



## Snapthrough of Rhombus Panels

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**Overview** | This report evaluated the snapthrough phenomenon which occurs when a square or rhombus plate has one of its corners displaced out of the plane relative to the other three. This has implications for the cold bending of glass to which is cheaper than hot forming the glass panels in the factory. In this case of snapthrough, the initial anticlastic curvatures flip to form synclastic curvatures which hence causes changes in the panel stiffness, stresses and boundary support reactions. This project investigated the influence of panel thickness, aspect ratio, uniform wind loading and the boundary conditions on snapthrough. All of these tests were performed numerically using the ABAQUS finite element software package using a RIKS analysis to capture the unstable behaviour.

**Main Outcomes** | Corner displacement to snapthrough was shown to vary linearly with thickness and quadratically with aspect ratio. From these results designers can determine whether the glass panel in question will undergo snapthrough when cold bent to a particular curvature. It was also shown that there are large curvatures of the edges in the post-snapthrough state (compared to almost straight edges pre-snapthrough). It is therefore desirable to keep the panel in a pre-snapthrough state as the curved edges will present challenges for water tightness and will tend to induce considerable stresses in any sealant or adhesive along the edges. The latter that would require careful stress analysis to ensure the additional stresses do not exceed the material strength limits.

**Future Work** | Further tests can be run to build up a full library of diagrams to show the snapthrough points of panels of all thicknesses and aspect ratios. In addition to this, a physical experiment to validate the results would validate the findings of this project.

**Industrial Partners** | *Tim MacFarlane, Glass Ltd.*

