

Abstract

The application of timber in multi-storey buildings is limited by the building code requirements because of its combustibility. Until a few years ago buildings with load bearing timber elements were restricted to a maximum height of 7 meters. The application of timber in higher buildings was not allowed because of the danger of unnoticed glowing combustion inside the construction that could lead to a delayed collapse. Furthermore it was assumed, that timber constructions do not have a sufficient smoke tightness like monolithic constructions made of concrete or brickwork.

With the new edition of the model building code in 2002 and a model guideline for fire protective requirements on multi-storey buildings made of timber in 2004 it is now possible to construct buildings out of timber up to a height of 13 m. The building code demands for these types of houses, that the load bearing timber elements are protected by a non-combustible cladding against ignition over a standard fire exposure of 60 minutes (classification K₂60). Furthermore, combustible insulation materials are not allowed inside the timber frame construction.

Within this work it was shown by fire tests in different scales that combustible insulation materials in timber frame elements as well as solid timber elements can be used if the non-combustible K₂60 cladding is kept and additional constructive requirements are fulfilled. Under these conditions the fire safety level according to the building code requirements will not be reduced.

Another part of the work dealt with the possibility to reduce the non-combustible cladding of the timber elements. Based on fire tests and theoretical studies, different fire safety concepts for timber structures have been elaborated which compensate a decrease of the cladding and the related increase of the fire risk by other preventive measures and therefore avoid a reduction of the presently accepted fire safety level.

A Scandinavian semi-quantitative risk index method was chosen and further developed for the evaluation of multi-storey buildings of building class 4 with timber construction in order to compare the fire risk of different types of construction and different safety concepts. The weights of the parameters defining the fire protection were modified on the base of a Delphi-inquiry of German experts. Additional parameters describing especially the timber construction with a non-combustible cladding, minimal requirement for all parameters and compensation groups to account for the common efficiency of several compensation measures were introduced.

This extended index method was applied to the developed alternative fire safety concepts for multi-storey apartment buildings of building class 4 with timber construction. The comparison of the calculated risk indices confirmed the results of the own fire tests and theoretical studies that the presently accepted safety level as it is given by the standard requirements of the building code and model guideline for multi-storey buildings made of timber will not be reduced.