Level | **PGR**

Design and performance of cold bent glass

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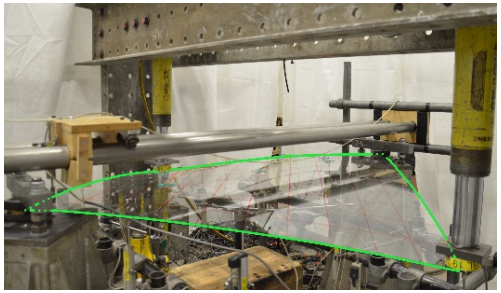

Fig.1: Cold bent 1x1m glass plate (150mm of applied displacement on each loaded corner).

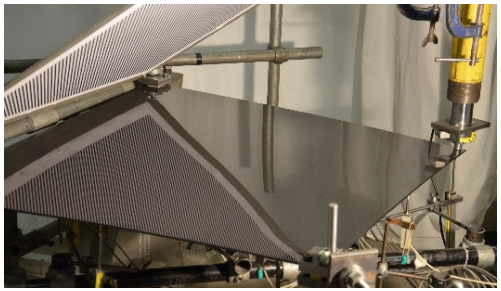

Fig.2: Zebra board reflection for the evaluation of the optical quality of cold bent glass - cold bending distortion arising form local buckling along the support axis.

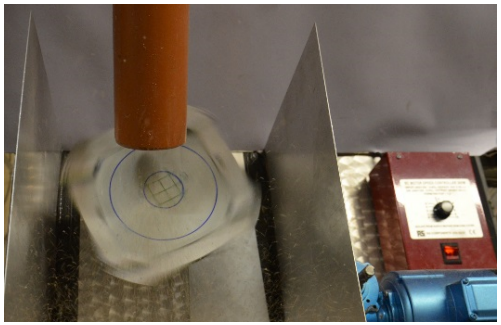

Fig.3: Artificial ageing of glass under 3kg of falling abrasive with a 3m drop height.

Overview | There has been a significant increase in the use of glass in buildings over the last decades due to architectural trends of lightness and transparency. More recently there has been a surge of interest in curvilinear glass forms. The principal challenges that arise from this are 1) to form the curved shape in a cost effective manner and 2) to ensure its efficient long term performance.

The recent availability of high strength and thin glass in the form of chemically toughened glass (CTG) provides an opportunity to address the first challenge by developing a new generation of lightweight stressed-skin glass surfaces. This can be achieved by introducing a controlled amount of strain in the panels thereby producing the required curvature. However, the durability of CTG is not well documented. Therefore, its long term performance should also be evaluated.

Outcomes and Impact | The aim of the project is to determine unknown parameters of cold bent glass products during the shaping process and their long term performance. The practical advantage of this research will be to produce a clear set of guidelines that will be used by engineers and that can be adapted for different case studies. The evaluation of the durability of CTG will determine its suitability for use in structural applications so that CTG could be then reliably used in cold bent glass applications ensuring its efficient long term performance.

Work Involved | The project will focus on the following:

- Numerical and experimental investigation of the mechanical response of monolithic and laminated cold bent glass units (*Fig.1*) and identification of the influence of boundary conditions, geometrical characteristics and orientation of the plate on global and local buckling instabilities (*Fig.2*) occurring during the cold bending process.
- Experimental evaluation of possible artificial ageing methods of glass producing random damage with falling abrasive *(Fig.3)* and deliberate damage using a scratching device. Subsequent implementation of the most reliable method on CTG to assess its durability.

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