Brunswick conference

Timber construction and fire safety design guidance were among the topics discussed at Germany's leading fire engineering conference. **Karl Wallasch** reports

© Carsten Reisinger - Fotolia.com

NOW IN its 23rd year, the annual fire engineering conference held in Brunswick, Germany – the leading fire engineering conference for German-speaking European countries – took place last September. Some 1,300 delegates attended the two-day event. These included representatives from regulatory bodies, fire and rescue services, fire engineering consultancies, architectural practices, regional and national building authorities, research organisations, trade bodies and the insurance sector.

Once again, the conference was organised by Professor Dietmar Hosser of the Institute of Building Material, Concrete Construction and Fire Protection, at the Technical University of Brunswick (TUB). The main topics debated were:

- research results and the latest developments in the fire industry, with a specific focus on timber construction
- new guidance relevant to fire engineering, including the implications of Eurocodes in Germany and guidance regarding the design of smoke extract systems for industrial buildings
- examples of strategies and projects where fire engineering principles have been used to justify unique design concepts – for example, a 19m residential building where timber was used as the main structural element, without additional fire protection or sprinkler provision
- new features that have been introduced to the second edition of *Code of Practice – Fire Engineering*, the fire engineering guidance in Germany

More than 1,300 delegates attended the two-day conference

© Michael Hagelganz

Timber research

Dr Ing Björn Kampmeier and Dirk Hollmann, both from TUB, presented the latest research into the design of buildings where timber is an element of the main structure.

Before 2002, German building regulations permitted the use of timber as a material for the main building structure only up to heights of 7m. Since 2002, the regulations have permitted buildings using timber as the element of the structure up to a height of 13m. However, all timber elements are required to be protected using non-combustible material, such as gypsum plaster board or gypsum fibreboard.

Dr Kampmeier's latest research, based on theoretical and experimental analyses, has proved that solid timber elements can be used in buildings up to a height of 13m, using specific construction details. The research also identified that the practice of providing non-combustible material to protect structural elements is key to reducing the risk of failure in the event of a fire in a tall building (greater than 13m in height).

The next edition of the building regulations will incorporate these findings. This will lead to 'prototype' guidance for timber buildings for further development within each of the 16 states within Germany. (Prototype guidelines are developed by a committee of representatives from each of the 16 states, but need to be implemented by each state separately to become a regional regulation.)

Mr Hollmann followed with a summary of the results of a related research project. Sponsored by research institutes and timber manufacturers, the project looked at creating coating compound materials for timber structures, in order to achieve a non-combustible fire rating of 60 minutes. This would comply with building regulations, and allow architects and clients to have visible timber structures in taller buildings.

These new timber coating compounds could be of interest to the UK market, given the growing use of timber in building design in the UK.

New guidance

This topic of discussion was divided into the new DIN standard on elements of structure and a review of new guidance on industrial buildings. DIN is the German Institute for Standardisation, and is similar to British Standards Institution.

Astrid Weilert, a fire engineer with HHP, Cornelius Albrecht of TUB and Professor Hosser presented a new national annex (applicable to Germany) to the Eurocodes – harmonised technical rules for the design of construction works in Europe. The new national annex is due to be issued in March 2010.

> "A new national Annex to Eurocode 1 advises on the calculation of a time equivalency analysis"

In Germany, Annex E from the guidance DIN EN 1991-1-2: 2003-09 advises on the calculation of relevant risk/safety factors for a time equivalency analysis. This is the country's equivalent of BS EN 1991-1-2: 2002 Eurocode 1: *Actions on structures*. Part 1-2: *General Actions – Actions on structures exposed to fire.*

However, in a situation similar to the UK, the national Annex E in Germany was not accepted by the relevant authorities. The revised method for calculating fire load density, with specific reference to the factors relating to the danger of fire activation and the function of active firefighting measures, was deemed not to be appropriate in Germany.

The general opinion appears to have been that adopting Table E.2 of EN 1991-1-2: 2002 could lead to an under-estimate in the required period of fire resistance, which could compromise life safety. It was also generally felt that the safety factors were very subjective and that little information was given regarding how they had been agreed and where the research supporting them had come from.

As presented at the conference, the new national Annex E for the use of Eurocodes in Germany is called 'Sicherheitskonzept' (safety concept). It is a probabilistic method, based on characteristic values and partial safety coefficients for different building types.

This is interesting, as it reflects the UK industry's own concern regarding the Eurocode. Most UK engineers did not use the 2002 Eurocode in its original format, and instead used an adaptation of the Eurocode. They now use the National Application Document (NAD), PD 6688-1-2: *Background paper to the UK National Annex to BS EN 1991-1-2*, which sets out additional recommendations on how to apply the Eurocode, to ensure it is suitable with regards to UK legislation.

It is hoped to undertake a comparison between the new national annex in Germany and the NAD in the UK at a later date, in order to compare fire engineering techniques in both countries.

Standard for industrial buildings

This was followed by a presentation from Professor Ulrich Schneider and Nina Schjerve from the Institute for Building Construction and Technology at Vienna University of Technology, on a new DIN standard, currently under development, covering the use of fire engineering for industrial buildings.

Currently, the existing standard DIN 18230-1: *Structural fire protection in industrial buildings – analytically required fire resistance time* is based on simple calculation methods for estimating required fire resistance (time equivalency assessment) or sizes of minimum smoke extract/outlets.

The new DIN standard under development, DIN 18230-4: *Structural fire protection in industrial buildings – time equivalency assessment methodology and smoke extract using fire simulation*, allows fire engineers to use zone modelling, as well as computational fluid dynamic (CFD) simulations, to calculate the time equivalency and smoke extracts/outlets for any industrial building, and thereby achieve more precise and realistic results. This guidance will allow fire engineering methods to be used for industrial buildings, and assist fire engineers in developing fire strategies for large and super-large industrial buildings. It will also offer authorities guidance during the approval process.

Fire engineering strategies

Prestigious fire engineering strategies were also presented at the conference, including:

- an auditorium project (1,844m^2), where a combination of CFD and real smoke tests were used to design smoke control provisions
- examples of pressurisation stairs in high towers, such as Wintower in Winterthur, Switzerland
- structural fire engineering design for the Adidas headquarters in Bavaria

The most interesting example was a typical residential building in Berlin, as presented by Dirk Kruse and Dr Michael Dehne of Dehne & Kruse Brandschutzingenieure. This had a client requirement that the development should achieve a high sustainability rating and become a beacon project. The main features were timber construction for all elements of the main structure, and for some of the timber structure to be visible to the building users – for example, in the form of a suspended timber ceiling.

The fire engineering strategy for this residential timber building in Berlin was outlined

The building has a height of 19m and therefore complies with German building regulation height group 5 (a building with a height greater than 13m but less than 22m). Following the regulations, any building less than 13m in height can be constructed with timber as the material for the main structure. However, non-combustible materials are required to protect all timber elements.

Kruse and Dehne developed a fire engineering strategy which omits the requirement for a non-combustible layer for the floor structure. The timber walls are protected using non-combustible materials. All timber elements achieve a fire rating of 90 minutes. One flat is provided per level – this is constructed as a single compartment. Enhanced detection is provided throughout the building and an external concrete stair core is provided as first means of escape where each level is also provided with a second means of escape (this is via fire ladder from a fire vehicle and therefore travel distances comply with German regulations).

It is likely that, in the near future, hybrid construction systems (a mix of timber and concrete elements) will be used for tall buildings throughout Europe. This will allow greater flexibility regarding sustainable construction and architectural freedom. However, this also requires the development of substantial fire engineering concepts.

Code of practice

Professor Hosser gave an overview of the second edition of *Code of Practice – Fire Engineering* in Germany. The first edition was published in May 2006 by the vfdb, the German Fire Protection Association, as a free copy. Since then, the guidance has been downloaded throughout Europe and used in practice. Feedback was collected and integrated in the production of the second edition by a European reviewing committee.

In future, timber-concrete hybrid constructions will become more popular

The revised document is now more similar to BS 7974: *Application of fire safety engineering principles to the design of buildings. Code of practice*, and the Chartered Institution of Building Services Engineers (CIBSE) Guide E: *Fire Engineering*, applicable in the UK.

However, the new German guidance does not have DIN status. Its use in general practice therefore still requires discussion and approval from authorities. Notwithstanding, in less than five months, more than 25,000 downloads of the new document were registered. It is hoped that, with the release of the second edition, the use of fire engineering techniques will become more common in Germany and other German-speaking countries.

The next major fire engineering conference in Germany, the 11th International Seminar on Fire Protection: *Developments in Fire Risk Assessment and Fire Prevention*, will take place on 8-9 June 2010. This conference, organised by the vfdb, is part of the international trade fair, *Interschutz 2010*, being held on 7-12 June in Leipzig ■

Karl Wallasch is a senior fire engineer with Hoare Lea Fire Engineering