PVB -GLASS ADHESION AND ITS INFLUENCE ON THE BLAST PROTECTION PROPERTIES OF LAMINATED SAFETY GLASS

Luke Pasoce[1], Jessica Klimenko[2], Daniel Aggromito[3], Will Wholey[4]

[1]Arup, 699 Collins Street, Docklands, VIC Australia;
[2]Arup, 151 Clarence St, Sydney, NSW Australia;
[3]Arup, 560 Mission Street, San Francisco, CA USA
[4]Arup, 77 Water St, New York, NY USA

Key words: Blast, Laminated Glass, Delamination, Adhesion

Abstract:

Within the field of blast resistant design, laminated safety glass (LSG) incorporating a Polyvinyl Butyryl (PVB) interlayer is often used to meet two overarching objectives: maintaining the building envelope and minimizing flying debris. When suitably captured by its framing system, LSG can limit the ingress of the blast wave beyond the building envelope, while providing an adhesive surface to reduce fragmentation hazard. Though in order to adequately quantify the protective benefit of LSG, a thorough understanding of the post-fracture mechanical behaviour of LSG is required.

Previous studies have identified that protective performance is typically dependent on material thicknesses, glass heat treatment and support conditions. This is well researched and has led to the development of engineering models such as Wingard PE to predict the protective performance of typical LSG arrangements. More recently, factors such as interlayer mechanical properties, temperature, and adhesion level (the bond between the interlayer and the glass itself) have also been identified to influence the protective performance. However, the quantification of the effects of interlayer adhesion at high strain rates for engineering design applications remains a gap in existing knowledge.

In recent years, research and guidance have recognised that differing PVB adhesion levels may be suitable for differing applications, however there is limited high-quality data in the public domain to quantify the differences between levels. This study aims to address this issue by conducting physical testing on a range of PVB products at high strain rates, varying manufacturer and adhesion levels. This will then be post-processed to determine values for adhesion energy and strength for use in numerical simulations. Finally, this data will then be utilised in a series of blast simulations to determine whether current guidance is appropriate and form a source for evidence based, high quality data on PVB-glass composite behaviour.

Note this study is an extension of the work published by the authors in 2022 in the International Journal of Impact Engineering, 'Simulation of PVB-glass adhesion and its influence on the blast protection properties of laminated safety glass.'

[1] Aggromito, D., Pascoe, L., Klimenko, J., Farley, J., Tatarsky, M., Wholey, W. (2022). Simulation of PVB-glass adhesion and its influence on the blast protection properties of laminated safety glass. International Journal of Impact Engineering, 170, 104372.