

English Summary

Limited natural resources and a rising awareness of economic and sustainable building increase the importance of timber constructions, in particular for multi-storey residential, office and functional buildings.

Due to strict building regulations, timber constructions in Bavaria were limited to a maximum of three storeys until January 2008. Few exceptions (pilot projects) were realized by special concepts using fire-engineering methods demanding high costs and a complicated approval procedure.

With the amendment of the Bayerische Bauordnung (Bavarian Building Regulation; BayBO) in 2008 and the harmonization with the Musterbauordnung (Master Building Regulation; MBO) from 2002, Bavaria achieved an intermediate objective to extend the application area of timber construction from three storey buildings up to five storey buildings without losing the high national safety standard. This was enabled by introducing a new building class 4 covering buildings with a medium height. Building class 4 regulates buildings with a maximum height of upper floor level of 13 m above mean value of ground level and units with a maximum gross base area of 400 m².

Already in 2004 high fire retardant building parts in timber-frame building methods as well as their connections and details were defined in a „Muster-Richtlinie über brandschutztechnische Anforderungen an hochfeuerhemmende Bauteile in Holzbauweise“ (model guideline for fire protective requirements of high fire retardant timber structures; M-HFHolzR). It was verified, that the defined building elements ensure safe multi-storey constructions concerning danger for individuals through the spread of smoke and fire gases as well as through masked or smouldering fire inside the timber construction.

By the amendment of the Bavarian Building Regulation this model guideline became part of the technical building rules of Bavaria.

In practice the application of this guideline – mainly in other German federal states which established them before Bavaria – and application based on the Musterbauordnung (Master Building Regulation; MBO) showed, that the defined terms and requirements are still too conservative and building with this method implicates high expenses in material and fabrication.

In competition to other building materials, multi-storey timber constructions often lose their attractiveness compared to brick and concrete constructions due to high initial costs - although these costs could be amortized on the long run through

lower maintenance costs (i.e. energy consumption).

Project TP2 was run within the research cluster “Holzbau der Zukunft” (future timber structures) as a part of the “High-Tech-Offensive Bayern” to focus in particular on the mentioned disadvantages of building class 4 timber constructions and to develop solutions. Additionally, proposals for using timber in building class 5 (up to high rise buildings) were worked out.

Since in the present building regulations, multi-storey facades from three storeys up to high-rise buildings are only allowed with difficult combustible materials on the surface, constructions of combustible materials had to be found applying additional measures to meet the relevant protection goals.

In 2001 Switzerland started a major research project “Brandsicherheit und Holzbau” (fire safety in timber construction) which aimed at basically identical objectives:

- Modification of the rules and regulations in fire protection for timber constructions
- Provision of technical solutions
- Increased attractiveness of timber construction to house-builders
- Risk management

Goal of the Swiss project was to create criteria for the construction material timber which meet these objectives and additionally to define material specific conditions to be documented as “state-of-the-art technology”.

Based on the experimental data of the testings performed in the Swiss project, recommendations were developed in the Bavarian research program to transform the present model guideline for high fire retardant building parts in timber constructions M-HFHolzR into a new “Muster-Holzbau-Richtlinie” (model guideline for timber construction; M-HolzR) which covers all multi-storey timber constructions.

As far as possible, the text of the recently amended Bayerische Bauordnung (Bavarian Building Regulation; BayBO) was not altered and proposals were included in the new model guideline to achieve practicability and quicker feasibility of the results by the authorities.

At a glance, the major innovations of the research project are:

- The scope of the draft, covering the regulations for building class 4, was ex-

tended to building class 5.

- The existing building component classes (high fire retardant, fire resistant) were not changed. The definition of their configuration has been expanded concerning the use of normal combustible protective claddings and combustible insulating material.
- Smoke alarm devices, fire alarm systems as well as sprinkler systems were included into the guideline as standard measures. These were already accounted as compensation measures for the determination of the performance requirements imposed on the building parts and building materials. In combination with different construction methods, they shall as well assure a constant performance concerning the protection goals.
- In addition to the present high fire retardant construction method which is regulated by the M-HFHHolzR by demanding a non combustible cladding of K260 according DIN EN 13501-2, an additional classification into classes K245, K230 and K215 was established providing the measures mentioned above. In combination with a sprinkler system, the encasing classes K230 and K215 are allowed to be composed of combustible material.

An analogue classification was developed for building parts demanding fire resistant building methods. The basic building element to be used without additional compensation measures is a combination of a loadbearing structure providing a fire resistance of minimum 90 minutes (R90) and a fire protection, encasing cladding providing a encasing criteria of minimum 90 minutes accordingly (K290). By taking into account fire alarm devices and sprinkler systems, an additional classification achieved a minimal encasing class K245 using combustible building parts.

P02 - 6 Summary

- The regulations of the M-HFHHolzR concerning connecting building parts were adopted with only minor modification. Attention was paid to specify systematically all details to connections and openings of building parts which can be applied without ambiguity to similar situations not described.
- The existing regulations of the M-HFHHolzR concerning to installations were adopted and extended to be applied to constructions in building class 5. Therefore, it was important to apply the rules for installation of sealing and lead-through systems onto timber construction parts with high performance requirements; these rules are approved by the building authorities for drywall construction or masonry and concrete structures.
- Based on the data of the Swiss project developed through the original fire tests on multi-storey facades with combustible claddings, fire protection

measures were developed. Adopting these measures, the defined protection goal can be attained comparable to facades of buildings using difficult combustible cladding materials. A catalogue of additional constructional measures to the various common types of claddings is available. Furthermore, construction details necessary for the planning and building of such facades are listed e.g. for transition to different types of facades or for openings in external walls.

The development of a recommendation for a new “Muster-Holzbau-Richtlinie” (model guide line) was an attempt to contribute to the realization of multi-storey timber constructions up to high-rise building size. Following this research project, a quick implementation in practice is planned in close collaboration with the building authorities. This could be realized by the establishment of this draft as a model guideline through the “Bauministerkonferenz” (Ministerial Conference of Construction).

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