INVESTIGATE THE BEHAVIOUR OF GLASS BALUSTRADES UNDER HUMAN IMPACT LOADS

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Glass balustrades are extensively used in various settings and are frequently subjected to different impact loads, including rigid or soft body impacts (human impacts). Ensuring the safe design and installation of glass balustrades to withstand these impact loads is crucial for minimising the risk of injuries caused by falling glass fragments. This research studies the behaviour of simply supported glass panels when subjected to different impact locations and speeds.

A comprehensive field survey was carried out to investigate the support conditions, glass types, and their behaviour under human impact loads. A Finite Element (FE) model of a pendulum impact test was developed to analyse and understand the response of tempered glass panels under human impact loads. Specifically, the horizontal and vertical strains of the glass plate were used to validate the FE model.

Additionally, a parametric study was carried out to examine the deflection patterns of the glass plate under impact loads, considering various impact locations and speeds. This research highlights the lack of public awareness regarding the safety requirements of glass balustrades, emphasising the need for education and guidelines.

Results obtained from the FE model agreed well with experimental data for drop heights below 700 mm, while acceptable deviations (-10% to +10%) are still observed for higher drop heights. Furthermore, the impact location significantly influences the maximum deflection in glass balustrades, with shifts towards the impact location observed at higher impact energies. The research findings highlight that the horizontal strain consistently surpasses the vertical strain across all drop heights. These insights provide valuable information for glass balustrades' design, installation, and maintenance processes, ensuring their safety and dependability in real-life situations involving soft body impact loads, such as human impacts.

Keywords: Glass Balustrades, Soft Body Impacts, Explicit Dynamic Analysis, Tempered Glass, Finite Element Analysis

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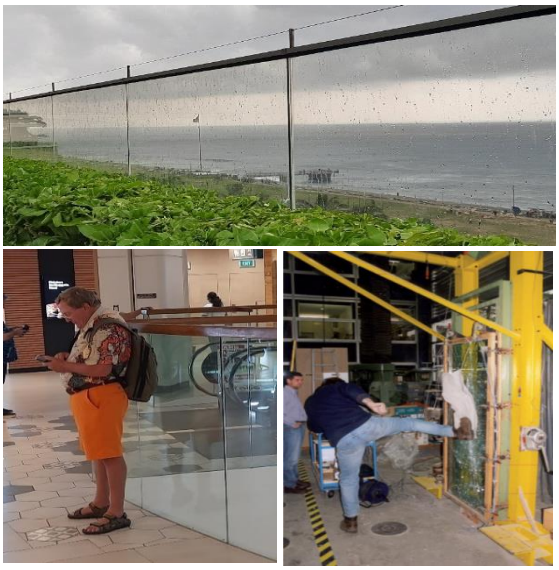
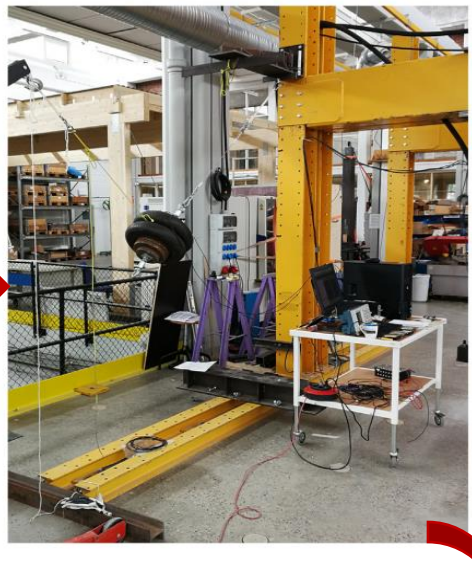
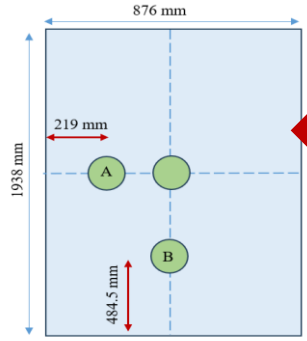


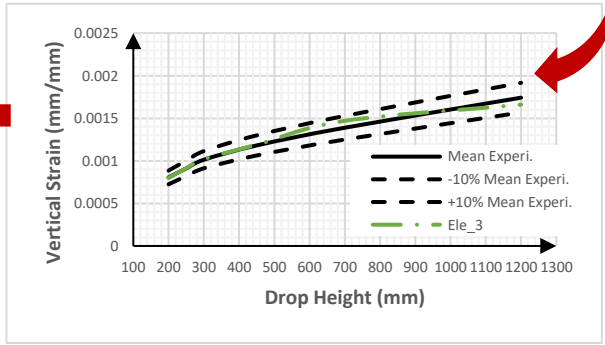
Human impact loads on Glass Balustrades

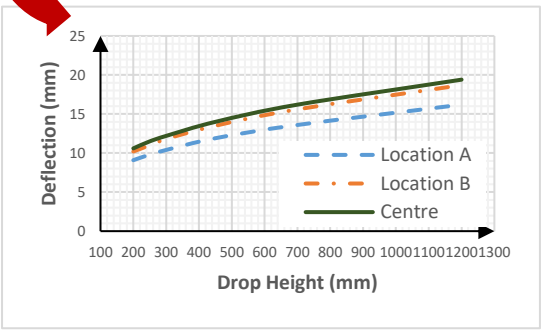


Soft body impact test setup

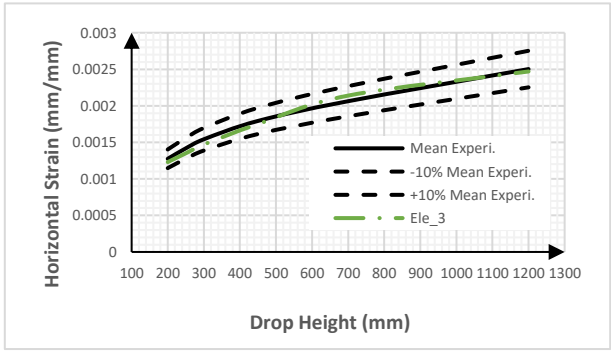


Variation of impact locations





Deflection vs Drop height with varying impact locations



Comparison of vertical and horizontal strains with FE model of glass panel with 3 number of through thickness elements (Ele_3)