FIRENWOOD

Medium- and large-scale fire tests

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Full-scale compartment fire tests with wooden I-joists

Project title:

Improved fire design of engineered wood systems in buildings

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In order to validate results acquired from small-scale tests and the fire design models proposed in the project, an extensive number of the model- and full-scale fire tests were performed in the time period March 2020 to April 2022.

Loaded I-joists with finger joints in the bottom flange were tested in a model-scale fire test furnace (1.5m × 1.5m) where the time to loadbearing failure was measured. The I-joists were loaded with 40% of their maximum flexural load which earlier had been determined for each I-joist on twin specimens. Cross-laminated timber (CLT) and glue-laminated timber (GLT) elements were also tested in the same model-scale fire test furnace where the mass loss and the charring rate were measured and calculated. Thanks to partners and adhesive manufacturers the project was able to increase the number of model-scale CLT and GLT tests from the initial test plan, leading to a wider range of data to use for validation. One specific adhesive was selected for further testing in large scale. Three of the four large-scale tests were performed using two fire resistance furnaces (vertical 3m × 3m and horizontal 4m × 3m). One test was on a load-bearing wall, and one was on a load-bearing floor where both incorporated I-joists with finger joints in the construction. The horizontal furnace was also used for testing a load-bearing horizontal CLT element. The loadbearing capacity was measured in all loadbearing capacity tests together with temperatures inside the constructions. Finally, a compartment test was performed in a large fire test hall. The compartment was built inside the hall and consisted of wooden I-joists, stone wool insulation and gypsum boards. Temperatures were measured during the test and residual cross-sections of some of the I-joists were measured after the test.

The results from the model- and large-scale tests revealed that there was a good correlation between the small-, model- and large-scale tests and the proposed fire design models were possible to finalize together with this valuable and necessary data.

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