SNOW LOADING ON CLADDING

We are fortunate in the UK to live in a country where winters are often relatively mild and severe snowfalls are rare. However, when heavy snowfalls do occur there are often reports of damage to buildings, in particular collapses of roofs and their supporting structures. It is perhaps because of our mild climate that we tend to view the snow that causes these collapses as exceptional. The reality is that most of the recent snowfalls in the UK have been within the design values predicted by the codes and standards, so should not have caused the damage that they did. As winter approaches, the Metal Cladding and Roofing Manufacturers Association (MCRMA) has some useful guidance to offer.

Since most of the snow that falls on a building lands on the roof, the correct specification of the roof cladding and its supporting structure are essential to ensuring that buildings survive the winter storms. Key to this is the accurate determination of the likely snow load appropriate for the location and geometry of the building. This article is intended to highlight some of the key issues affecting snow loading on buildings and to provide guidance to building designers when specifying roof cladding to resist this loading.

Snow loading on buildings

When designing a building for snow loading, it is important to distinguish between the two fundamental types of load uniform snow loading and snow drift. The former is based on the assumption of an even distribution of snow over the roof and should always be designed for. The latter may need to be considered if there are obstructions against which the snow could accumulate, such as parapets, valleys or walls. While snow drift loading is usually much higher than the uniform snow load, it is limited to a relatively small area.

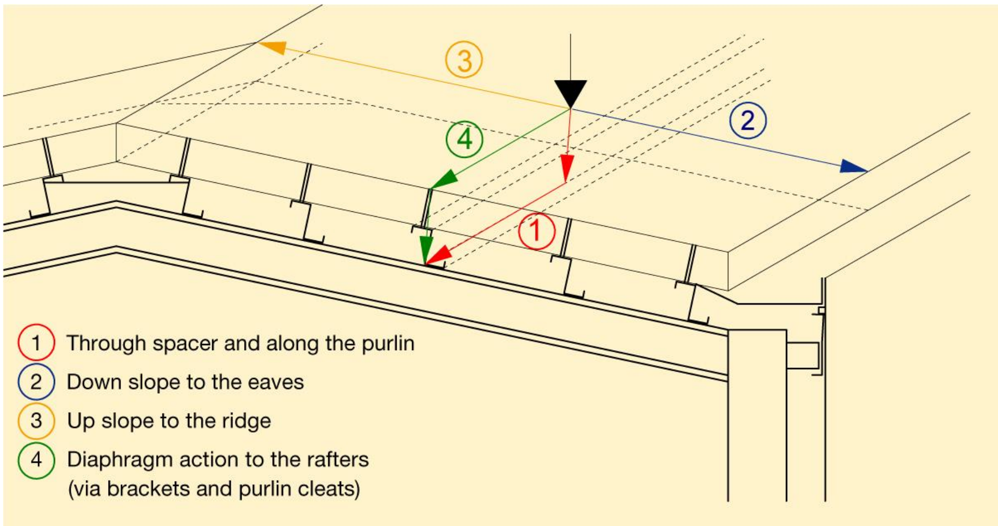
Factors affecting snow loading

Snow loading is site and building specific, so it is not possible to calculate a single value of snow load for use across the UK. The main factors that influence snow load are:

- Location – some parts of the country are more susceptible to snowfall than others
- Altitude – the higher the site, the greater the snow load
- Parapets, valleys and obstructions – these cause snow drifts resulting in localised high snow loads
- Neighbouring roofs – there is a risk of snow falling off higher roofs causing local overloading

Load paths

The weight of the snow on a roof must ultimately be transferred safely to the building foundations through the cladding, secondary steelwork and primary frames. On flat roof buildings, all gravity loading is resisted by bending and shear in the roof deck and supporting beams. However for pitched roofs, the matter is complicated by the existence of several alternative load paths as shown below.



In practice, the distribution of load between the various load paths is dependent on the relative stiffness of each path. This will depend on the stiffness of the individual components (for example, axial stiffness of the cladding compared to its bending stiffness) and the detailing of the connections and fasteners.

How to determine snow loading

Snow loading is site and building specific so should be calculated for each building project. The magnitude of the snow loading should be determined using a recognised code of practice (British Standard or Eurocode). Until March 2010, the code of practice for snow loading in the UK was BS 6399-3, but this has since been replaced by BS EN 1991-1-3 (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.

When designing to the Eurocodes, the snow loading is combined with the dead load for example, self-weight) and any positive (downward) wind loading, all multiplied by the appropriate safety factors to give the factored loading for the roof. Access for maintenance (imposed load) is considered as a separate load case and is combined with the dead load only.

This means that the snow loading must always be considered, even if it is lower in magnitude than the imposed load. By contrast, in BS 6399-3 designers were told to use the snow or imposed load, whichever was greater. In both codes, snow drift loading is considered separately and is treated as an accidental load case.

Conclusion

Snow loading varies from site to site and building to building and the calculation of snow loading is complicated, requiring the services of a qualified engineer. However, by following the recommended calculation procedures and specifying the cladding and supporting structure accordingly, building designers can ensure that the roofs of their buildings do not collapse due to snow loading even in the harshest of winters. 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.

This article has been written for MCRMA by Martin Heywood, consultant engineer

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