Residual Performance of Structural Glazing Joints After Seismic Low-Cycle Fatigue Loading

Paul Müller [a], Christian Schuler [a], Geralt Siebert [b]

a. University of Applied Science Munich, Institute for Material and Building Research, Karlstraße 6, 80333 Munich, Germany, mueller.paul@hm.edu, christian.schuler@hm.edu

b. University of the Bundeswehr Munich, Department of Civil Engineering and Environmental Science, Werner-Heisenberg-Weg 39, 85579 Neubiberg, Germany, geralt.siebert@unibw.de

Abstract

Structural glazing joints in glass and facade constructions are exposed to extreme loading conditions, including seismic events that induce few intense and randomly occurring load cycles. While previous research has demonstrated the predictable load-bearing and failure behavior of SG joints under such conditions by low-cycle fatigue tests, their residual load-bearing capacity after seismic events, particularly against wind loads, remains a critical concern. To address this issue, a comprehensive experimental program was conducted. Initially, the undamaged performance of the structural glazing joints was assessed through quasi-static reference tests on modified H-specimens. Next, low-cycle fatigue tests were carried out to characterize the load-bearing and failure behavior of the joints under seismic loading conditions. These tests provided the basis for calculating the number of load cycles required to introduce various levels of pre-damage in the samples. In the final phase, after loading with the predefined number of cycles, the residual load-bearing capacity was evaluated through quasi-static shear tests conducted to complete failure. The findings revealed a strong correlation between residual load-bearing capacity and pre-damage levels: Force-controlled tests showed that residual strength followed an elliptical relationship, with high coefficients of determination. Displacement-controlled tests exhibited a linear correlation between pre-damage and residual strength. The load level had little to no influence on the residual strength. These insights establish a better understanding of the behavior of structural glazing joints, especially after seismic loading scenarios. The results make a significant contribution to the development of a robust design framework for structural glazing joints under earthquake effects, supporting the safe and reliable design of facade systems in disaster scenarios.

The full paper will be published in the Glass Performance collection of the Glass Structures & Engineering journal (Springer).

Keywords

Structural glazing, seismic load, residual load-bearing behavior, silicones, low-cycle fatigue

Article Information

- Published by Glass Performance Days, on behalf of the author(s)
- Published as part of the Glass Performance Days Conference Proceedings, June 2025
- Editors: Jan Belis, Christian Louter & Marko Mökkönen