Abstract

This literature review is part of the *Fire Protection Research Foundation* project on *Fire Safety Challenges of Tall Wood Buildings* and focuses on the contribution of wood based construction to compartment fires. In order to provide a basis for experimental research, predictive models and comparative studies, this literature review includes a summary of 41 fire test of compartments comprising exposed or protected wood based construction and 4 reference tests of compartments comprising non-combustible steel frame construction. Additionally, overviews of test parameters, results and conclusions are provided.

Experimental methods found in the literature for quantifying the contribution of wood based construction involve measurement of the weight loss, measurements of the average charring depth/rate or heat release calorimetry of all extracted air. Heat release calorimetry has been performed successfully in recent works and requires knowledge of the heat release that corresponds solely to the movable fire load in order to determine the contribution of the combustible construction materials. The heat release of the movable fire load can be obtained from a reference test of a similar compartment consisting of non-combustible construction materials. In cases where combustible gases, such as propane, are used as fire load, the heat release corresponding to the fire load can be controlled by regulating the gas inflow.

Mass loss has previously been determined in order to estimate the heat release rate corresponding to a compartment fire. In order to quantify the sole contribution of combustible construction, either the mass loss of solely the construction or a reference tests without combustible construction materials is required. Charring depths and charring rates have been used to estimate the heat release of the construction materials. This method does not require reference tests.

Studies have shown that the contribution of encapsulated timber to a compartment fire can be non-existing or insignificant. Potential failure of the encapsulation, however, can lead to the involvement of timber in the fire and can eventually lead to a second flash-over. It was shown that the presence of unprotected combustible surfaces leads to an increase of the heat release rate, but does not necessarily lead to increased temperatures within the compartment. In under ventilated fires, the contribution of unprotected timber can lead to significant flaming combustion outside of ventilation openings, such as windows. The contribution can, but does not always, lead to a delayed decay of a fire.

An overview of relevant results such as peak heat release rates, charring rates time to decay of a fire and encapsulation times is given and discussed. Furthermore, complications that have been reported in the literature have been discussed.