Numerical modelling of beam-beam connection systems using compressed wood plates and dowels

Iman Mohseni[†*], Sameer Mehra[†], Adeayo Sotayo[‡], Zhongwei Guan[‡], and Annette M. Harte[†]

[†]National University Ireland Galway, iman.mohseni@nuigalway.ie, s.mehra1@nuigalway.ie, annette.harte@nuigalway.ie
[‡]University of Liverpool, a.sotayo@liverpool.ac.uk, zhongwei.guan@liverpool.ac.uk

The compressed wood could be an eco-friendly alternative for metallic fasteners and adhesives in timber construction. Compression of wood leads to improved material characteristics, increase density and dimensional stability [1]. In this paper, the results of a finite element analysis on beam-beam spliced connection with compressed wood (CW) plates and dowels were presented. The main aim of this numerical modelling was to perform a parametric study to optimize the number and configuration of CW dowels and plates in the connection. There were three FE models developed for three different design configurations of beam-beam connection systems fabricated using CW dowels of 10 mm diameter and CW plate of 10 mm thickness. Figure 1 shows the geometry and stress distribution of a typical beam-beam connection using full CW plate. In the numerical models, the timber and CW were modelled as orthotropic materials with elasto-plastic behaviour. The interaction between the beam and plate is modelled by defining both tangential and normal contact behaviour. Tie constraints were used between the CW dowels and timber, and CW plates and dowels to form a tied connection during the simulation. Hexahedral 8-node reduced integration elements were used. Due to symmetry, only a half of the geometry was modelled in the finite element analysis. A comparison of testing [2] and numerical prediction of load-deflections and moment-rotations responses are presented so as to validate the developed 3D finite element models. The validated FE model is used to develop the influence of connection geometry on the responses. Based on the obtained results from parametric study, recommendations were provided on dowel patterns and geometrical conditions of the connection.

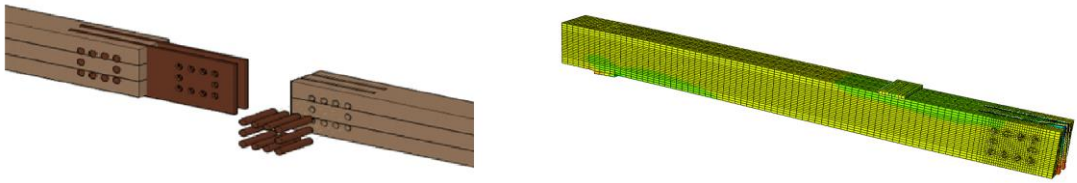

Figure 1. Full-plate connection (a) geometry; (b) stress distribution

References

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