ENSURING CORRECT CLADDING INTERACTION WITH SECONDARY STEELWORK

Metal cladding systems supported by light gauge secondary steelwork provide an efficient and reliable solution to the building envelope of steel framed buildings. However, as with all construction components, the ability of the cladding to satisfy its functional requirements is dependent on its correct specification and installation and, equally as important, on its interaction with the other elements of the building envelope and structure.

Rathfrilland Fire & Rescue Service, Co Down. Image courtesy of Kalzip

To meet with the government's sustainability targets changes to Part L of the Building Regulations in England and Wales and Section 6 in Scotland have increased the energy performance requirements of buildings, thereby increasing the demands on the cladding system. The cumulative changes have resulted in an increase in insulation thickness for both built-up and insulated panel construction and major improvements in air leakage limits.

Research by the Metal Cladding and Roofing Manufacturers Association (MCRMA) has identified that this fabric first approach, which was a sensible methodology for the initial development of sustainable buildings, has now reached its practical limit and improvements in U values with thicker insulation do not offer further useful gains.

Citroën Dealership, East Driffield, Yorkshire. Image courtesy of Steadmans

The adoption of deeper cladding systems has resulted in the need to take a more holistic approach to the design and structural evaluation of the interaction between the building envelope and the supporting structure. This is particularly evident when assessing the following scenarios:

1. Ability of the cladding systems to transfer down-slope loads to the purlins
2. Ensuring the purlins (or rails) are correctly aligned to accept the fasteners
3. Ability of the cladding to provide a degree of restraint to the purlins (or rails) against wind uplift (or suction) loads
4. Close steelwork tolerances ensure airtightness of the building envelope.
5. Ability of the secondary steel to support increased weight.

In the first scenario and as part of the design process, it is essential that the structural engineer gives careful consideration to the load path (or paths) between the cladding sheets and the primary and secondary structural steelwork. In the case of built-up roof cladding, there are four potential load paths;

- Through the spacer system to the purlins and back to the rafters;
- Through the outer sheet down slope to the eaves;
- Through the outer sheet up slope to the ridge;
- Diaphragm action through the outer sheet via the spacer brackets to the rafters.

Scenario two puts an emphasis on the designer and the erection and sheeting contractor to ensure that the purlins are truly aligned and any down slope rotation, particularly at mid span, is minimised. The specification of purlins with adequate stiffness and the specification and installation of sag rods between the purlins or cladding rails will elevate most of the problems. When used, sag rods serve the following functions:

- Restraint to the purlins against lateral-torsional buckling under wind uplift.
- Restraint to the purlins in the construction phase.
- Additional support to the downslope component of the applied loads.
- Maintain purlin alignment.

Without these design considerations purlins may rotate or move out of alignment more than the width of the top flange and, on occasions, site inspections have identified that primary sheeting fasteners have completely missed the underlying purlin. The photograph below (a non MCRMA member project) illustrates just what can happen when purlins are misaligned.

An example of what happens when purlins are misaligned

The third scenario is closely linked with the topic above. In practice it is common for the manufacturers of purlins and side rails to assume a certain amount of restraint from the cladding panels or sheets. Indeed, the validity of the values in the manufacturers' safe load tables often depends on this assumption. It is, therefore, important for the cladding specifier to ensure that the chosen cladding system is capable of providing the required degree of restraint and that it is appropriately detailed.

The fourth scenario which is crucial to the performance of the cladding system is the accurate installation of the purlins and side rails to the required tolerances. Misalignment or rotation of the purlin or rail can have an influence on air-leakage and the potential for non-compliance with Building Regulations.

In addition, insulated panels are far more ridged than built-up systems and they require closer alignment and tighter tolerances for both the primary and secondary structures. The practice of ‘fly fixing’ of insulated panels that is, installing consecutive panels with a minimum of initial fixings can exacerbate the problem and can contribute to further rotation or movement of the structure. This practice should be avoided and panels should be fixed fully as they are laid into position.

The fifth and final scenario is a structural issue which must be determined by the engineer but can be influenced by the change of specification or site practice. Any change must be referred back for consideration.

More specific advice about the interaction of cladding systems with the primary and secondary structure can be found in the publication entitled *Best Practice for the Specification and Installation of Metal Cladding and Secondary Steelwork (P346*) published by the Steel Construction Institute and available for download from the MCRMA web site.

Hawarden Business Park, Flintshire. Image courtesy of Tata Steel

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