Exploratory numerical investigation on aluminum reinforced PVB-laminated glass beam

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Abstract

Recently, reinforcement technology is introduced into structural glass beam design creating reinforced glass beam (RG beam). Although many pioneering experimental studies have demonstrated the technical superior, such structures frequently exhibited premature failure modes due to the adhesive detachment and glass brittleness. Numerical methods are in need for RG beam bond-slip behavior analyses and strength prediction. In this paper, a numerical model is proposed to analyze RG beam mechanical behavior. Based on previous experimental studies, the in-plane bending performance of newly invented Aluminum-reinforced glass beam (ARG beam) is validated by means of a simplified but focused 2D numerical model for quasi-static loading. Adhesive detachment behavior is simulated in the numerical model by using cohesive zone model (CZM) and 'killing element method'. Besides, the PVB interlayer effect is blended into the 'brittle cracking' module for glass elements in a subtle way. Effect of mesh size, adhesive fracture energy and adhesive thickness were analyzed.

Keywords: Reinforced glass, Aluminum, Experiment, Numerical investigation, Ultimate strength

References

[1] Bedon C, Louter C. Finite-element analysis of post-tensioned SG-laminated glass beams with mechanically anchored tendons. Glass Structures & Engineering. 2016;1:39-59.

[2] Khan MA, El-Rimawi J, Silberschmidt VV. Relative behaviour of premature failures in adhesively plated RC beam using controllable and existing parameters. Composite Structures. 2017;180:75-87.

[3] Kozłowski M, Kadela M, Hulimka J. Numerical Investigation of Structural Behaviour of Timber-Glass Composite Beams. Procedia Engineering. 2016;161:990-1000.