Abstract

At Darmstadt University of Technology, Institute for Structural Analysis, extensive theoretical and experimental works have been made to develop design methods for soft body impact (human body) on glass panes. The behaviour of glass panes under impact loading plays an important role in the design of glass structures. Today it exists no design code for the design of glass panes under soft body impact in Germany. This is why all glass structures that prevent from falling have to be experimentally tested. The tests are done not only by certifying that a normative glass pane, linear supported at all sides in a stiff frame resists a certain impact load with an impactor, but all constructions have to be tested in situ or at least in an 1:1 test set-up. Therefore a design method without experimental testing was developed.

In the experiments the acceleration of the impactor and the strain at the backside of the glass panes was measured. Moreover the Institute for Structural Analysis carried out various experiments with human body impact in comparisons with the impactor at different drop heights. Results show that dynamic loading caused by the impactor at the present drop heights are much higher than dynamic loading by human body.

On basis of the experimental results a finite-element-model and a simplified dynamic model (2-DOF-model) was developed for the design of glass panes under soft body impact. The calculated results are in good agreement with experimental results. The 2-DOF model was then used to calculate equivalent static load for the design of the most common linear supported glass panes. A general table for equivalent loads, where only the parameters stiffness and generalized mass of the glass pane have to be given as an input, can used for the calculation of equivalent static loads for all types of glass structures.

Moreover the experimental results and calculations on the basis of fracture mechanics corroborate that the mechanical strength of glass for a short loading period is significantly higher than those determined by bending tests according to the norms.