Experimental investigation of bonded-in rods in beech wood connections with sinking lengths

Degree programme: Master of Science in Wood Technology | Specialisation: Complex Timber Structures
Thesis advisors: Dr. Bettina Franke, Prof. Dr. Steffen Franke
Expert: Prof. Dr. Alexander Salenikovich

Single bonded-in rod connections in beech wood with fixed edge-distances 1.75d and fixed bonded lengths 13d without and with various sinking lengths from 1d to 5d were tested. All samples with sinking lengths from 2d to 5d had exclusively steel failures and connection utilization factors from 0.78 to 0.96. Two samples without sinking lengths and one sample with sinking length 1d had brittle timber splitting failure.

Experimental research

Steel rods M16 strength class 8.8 were glued using two-component PUR adhesive Loctite® CR82 into glulam European beech timber class GL40h. Six series of samples were prepared and experimentally tested according to SN EN 26891:1991 using a universal testing machine (ZwickRoel, Z250). Each series of samples had four samples. Edge-distance 1.75d as well as bonded length 13d were constants for all samples in all series. Samples for series 0 had no sinking lengths, while samples within series 1, series 2, series 3, series 4 and series 5 had sinking lengths 1d, 2d, 3d, 4d, and 5d respectively. Pull out load at speed 1 mm per min by a machine jack was applied till the sample failure or until 30 % of maximal achieved force dropped down. All samples were after testing cut out along its length to investigate occurred failures. Connection utilization factor for each sample was calculated by division of maximal experimental connection force and timber tensile breaking force.

Results

Connection breaking force were in the range of 97.3 kN and 138.8 kN. Two different types of connection failures were seen, brittle timber splitting and ductile steel failure. Two samples without sinking lengths and one sample with sinking length 1d had timber splitting. All samples with sinking lengths from 2d to 5d had exclusively steel failures and connection utilization factors from 0.78 to 0.96.

Conclusion

Edge-distance 1.75d and spacing 3.5d for bonded-in rod beech wood connection with sinking length 2d is suggested. Edge-distances 1.75d and spacings 3.5d may increase the connection efficiency, while 2d sinking length may prevent timber splitting failure. However, in this experimental study only four samples per series were tested. Connections with only rod diameter 16 mm and beech glulam GL40h were considered. To obtain more statistically reliable results a larger number of samples with various material

Milos Asenov

Figure 1: Timber splitting failure

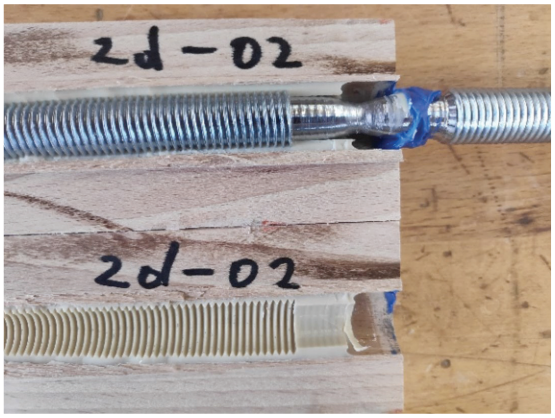

Figure 2: Ductile steel failure