Edge Connection Technology for Cross Laminated Timber (CLT) Floor Slabs Promoting Two-Way Action

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Summary:

Cross-laminated timber (CLT) is a class of engineered wood product with the ability to act as a flat plate floor system transferring loads in two-directions due to the orthogonally crossed layers. Currently, dimensional limitations from manufacturing and transportation limit the minor span to about 3.0 m. This results in under utilization of the bending properties of the cross-layers or the choice of a different product because of the common use of one-way bending support conditions such as drop beams simply supporting the ends of the longer span. This study investigates the performance of a newly developed edge connection system to maintain continuity in the minor direction span of CLT and promote two-way bending action. Three connections utilizing a tension splice fastened to the underside of the panel edges with self-tapping screws are investigated, with experimental results showing promise to maintain a high level of stiffness. This connection system was placed in the maximum moment location of the minor span - attaining a connected span modulus of elasticity up to 1.17 times the intact span modulus of elasticity, indicating a reinforcing effect created by the connection. Further, the minor direction span is additionally stiffened through the use of parallel-strand lumber rim beams fixed to the edges of the CLT in the minor direction span and hidden within the cross-section of the CLT. ANSYS finite element modelling calibrated and validated from the experimental results show the potential of this flat-plate system using 5-layer CLT to reach column spacing of 6.0 m by 6.0 m limited by deflection under a serviceability limit state uniformly distributed load of 3.25 kPa. This claim maintains a high degree of conservatism, as the boundary stress obtained from the minimum observed failure load is greater than 6 times the maximum stress at an ultimate limit state load of 4.67 kPa. This system has the ability to expand the flexibility for designers to utilize CLT more efficiently and create large open floor spaces uninhibited by drop-beams.

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