

A MOVING EXPERIENCE

By John Stamp, technical consultant, Kawneer Architectural Aluminium Systems



One of the biggest challenges for today's architects and building contractors is the reconciliation of material interfaces. Whereas in traditional build the interactions between brick, mortar and timber are simple and predictable, today's buildings incorporate a far greater variety of materials that must be joined without compromising overall building performance.

The most basic interface – and often one of the most challenging – is that between the structural frame and the building envelope. And the biggest headache for designers and builders is how to cope with differential movement.

“One of the problems is that today's buildings are designed largely by computer to published design codes – but the structural frame is often designed without a thought to the cladding solution,” comments John Stamp, technical consultant with curtain walling manufacturer and architectural aluminium systems company Kawneer.

Computerised structural design technology gives today's engineers a freedom their predecessors never dreamed of. An architect can produce an audacious building shape and the engineer can use computer technology to model a structure that will support huge cantilevers, flowing compound curves and slender towers.

Being able to predict loads and model a structure's behaviour electronically means engineers can work to very fine tolerances. This has banished the 'belt-and-braces' practice of over-engineering, delivering significant savings on material costs and producing lighter-weight structures.



But the lighter the structure, the more flexible it is likely to be, and this is where the problem of building movement arises.

“Steel frame has become more popular in commercial buildings because it’s light, it’s quick to erect and it’s more flexible than concrete. More building movement is permitted and that means we have to design curtain walling systems that can accommodate that movement,” says Mr Stamp.

The problems start when one part of a wall moves because of live load and another part does not move because of lack of live load.

Building movements are very small in real terms and are seldom if ever visible to the naked eye. Permissible displacement is calculated by dividing the span of the beam by a given co-efficient of deflection. Typically, a six-metre-long steel beam would be permitted to flex by up to 12mm along its length, the co-efficient of deflection being L/500.

In low-rise buildings, movement is seldom a problem.

“On a building up to about six storeys you can get round the movement problem by ‘stacking,’” says Mr Stamp. ‘Stacking’ is the practice of transferring the façade loadings onto the ground floor slab – literally stacking one storey-height on top of the other.

This allows the architect to design a self-supporting curtain wall structure behind which the building structure can flex and move. But on taller buildings the cumulative loads imposed by stacking are unfeasible.

“With high rise buildings each storey height is hung from the floor slab above and movement has to be accommodated at each connection,” says Mr Stamp.

Kawneer’s solution to the increase in building movement has been to design and develop a curtain-walling system in which each glazed panel can move more freely within its frame. The industry standard is a 50mm aluminium transom/mullion design that contains the glass within a 20mm-deep rebate with standard glass cover of 13mm. Kawneer’s 50mm system, the AA@100, is a successful example of this.



However, the new AA®110 system features a deeper 65mm box section which adds about 7.5mm to the rebate depth. This extra depth has two benefits: firstly, there is enough depth to increase the overlap between the aluminium frame and the glazed unit, thereby permitting higher barrier loadings (that is, the amount of lateral load the assembled system can withstand) and secondly, it leaves enough extra space between the frame and the glass to permit movement within the system.

The first application of the AA®110 system was completed this summer by Kawneer-approved installer Charles Henshaw & Sons at the futuristic Marine Operations Centre at Aberdeen Harbour.

This building, which is exposed to fierce salt-laden winds blowing off the North Sea, is subject to relatively high movements resulting from live loadings. Moreover, the curtain walling follows a complex faceted contour giving panoramic views over more than 270 degrees.



“We specified the 65mm system because our calculations showed that a 50mm system simply couldn’t do the job,” comments Charles Henshaw’s managing director Tom Lamb.

This £650,000 curtain-walling contract was successfully completed thanks largely to the collaborative team effort of Charles Henshaw & Sons, architects the Parr Partnership, Kawneer and main contractor Sir Robert McAlpine. Not all cladding contracts are as complex as this but neither do all cladding contracts benefit from such exemplary teamwork.

The trend in prestige commercial development today is very much towards high-rise steel framed buildings with a fully glazed curtain-wall façade and the pressure is therefore on system manufacturers to rise to the challenge.



“Other façade treatments are more forgiving,” observes Mr Stamp. “A rainscreen cladding or an insulated composite panel system hides what’s going on underneath. But these days the requirement is for floor-to-ceiling glass over slender concrete floor slabs and everything is on display. The challenge for us is to design a weatherproof façade that will accommodate structural movements without compromising the architectural effect.”

Mr Stamp says that 50mm systems are still very much the industry norm – though he believes that is set to change.

“There are undoubtedly buildings being built today with 50mm-wide systems when they should be using 65mm. In practice you seldom, if ever, get the maximum deflections you’ve designed for, so they might get away with it. But then they might not,” he says.

“I certainly think that within the next three or four years, 65mm curtain wall systems will become the norm. The industry is moving more and more towards lightweight structures and larger expanses of clear glass. If you are to accommodate the inevitable building movement, and deliver the necessary barrier loadings, you simply won’t be able to use a 50mm-wide box section,” says Mr Stamp.

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