WHEN THE WIND BLOWS…

This article looking at the issues surrounding wind loading on cladding is by Martin Heywood, consultant engineer, on behalf of MCRMA

Buildings and their cladding are expected to withstand the worst that the weather can throw at them without risk of failure or loss of function. However, such performance is only possible due to the care that goes into their design and the attention to detail during the manufacture and installation of the building envelope. The Metal Cladding and Roofing Manufacturers Association (MCRMA) offers some timely advice for all involved in the specification process as winter approaches.

Of all the loading that a building is likely to encounter over its life, the wind has the greatest potential to cause damage to the cladding and even to the building structure.

Proper attention to design and detailing will avoid a fate like this

News stories about winter storms are often accompanied by pictures of buildings with damaged roofs or walls and it has almost become accepted that some damage will occur during the most extreme weather.

However, with the correct design and specification of the roof and wall cladding systems and their fasteners, it should be possible to ensure that no new building built in the UK or elsewhere in Europe suffers this fate.

WIND FORCES ON BUILDINGS

When the wind blows on a building, the change in wind speed as the air negotiates the obstruction in its path may result in either an increase or a decrease in pressure. When combined with changes to the internal air pressure the result is either a net positive pressure (on windward facing walls and the windward slopes of steep roofs) or a net suction (on leeward facing walls, on walls parallel to the direction of the wind and on roofs generally).

Wind pressure and suction will both cause bending effects in the wall and roof cladding and may, in extreme cases, cause structural failure of the cladding profile. Additionally, wind suction may result in failure of the fasteners if not properly specified.

FACTORS AFFECTING WIND LOADING

It comes as a surprise to some people that there is no single value of wind load for design of buildings in the UK. This is due to the variation of wind speed with location and building geometry. The main factors that influence wind speed are:

- Location – some parts of the country are more windy than others
- Altitude – the higher the site, the greater the wind speed
- Distance to sea – the closer to the sea, the greater the wind speed
- Town or country – buildings may provide shelter from the wind
- Topography – topographical features can increase wind speed
- Wind direction – the strongest winds generally blow from the south west
- Building height – taller buildings are exposed to stronger winds

Taking account of all of these factors, it is clear that wind loading is site and building specific, so should be calculated for each and every building project. Failure to do so may result in unsafe buildings in some cases and uneconomic buildings in others.

Furthermore, the force generated by the wind blowing over a building is dependent on the shape of the building and even the location on the building's surface. For example, the edges of a roof are subjected to higher pressures than the centre, so may require additional fasteners or closer purlin centres. The ridges and corners of roofs and the corners of walls are especially vulnerable to high wind loads.

HOW TO DETERMINE WIND LOADING

The wind loading on all buildings should be calculated using a recognised code of practice (British Standard). Until March 2010, the code of practice for wind loading in the UK was BS 6399-2, but this has since been replaced by BS EN 1991-1-4 (although the former is still widely used). The latter standard is one of the structural Eurocodes and is applicable across the European Union, although each member state has its own National Annex that must be used when designing for that country.

The calculation methods for wind loading in both codes of practice are complex and sometimes difficult to follow, so it is essential that wind loading calculations are undertaken by a qualified structural or civil engineer.

Software is also available; some examples of which may be obtained free of charge as part of the packages on offer by the purlin manufacturers.

It is important to note that the codes of practice aim to calculate the wind loading corresponding to the 1 in 50 year storm, so cladding and buildings designed to these standards should be able to withstand the typical winter storms with ease. If designed properly, no cladding should fail due to wind loading.

CONCLUSION

The only way to be confident that your buildings will survive the worst storms year after year is to ensure that the wind loading is calculated properly for every building and that the cladding and fasteners are specified accordingly. MCRMA member companies can advise on the suitability and performance of materials, systems and assemblies. In addition advice can be obtained from any of the independent roofing and cladding inspectors featured on the MCRMA web site.

A detailed document *Guidance for wind loadings on roof and wall cladding* is available for download on the MCRMA web site at http://www.mcrma.co.uk/pdf/Wind_guidance_document_final.pdf

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