Sloped Glazing Loads

With the introduction of AS/NZS 1170 and the revision NZS 4223:2008 the requirements for sloped glazing in roofs, canopies and awnings changed. This created some confusion in the glass industry about "when and why" the live load requirements shall be applied to sloped glazing, however, from an engineering design perspective, all design actions (loads) must be considered.

NZS 4223: Part 4:2008 Section 3 covers sloped glazing and applies to glazing up to 75° from the horizontal (15° from the vertical).

Clause 3.3 requires the glass to be designed for the following actions (loads)
(a) Wind load
(b) Dead load (including glass weight, snow and ice)
(c) Live load (maintenance)

Although the glass industry is familiar with the wind and dead loads, the live load requirements are newer and require some clarification.

The live loads for roofs are from AS/NZS 1170.1 Table 3.2 and there are three concentrated actions that may apply to glazing

- 0.5 kN – R2 (iii) for surfaces over which boards or ladders are required to be laid
- 1.1 kN – R2 (ii) for cladding providing direct support
- 1.8 kN – R1 for street awnings

The R1 roof requirement for street awnings is outside the scope of NZS 4223 and requires specific design.

Point, fixed and spider glazing systems also require specific design, but the loading requirements will normally be the same.

Maintenance Loads

The 0.5 kN live load is required to be applied to all glazing in which boards or ladders are required to be laid for maintenance reasons. In simple terms 0.5 kN is 50 kg, or half the weight of a 100kg person. The load is applied over a small circular area (0.01m²).

AS/NZS 1170.1 indicates that this is a special load case under controlled or constrained conditions and the 0.5kN concentrated load allows for some of the concentrated maintenance load to be carried by the underlying surface.

This may mean the boards or ladder must be designed and positioned and/or aligned so that the surface over which the load is applied is protected. For example - for glass, the boards or ladders may have to be stiff enough, and have boards spanning in two directions or whatever is required, such that loads are not applied to the glass surface. In commercial applications the specially designed steel planks are often quite stiff enough to span between mullions without imposing any load on the glass, particularly since glazing frames generally sit a few mm above the glass. In this case the 0.5kN concentrated load could allow for a foot load where one foot is on the plank and one on the glass or other surface.

The provision is intended to apply to all roofing materials, including glass. How much load goes on the underlying surface is related to the relative stiffness of the "board". The provision would imply that the boards or ladders do not impose any load on the underlying surface otherwise in the worst case the full load would have to be taken as a uniformly distributed load on the surface.

It may not matter if the boards or ladder are placed over a flexible roofing material (eg polycarbonate) where the boards are far stiffer than the underlying material such that the deflection of the boards or ladder under maintenance loads were able to be accommodated without damage to the underlying material.

However, if the glazing is so designed with a walkway or other form of maintenance access, then the glass can be designed without the live load requirements. This would need to be clarified at the design and tender stage.

Glass Design

The design procedure for wind, dead and snow load is detailed in Section 3 of NZS 4223.4:2008 and this is similar to the 2000 version. Loads for each are determined and then combined to determine the ULS design pressure, which is used to calculate thickness.

In addition, live load design tables for single glazing are provided in NZS 4223.4:2008 for two of the live load cases.
0.5 kN – Use Tables 7, 8, 9, 10
1.1 kN – Use Tables 16, 17, 18, 19

For an IGU the live load (point load) is applied separately to the uppermost pane only.
The ULS design pressure is applied to both panes using a load sharing formula.

So - In simple terms – you need to check the glass thickness for ULS design pressure and then check the outer glass meets the live load requirements. Deflection can be checked at SLS design pressure

If you alter the outer pane thickness of the IGU to meet the live load you may need to re-check the combined loads due to the increase in dead weight, and then check the inner pane of the IGU again as this may decrease due to load sharing.