Peer reviewed.
Full paper published in the Glass Structures & Engineering journal.

Safety concept for the assessment of different failure scenarios on load-bearing glass structure

Nathalie Nießer [1]
Prof. Dr. Ing. Geralt Siebert [1]

[1]Universität der Bundeswehr München,
Institute for Structural Engineering
Werner-Heisenberg-Weg 39, 85579 Neubiberg,
Germany
nathalie.niesser@unibw.de; geralt.siebert@unibw.de

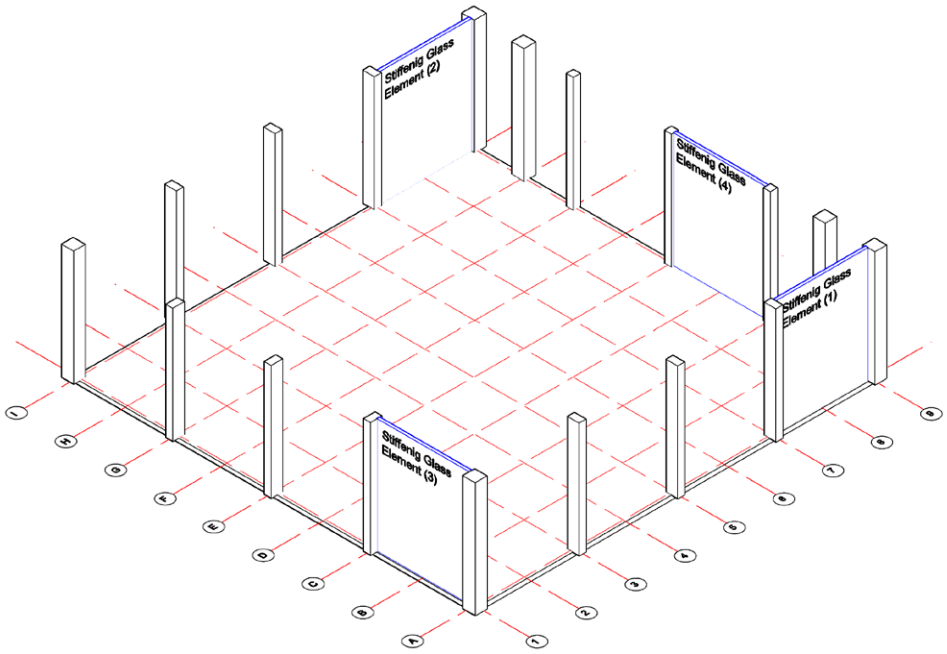

Figure 1. Different glass failure scenarios.

Key Words:

1=Redundancies 2=Safety concept 3= Glass failure analysis 4= Load scenarios

Extended abstract

The use of glass panes as load-bearing elements in building structures has been the subject of much research and development work in recent years. Although it has been proven that glass panes are capable of carrying loads in a structural system, their widespread use in load-bearing applications has not emerged yet. This is due to uncertainties regarding the reliability and safety of glass panes. One of the main problems is the sudden failure of individual glass panes, which can have a significant impact on the safety of the entire structure [1].
To address these problems and improve the safety of glass structures, the Institute of Structural Engineering at UniBw M has carried out a research project to develop an improved safety concept for such structures.
The research includes the development of a building model with a wooden supporting structure, stiffened with redundant, infilling glass panes, which is used to simulate the failure of one or more glass panes in order to determine the effects on the overall structure in general, as shown in Figure 1.
The virtual damages are examined for their probability of occurrence and the extent of the expected damage. Based on these results, qualitative statements can be made about the maximum credible damage.
The research project focuses on evaluating the necessity of redundancies in glass pane constructions and the possibilities of redistributing forces into load-bearing reserves of the construction. For this purpose, the load-bearing behaviour of the building model is analysed in different load scenarios and possible failure modes are identified. From the results of the analysis, a safety concept is developed that includes recommendations for redundancy and load redistribution in glass pane constructions.
The damage will also be investigated quantitatively. This numerical model will provide a solid basis for further investigations on a real model.
The research project has the potential to significantly improve the safety of structures that use glass panes as load-bearing elements. Furthermore, this should also lead to a wider application of glass panes in load-bearing structures in the future.
In summary, the research project on the safety of glass panes in load-bearing structures is an important step towards improving the reliability and durability of such structures. The development of an improved safety concept for glass pane structures will contribute to the safety of these structures and should support an application of glass panes in load-bearing structures.

References

[1] J. Wurm. Glass Structures: Design and Construction of Self-supporting Skins. Birkhäuser Architecture, 2014.