Maria Binte Mannan, “Fire Behaviour and Fire Stability Test of Wood Species and Joint Types”, IMFSE Master’s Thesis, May 2024

Popular Science Summary

Timber is gaining popularity for sustainability, quick assembly, and aesthetic value. Recently, the uses of an engineered product like Glue laminated timber and Cross-laminated has increased which required glued joints to produce them. Not only just producing this timber specimen, but also in any timber construction joints exist to minimize wastage, and support the structure. This jointed part is considered the weakest part of the structure. So, it is really important to include the behaviour of joints in fire design. Although the wood behaviour is widely described, the fire behaviour of glued joints still needs to be explored.

This research is structured around two main goals. Firstly, it aims to investigate the behaviour of five different types of jointed wood across various wood species during the developing fire stage. Secondly, it focuses on understanding the stability (failure of the joints) of these jointed wood structures under fully developed fire conditions. To achieve these goals, two distinct tests were conducted: the Cone Calorimeter test and the Fire Stability test. Through 160 small-scale tests, including cone calorimeter and fire stability tests, Pine, Spruce, and Beech woods with various joints and thicknesses were analyzed. For the cone calorimeter test, the ISO 5660:2015 standard was followed, and the fire stability test was conducted on a small scale at the BAM laboratory to meet the specified objectives. Detailed descriptions of the test setup can be found in the report.

The main results revealed that different types of wood and joints exhibit varying behaviours in terms of the time of ignition, first and second peak release, time to reach the first and second peak, mass loss rate, and total heat release when subjected to fire. Differences have been observed in the failure time, and thermal penetration among jointed wood due to density, and thermal conductivity differences. Understanding these differences is crucial for designing buildings that can better withstand fires. The small-scale tests were the focus of this work. Furthermore, the findings suggest that further research is necessary to fully comprehend the behaviour of wood joints in fire scenarios, which can ultimately enhance building safety standards.