

An aerial, slightly faded photograph of a city, likely Barcelona, showing a dense urban landscape with many buildings and a construction crane visible in the lower right.

Management Committee Meeting Working Group Meeting COST Action FP 1404

Bio-based Building Products and Fire Safe Design of Buildings - Recent Developments

Two photographs at the bottom of the slide. The left one shows a pile of light-colored wood chips or sawdust. The right one shows a close-up of a log with a cross-section revealing the wood grain.

**Barcelona, Spain
20th – 21st April 2015**

Management Committee Meeting Working Group meeting

Book of abstracts



Bio-based Building Products and Fire Safe Design of Buildings - Recent Developments

**School of Building Construction of Barcelona EPSEB
Technical University of Catalonia UPC**

**Barcelona, Spain
20th – 21st April 2015**



Book of abstracts of the first working group meeting of the COST Action FP 1404
Fire Safe Use of Bio-Based Building Products: Bio-based Buildings and Fire Safe
Design of Buildings – Recent Developments.

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Disclaimer: This book of abstracts compiles the papers presented in the
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 Buildings and Fire Safe Design of Buildings – Recent
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 The opinions expressed within are those of the authors and may
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Fire safe use of bio-based building products in Macedonia

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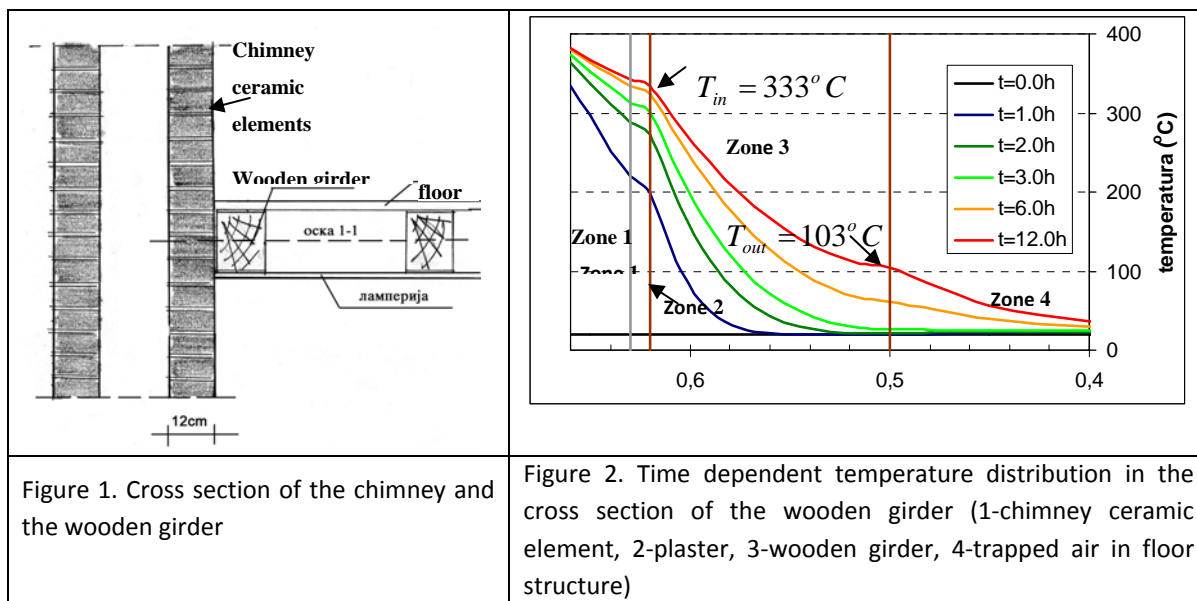
The combustibility of wood is one of the main reasons why most building codes strictly limit the use of timber as a building material, in particular by limiting the number of storeys. In Macedonia timber structures are limited to low-rise buildings with 2 or less storeys, but the fire safety is not the only precondition for the use of wood for multi-storey timber buildings. Macedonia is active seismic region and the seismic resistance of the structure is the main criterion for the material choice. Timber structures have lower seismic resistance than reinforced concrete structures and steel structures. Active seismic regions need a new seismic design philosophy that will provide the necessary mechanisms to safely increase the height of wood-frame structures. This philosophy is based on the application of seismic damping systems for wooden buildings, such as strong metal frames inside the wooden walls, bracings and dampers filled with viscous fluid. According to Macedonian regulations, the design model for fire exposed timber structures takes into account the loss in cross-section due to charring of wood and the temperature-dependent reductions of strength and stiffness of the residual cross-section. This model is in analogy with the “Reduced Cross-Section Method” according to EN 1995-1-2 commonly used for the fire design of timber members.

Overview of the finalized research projects

In Macedonia there is no option for fire tests of elements or full scale fire tests and from that reason only numerical investigations on fire resistance of structural elements are performed. For that purpose the computer program FIRE [1] based on FEM is used. This program was originally developed at the Faculty of Civil Engineering in Skopje. For timber elements only thermal analysis were performed. One of the research projects was “Influence of high temperatures from chimneys on flammability of wooden girders” [2]. Few types of mostly used chimneys and floor structures were analyzed. The time dependent temperature distribution for one of the analyzed girders is presented on Figure 2.

Researches of different types of wood-based panels for use in construction were conducted within scientific research projects, master thesis and doctoral dissertations at the Faculty of design and technologies of furniture and interior-Skopje, as well as at the Faculty of Forestry in

Skopje [3,4]. One of these research projects was the scientific project “Finding the most favourable way of production of wood panels by combining wood, gypsum and cement”. The main objective of the project was production of structural panels based on wood and mineral binders (cement, gypsum and cement-gypsum mixture) for application in construction. The following properties of these panels were tested: water absorption and thickness swelling, bending strength, in-plane compressive strength and coefficient of thermal conductivity. The fire resistance test of the panels was not performed due to the lack of equipment, but the future planned investigations are in that direction.



Laws, Rulebooks and Standards applicable for bio-based building products:

1. Law on construction products
2. Rulebook on protective measures for fires, explosions and hazardous substances
3. Rulebook on the essential requirements for fire protection of buildings
4. Standards: MKC EN 13501-1; MKC EN 13501-2; MKC EN ISO 1182; MKC EN ISO 1716; MKC EN ISO 9239-1; MKC EN ISO 11925-2; MKS EN 1995-1-2.

Research Projects:

- [1] Cvetkovska M. “Nonlinear stress strain behaviour of RC elements and RC frames exposed to fire”, Phd. thesis, University St.Cyril and Methodius, Skopje, 2002.
- [2] Cvetkovska M., Trombeva Gavriloska A. “Influence of high temperatures from chimneys on flammability of wooden girders”, Research project funded by GTZ, 2006.
- [3] Dimeski, J., Yosiffov, N., Nacevski, M., Iliev, B., Stancic, J.: Finding of the Most Favorable Way of Production of Construction Wood Panels by Combining Wood, Gypsum and Cement. Scientific project funded by the Ministry of science in R. of Macedonia, Skopje, 1999.
- [4] Iliev B., Jakimovska Popovska V., Characteristics of modified multilayer structural plywood”, National scientific research project funded by the Ministry of education and science of the R. of Macedonia, 2012.