of 1988/89.

While the primary function of overcladding is to prevent the original fabric being wetted by wind-driven rain, the opportunity is often taken to add thermal insulation as well. There are two types of system, one with open joints between sheeting and one with sealed joints. There may be a vented cavity at the back to permit evaporation and ventilation to the external environment.

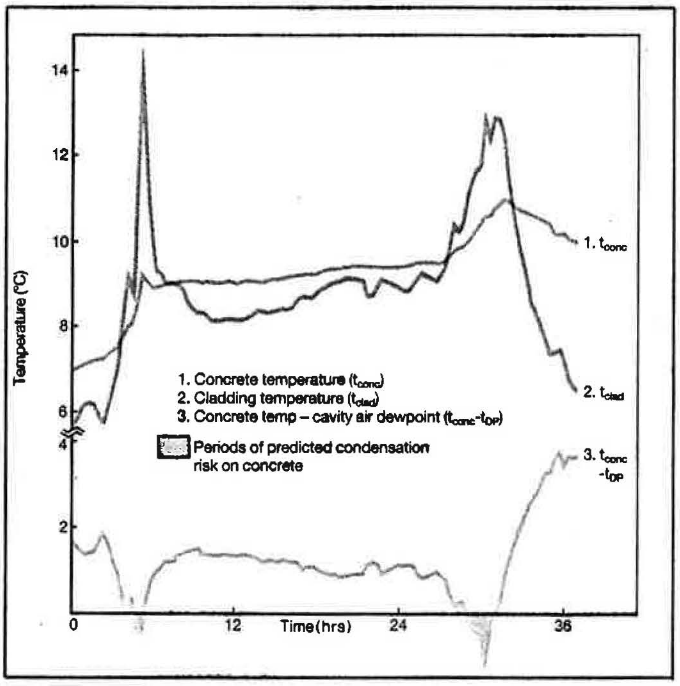
The multi-storey block of flats chosen for the pilot study is of large concrete panel construction and is 15 storeys high. The flats were constructed during the 1960s and overclad in 1985. The overcladding system comprises 50 mm of expanded polystyrene insulation, a 30 mm ventilated cavity which extends the full 15 storeys, and external storey height cladding panels fixed to aluminium rails with smaller panels between windows. The joints between the sheeting are sealed by means of a gasket, and outside air enters the cavity at first floor level.

Sensors were positioned behind the storey height panels, located at the first, fifth and tenth floor level. The sensors provided temperature profiles across the cladding system and relative humidity and air speed measurements within the ventilated cavity.

Mean temperatures in the cavity at the tenth floor were approximately 1·2°C greater than the temperatures at first floor level and approximately 0·5°C greater than at the fifth floor. In addition the temperatures recorded at the centre of the façade were 1-2°C greater than at the edge of the façade.



Above, figure 1: Relationship between air movement and temperature within the cavity – 10th floor. ***Below, figure 2:*** Condensation risk on concrete.



The mean temperature of the original concrete fabric was approximately 2°C above the cavity air temperature. Radiation on the external sheeting was found to have a major influence on both the air and moisture movement within the insulated cladding.

Air speeds within the vented cavity at the tenth floor were generally greater than those at first and fifth floor levels, and there were few occasions when no air movement was measured. Wind speed data was available from a meteorological station approximately 8 km from the site. The results indicate some relationship of air movement within the cavity to the external wind speed, however a direct relationship has not been established. The major influence on air movement within the cavity is the temperature stack effect. This is shown in figure 1 where there is increased air movement within the cavity with increased temperature.

The vapour pressures, calculated from the measured temperatures and relative humidities, suggest that there is an even distribution throughout the ventilated cavity. During the middle of the monitoring period (December – January), slightly higher mean vapour pressures were measured.

Under clear night sky conditions, interstitial condensation occurred on the back of the external sheeting, even with a vented cavity, because of radiation losses. During periods when the cladding temperature was relatively high, moist air migrated towards the concrete. Where the concrete temperature is below the dewpoint, moisture will condense; a phenomena termed "summer condensation"[1] (see figure 2).

Although the risk of condensation occurring on the concrete is generally less than on the back of the cladding panel, dampness was observed on the surface of the concrete when investigations were undertaken of the interior of the cladding system.

The vapour pressure within the cavity is influenced by the external vapour pressure on the inside and outside of the building fabric. The vapour pressures within the cavity were generally higher than those which might be predicted from standard calculations; this suggests that there is some storage of water behind the cladding.

This study of conditions behind a cladding system has shown that water can accumulate behind ventilated cladding panels. At present it is unclear whether the water is from rain leakage or the ventilating air. The study is continuing to identify the cause and hence improve design guidance.

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Reference

Southern, J R *Summer condensation within dry-lined solid walls*, BSER&T, Vol 7/3, 1986.