WoodWisdom-Net

FireInTimber

FINAL REPORT

Title of the research project	**Fire Resistance of Innovative Timber structures**
Coordinator of the project	Birgit Östman

BASIC PROJECT DATA

Project period	01.11.2007-31.03.2010
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URL of the project	-

FUNDING

Total budget in EUR	1 630 kEUR
Public funding from WoodWisdom-Net Research Programme:	Total funding granted in EUR by source:
Finland	
Tekes - Finnish Funding Agency for Technology and Innovation	135 kEUR
Ministry of Agriculture and Forestry (MMM)	-
Academy of Finland (AKA)	-
Denmark	
Danish Forest and Nature Agency (DFNA)	-
Danish Research Council for Production and Technology Sciences (FTP)	-
Germany	
Federal Ministry of Education and Research (BMBF)/ Project Management Agency Jülich (PtJ)	175 kEUR

Norway	
The Research Council of Norway (RCN)	29 kEUR
Innovation Norway (INVANOR)	-
Sweden	
The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas)	50 kEUR
Swedish Governmental Agency for Innovation Systems (VINNOVA)	154 kEUR
France	
Ministry of Agriculture, General Direction for Forest and Rural Affairs (DGPAAT)	-
Technical Centre for Wood and Furniture (CTBA)	50 kEUR
National Institute of Agronomical Research (INRA)	-
United Kingdom	
Forestry Commission (FC)	115 kEUR
Nordic Forest Research Co-operation Committee (SNS)	-

Other public funding:

FFG, Austria	163 kEUR

Other funding:

Building With Wood	486 kEUR
National sponsors in most countries	273 kEUR

PROJECT TEAM (main participants)

	Sex:	Organsation:	For a visitor:	Funder:
Birgit Östman, PhD Research leader	F	SP Trätek, SE	-	VINNOVA, BWW Formas
Jürgen König, Tekn Dr Senior researcher	M	SP Trätek, SE	-	VINNOVA, BWW
Esko Mikkola, PhD Chief Research Scientist	M	VTT, FI	-	Tekes, BWW National funding
Stefan Winter, Tekn Dr Professor	M	TUM, DE	-	PtJ, BWW National funding
Dhionis Dhima, PhD Senior researcher	M	CSTB, FR	-	CTBA, BWW National funding

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Harald Landrø, Tekn Dr Professor	M	Tresenteret, NO	-	RCN, BWW National funding
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Hans Hartl, Tekn Dr Professor	M	UIBK, AT	-	FFG, BWW National funding
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Andrea Frangi, Tekn Dr Professor	M	ETH Zürich, CH	-	Own funding
Alar Just, Tekn Dr Research Scientist	M	Resand/TUT, EE	-	National industry

DEGREES
Degrees earned or to be earned within this project.

Year	Degree	Sex	Name, year of birth and year of earning	University	Supervisor of thesis, supervisor's organization
2010	PhD	M	Alar Just,1969, 2010	Tallinn University of Technology	Karl Õiger, TUT Birgit Östman, SP Trätek Jürgen König, SP Trätek
2010	PhD	M	Maxime Audebert 1982, 2010	BPU, Clermont-Ferrand	A Bouchair, BPU D Dhima, CSTB
2011	Tekn Dr.	M	René Stein,1976, 2011	TUM, Munich	Stefan Winter, TUM

ABSTRACT

The FireInTimber project has been running between November 2007 and March 2010 in close cooperation between fourteen partners in nine countries Austria, Estonia, Finland, France, Germany, Norway, Sweden, Switzerland and UK. It has resulted in new knowledge especially for modelling of the load-bearing capacity of new types of timber structures. The results are presented in several scientific publications and presentations.

The main result for a greater audience is the technical guideline ***Fire safety in timber buildings.*** It is the very first European wide guideline on the fire safe use of wood in buildings. The guideline presents information for architects, engineers, educators, authorities and building industries on the fire safe use of timber structures and wood products in buildings. It aims at providing the highest scientific knowledge with regard to fire safety on the European level. The guideline covers the extended use of design codes (such as Eurocode 5), European standards, practical guidance and examples for fire safe design and principles of performance based design. The guideline also includes information on reaction to the fire performance of wood products according to the new European classification system. The importance of proper detailing in building design is stressed by practical examples. Active measures of fire protection and quality of construction workmanship and inspection are presented as important means for fulfilling the fire safety objectives.

This final report contains some proposals for implementing the new knowledge and focusing on future research, dissemination and strategic actions.

1.1 Introduction

1.1.1 Background

The project originates from a road-map study to address issues related to the limitations and barriers posed to wood and wood products by national fire regulations and fire performance issues. The pre-study was carried out by the Fire Safe Use of Wood network (FSUW) and resulted in a research project proposal to WoodWisdom-Net. The proposal was concentrated on research needs to influence regulations and the use of timber in construction, and to improve competativeness of European wood industries.

Major differences between European countries had been identified, both in terms of the number of storeys permitted in timber structures, and of the types and/or amounts of visible wood surfaces in interior and exterior applications. Several countries have no specific regulations, or do not limit the number of storeys in timber buildings. However, eight storeys are often used as a practical and economic limit for the use of timber structures. This limit may be higher for facades, linings and floorings, since these applications may also be used in, for example, concrete structures.

1.1.2 Objectives

The key objective for the project was to provide new possibilities for wood products in construction through proper fire design. The use of wood products is to be supported and stimulated by comprehensive and scientifically robust background data, which is presented in user-friendly and adapted tools for engineers and other stakeholders. The programme and its outcome are to facilitate and lead to simplified and quicker approval processes for wood products in buildings. This will increase the general public's confidence and positive perception of and about wood products and timber structures.

The vision was to ensure that the wider use of wood in buildings will be associated with improved fire safety. The project also built a knowledge base by promoting core competence and multidisciplinary research. The transfer of new knowledge will be enhanced by networking between research and industry.

1.2 Results and discussion

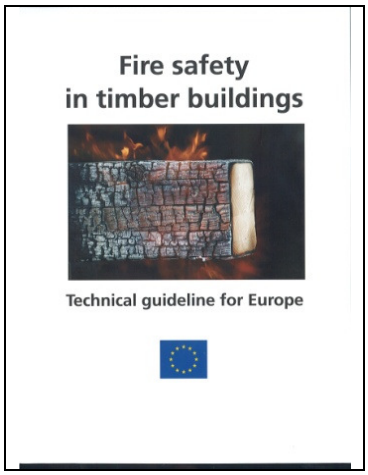
The FireInTimber project has resulted in new knowledge, especially for modelling of the load-bearing capacity of new types of timber structures. The project has resulted in more than sixty scientific papers, reports and presentations at scientific and technical conferences.

The main result for a greater audience is the technical guideline **Fire safety in timber buildings.** It is the very first Europe-wide guideline on the fire safe use of wood in buildings. The guideline presents information for architects, engineers, educators, authorities and building industries on the fire safe use of timber structures and wood products in buildings. It aims at providing the highest scientific knowledge with regard to fire safety at the European level. The guideline covers the use of design codes (such as Eurocode 5), European standards, practical guidance and examples for fire safe design and principles of performance based design. The guideline is focusing on structural fire protection by proving latest detailed guidance on load-bearing and separating functions of timber structures under standard fire exposure. New design methods are presented. They will be used as input for the next revision of Eurocode 5, but can already be used by designers. The guideline includes information on reaction to fire performance of wood products according to the new European standards. The importance of proper detailing in building design and on execution and control at building sites is stressed by practical solutions. Active measures of fire protection are presented as important means in fulfilling fire safety objectives.

A summary document including environmental and societal impact issues is available in seven languages.

Several societal, industrial, economic and environmental relevance influences of the results have been achieved:

- Validated knowledge is easily available at European level for all stake holders and lack of knowledge cannot be used as an excuse anymore for acceptance of timber structures.
- Designers/engineers start using new solutions will find examples in the guidance documents, which enable their use and help local authorities in taking position.
- Local authorities will find correct arguments and confidence to interpret and enforce fire regulations. Irrespective of norms, interpretations become uniform and will change gradually for the extended use of wood in buildings.
- Revisions of national building regulations will be facilitated and have long term effects by the new and easily available knowledge on fire safety in timber buildings, since the aim is to use the best available research knowledge.
- Performance based methods can be used also for reviewing basis of details of norms and for comparisons of fire safety levels. These methods are independent of norms which make them transferable from one country to another.
- Cost savings in guidance documents: There will be not anymore need to produce all fire safety guidance separately for each country because the same material can be utilised European wide.
- Cost savings in testing: National level testing needs are reduced to limited specific cases when the European standards system is fully implemented.



The very first Europe-wide guideline on the fire safe use of wood in buildings has been produced in the FireInTimber project.

It is expected to facilitate the extended use of wood in buildings and support the general trend on sustainability in the construction sector.

1.3 Conclusions

There are both possibilities and challenges for the wood industry. The industry is still in learning phases and need a close cooperation with R&D expertise for strategic decision making.

It is believed that the FireInTimber Network forms the ideal platform for continued activities. Together with the wider Fire Safe Use of Wood (FSUW) Network, additional countries and expert members should join. The R&D partners engaged in the work will need to be competent in the following main areas

- Experience in fire engineering and national regulatory frameworks
- Fire testing facilities and robust experimental procedures
- Experience in fire safety engineering, simulation of smoke and fire spread, simulation of evacuation scenarios
- Competencies in risk analysis, modelling, calculation and simulation

Limited research resources can be effectively used on European level by directing and prioritising research in co-operation based on needs highlighted by the Network. A further advantage is that all research results are more easily available for all parties.

It is of paramount importance to engage active participants in relevant standardisation committees and national decision makers to join to ensure that recommendations and findings are taken up in practice.

All promotion and education must be based on proper knowledge, only then the change of general attitudes and concepts can be effectively changed.

The overall most important issue is to maintain and further develop the wood industry engagement and involvement on both the European and national levels. A minimum level of activities is to keep the FSUW network active.

A first important strategic step would be to develop common European recommendations for improved national fire regulations based on performance based design.

1.4a Capabilities generated by the project

The main capability generated by the project is the European guideline that will facilitate the extended use of wood in buildings and support sustainability goals in the construction sector by reliable knowledge on fire safety.

The new models developed will be used as input for the next revision of the European standard for structural fire design of timber structures, EN 1995-1-2.

1.4b Utilisation of results

The project results may be used in many different ways and levels:

National levels

- Affecting national regulations and interpretations whenever possible. Most important are activities when revising the national regulations and for that a common European view would be very helpful.
- Interpretations of the regulations and examples of fire safe use of wood e g in national handbooks.
- Case studies, demonstrations, etc.
- Dissemination by seminars, publications, etc.
- Industry, research and authorities need to get together to develop the national regulations! There are good experiences on this in the Nordic countries.

European level

- Develop common European recommendations for improved national fire regulations based on performance based design.
- Information transfer to the BWW (internet) knowledge base. It is very important that this database will be available for open access to different stakeholders.
- Input to the Eurocodes review process.
- Activities in other CEN standardisation areas relevant for fire performance.
- Direct involvement by the wood product industry in the European standardisation work
- CWFT (Classification Without Further Testing) activities for K classes.

New research & knowledge development

- Develop knowledge on how to use parametric fire scenarios (design fires) to model the separating and load-bearing behaviour of timber structures.
- Continue FSE (Fire Safety Engineering) development for timber specific applications. Utilization in reviewing/revising regulations.
- Combining the use of different materials - optimization together with competitors.
- CWFT activities for typical timber structures. The possibilities and benefits for the industry are huge, but it needs new research/testing activities.
- Use and implement available calculation models to develop user friendly design of timber structures with specified fire resistance and separating and load-bearing capacities at fire.
- Develop further use of Fire safety design with sprinklers and other active fire protection systems.
- Regular and active information transfer / latest news delivered by industry to all stakeholders (in co-operation with research bodies) - Minimum level of common European activities for the timber industry.

1.5 Publications and communication

a) Scientific publications (* *Five most important publications indicated with an asterisk)*

1. Articles in international scientific journals with peer review

1. Audebert M, Dhima D, Taazount M, Bouchaïr A (2011). *Numerical and experimental investigations on the thermo-mechanical behaviour of steel-to-timber joints exposed to fire.* Under review, Engineering Structures.
2. * Frangi A, Fontana M, Hugi E, Jöbstl R (2009). *Experimental analysis of cross-laminated timber panels in fire*. Fire Safety Journal 44: 1078–1087.
3. Frangi A, Fontana M (2010). *Fire safety of multistorey timber buildings*. Structures and Buildings 163:213–226.
4. Frangi A, Schleifer V, Hugi E (2011). *A new fire resistant light mineral wool*. Fire Technology, in press.
5. Frangi A, König J (2011). *Effect of increased charring on the narrow side of rectangular timber cross-sections exposed to fire on three or four sides*. Fire and Materials, in press.
6. * Racher P, Laplanche K, Dhima D, Bouchaïr A (2010).*Thermo-mechanical analysis of the fire performance of dowelled timber connection*. Engineering Structures 32, 1148-1157.
7. Friquin K L (2010). *A review of models for the charring rate of solid wood, nail- and glue-laminated structural members*. J Structural Fire Engineering, 1(1), 61-72.
8. Friquin K L (2011). *Charring Material properties and external factors influencing the charring rate of solid wood and glue-laminated timber*. Fire and Materials, in press.
9. Just A, Tera T (2010) *Variability of charring along the wooden wall studs.* Engineering structures and technologies. 2(4), 119-128.
10. Just A, Schmid J, König J (2010). *Start of charring of timber frame behind gypsum plasterboards - evaluation of experimental data*. Submitted to Fire Safety Journal.
11. Just A, Schmid J, König J (2011). *Post protection effect of heat-resistant insulations on timber frame members exposed to fire*. Fire and Materials, in press.
12. König J, Frangi A (2010). *Effect of increased charring on narrow side on rectangular cross-sections exposed on three or four sides (unprotected members) and charring of protected members*. Submitted to Fire and Materials.
13. Östman B (2011). *Fire protection ability of wood coverings*. To be submitted.
14. Teibinger M et al (2010). *Feuerwiderstand von Holzrahmenkonstruktionen Untersuchungen und Berechnungen zum Raumabschluss*. Submitted to Holztechnologie.

2. Articles in international scientific compilation works and international scientific conference proceedings with peer review

15. Audebert M, Dhima D, Bouchaïr A, Racher P, Mindeguia J-C (2008). *Shear tests of wood at high temperatures,* Poster, 9th international IAFSS symposium, Karlsruhe, Germany, 21-26/09/2008.
16. Audebert M, Bouchaïr A, Dhima D (2009). *Tests and modelling of wood in shear at elevated temperatures.* Proc International Conf Application of Structural Fire Design, 19-20 February 2009, Prague, pp. 550-556.

17. Audebert M, Bouchair A, Dhima D, Taazount M (2010). *Behaviour and modeling of timber connections in fire.* Oral presentation, Workshop of the COST action IFER, Barcelona, 05 July 2010.
18. Audebert M, Bouchaïr A, Taazount M, Dhima D (2010). *Analysis and modelling of the thermo-mechanical behaviour of dowelled and bolted steel-to-timber joints*. Proc 4th Intern Conf on Structural Engineering, Mechanics and Computation (SEMC 2010), Cape Town, South Africa, 6-8 Sept 2010, pp. 979-983, CD-Rom.
19. Audebert M, Bouchaïr A, Taazount M, Dhima D (2010). *Thermal and thermo-mechanical behaviour of timber connections in fire*. International Conference for Urban Habitat Constructions under Catastrophic Events, Final International Conference, COST Action C26, Naples 16-18 Septembre 2010.
20. Bregulla J, Mackay S, Matthews S (2010). *Fire safety on Timber frame sites during construction.* Proc WCTE 2010, Trentino, Italy.
21. Frangi A, Fontana M, Hugi E, Wiederkehr R (2010). *Fire safety of Multi-Storey Timber Buildings*. Proc WCTE 2010, Trentino, Italy.
22. Friquin K L (2009). *Evaluation of natural and parametric temperature-time curves for the fire design of cross-laminated wood slabs*. Proc International Conference Application of Structural Fire Design 2009, Czech Technical University in Prague, 563-568.
23. Friquin K L (2010). *Experimental charring rates for cross-laminated timber panels compared to calculated charring rates*. Proc Interflam 2010, Nottingham, UK.
24. *Just A, Schmid J, König J (2010). *Failure times of gypsum plasterboards*. Proc Interflam 2010, Nottingham UK.
25. König J, Norén J, Sterley M (2008). *Effect of adhesives on finger joint performance in fire*. Paper16-1at CIB-W18, Meeting 41, Canada.
26. Östman B (2010). *Fire protection ability of wood products – A status report*. Proc Interflam 2010, Nottingham UK.
27. Östman B (2010). *Fire safety in timber buildings*, Proc Interflam 2010, Nottingham UK.
28. Östman B (2011). *Fire protection ability of wood coverings.* Submitted to 10th International Symposium for Fire Safety Science, IAFSS 2011.
29. Schmid J, König J, Köhler J (2010). *Design model for fire exposed cross-laminated timber*. Proc of the sixth International conference Structures in Fire, Lancaster, US.
30. Schmid J, König J, Köhler J (2010). *Fire-exposed cross-laminated timber – Modelling and tests*. Proc WCTE 2010, Trentino, Italy.
31. Schmid J, König J, Köhler J (2010). *Design model for fire exposed cross-laminated timber*. CIB-W18, N Zealand.
32. Stein R, Winter S (2010). *Influence of combustible insulation materials to the fire behaviour of timber-framed buildings*, Proc WCTE 2010, Trentino, Italy.
33. Teibinger M, Charwat, J (2010). *Multistory-Timber Houses in urban Regions in Austria*. Proc WCTE 2010, Trentino, Italy.

3. Articles in national scientific journals with peer review

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4. Articles in national scientific compilation works and national scientific conference proceedings with peer review

34. Audebert M, Bouchaïr A, Dhima D, Taazount M (2008). *Modélisation du comportement d'assemblages de structures bois en situation d'incendie*. Journées de l'*AUGC, Nancy, 4-6 juin 2008*
35. Audebert M, Bouchaïr A, Dhima D, Taazount M (2010). *Etude du comportement thermomécanique d'assemblages de structures bois.* 28ème Rencontres Universitaires de Génie Civil, AUGC, La Bourboule, 02-04, Juin, 2010, pp. 1237-1246
36. Hartl H (2009). *FireRisk – Cultural Heritage*. German Chamber of Engineers, Hessia.

5. Scientific monographs

37. * Östman, Mikkola, Stein, Frangi, König, Dhima, Hakkarainen, Bregulla (2010). *Fire safety in timber buildings, Technical guideline for Europe*, 210 pages. SP Report 2010:19.

38. Stein R, Werther N, Winter S (2011). *Konstruktionskatalog für Gebäude in Holzbauweise unter Berücksichtigung bauordnungsrechtlicher und versicherungstechnischer Aspekte*, Technische Universität München – Lehrstuhl für Holzbau und Baukonstruktion.

6. Other scientific publications, such as articles in scientific non-refereed journals and publications in university and institute series

39. Audebert M (2010). *Approche expérimentale et modélisation du comportement au feu d'assemblages bois sous différents types de sollicitations,* PhD thesis, Blaise Pascal University.
40. Bader T, Hofstetter K (2009). *Micromechanical models for estimation of the effect of thermal degradation on macroscopic mechanical properties of wood*. Final report of Task 1.3 in WoodWisdom-Net FireInTimber. Vienna University of Technology.
41. Bouchair A, Xu B, Taazount M, Dhima D (2009). *Dowelled wood-steel joints in tension perpendicular to grain or bending (Tests on joints in normal conditions preparing the fire tests)*, Blaise Pascal University, CSTB.
42. Dhima D, Bouchaïr A (2009). *Fire safety measures for timber structures*. Report of Task 1.4 in WoodWisdom-Net FireInTimber. CSTB report.
43. Duponchel X, Dhima D, Bouchair A (2008). *Analysis of fire resistance on relation to the separating performance of timber floors and walls to find optimal solutions*. WP2-2.1 FIT, CSTB report 10/2008
44. Duponchel X, Dhima D (2009). *Research data on the performance of materials and assemblies like timber walls and floors. Analysis of fire resistance on relation to the separating performance of timber floors and walls to find optimal solutions*. Report of Task 2.2.4 in WoodWisdom-Net FireInTimber, CSTB report.
45. Hakkarainen T (2009). *Thin thermal barriers for wood based products to improve fire resistance.* VTT Research Report VTT-R-07061-09.
46. Hartl H (2008). *Background documents for Eurocodes – chapter: structural fire design*. European Commission, DG Enterprise and Industry, Joint Research Centre, Brussels.
47. * Hietaniemi J, Mikkola E (2010). *Design fires for fire safety engineering*. VTT Working Papers 139.
48. Just A (2009). *Full-scale fire tests of timber frame walls*. Report Tallinn University of Technology.
49. Just A (2010). *Post protection behaviour of wooden wall and floor construction completely filled with glass wool*. SP Report 2010:28.
50. Just A, Schmid J. König J (2010). *Gypsum plasterboards used as fire protection – Analysis of a database*. SP Report 2010:29.
51. Just A, Schmid J, König J (2010). *The effect of insulation on charring of timber frame members*. SP Report 2010:30.
52. Just A (2010). *Structural fire design of timber frame assemblies insulated by glass wool and covered by gypsum plasterboards*. PhD thesis Tallinn University of Technology. ISBN 978-9949-23-030-3.
53. König J (2009). *The reduced cross-section method for light timber frame construction with solid timber members*. SP Report 2009:46.
54. Oksanen T (2009). *Fully and partially insulated cavities of floor assemblies*. VTT Research Report VTT-R-09687-09.
55. Östman B (2010). *Europeisk handbok om brandsäkert träbyggande*. Bygg & teknik 6/10.
56. Schmid J, König J (2010). *Cross-laminated timber in fire*. SP Report 2010:11.
57. Schmid J, Just A (2010). *Prediction of load bearing resistance of timber beams in fire*. SP Report 2010:46.
58. Schmid J (2010). *Nya modeller för att beräkna brandmotstånd hos träkonstruktioner*. Bygg & teknik 6/10.
59. Teibinger M, Pöhn C et al (2010). *Feuerwiderstand von Holzkonstruktionen*. OIB aktuell März 2010.
60. Teibinger M et al (2011). *Results of full-scale tests and comparative analysis*. Holzforschung Austria, HFA report.
61. Werther N, Stein R, Winter S (2010*). Recommendations of available calculation methods,* TUM Report, Technische Universität München – Chair for timber structures and building construction.

b) Other dissemination

62. *Fire safety in timber buildings.* Seminar 9 March 2010, Berlin. Presentations by project partners and invited speakers. SP Info 2010:11.
63. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in English). SP Info 2010:15.
64. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in Swedish). SP Info 2010:16.
65. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in Estonian). SP Info 2010:31.
66. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in Italian). SP Info 2010:32.
67. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in French). SP Info 2010:34.
68. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in Finnish). SP Info 2010:36.
69. *Fire safety in timber buildings, Technical guideline for Europe*, 8 pages (in German). SP Info 2010:68.
70. *Guideline display*. BAU-Messe, Münich, January 2011.
71. Just A, Schmid J, König J: *Failure times of gypsum boards*. Poster at the sixth International conference Structures in Fire, Lancaster, US, 2010.
72. Just A: *Post protection behaviour of wooden wall and floor structures completely filled with glass wool*. Poster at the sixth International conference Structures in Fire, Lancaster, US, 2010.
73. Mikkola E. *Fire safety in timber buildings.* National Fire Research Days, Seminar Espoo, Finland. August 2009
74. Mikkola E. *Fire safety in timber buildings.* Finnish Wood Research Workshop Helsinki, Finland, August 2010.
75. Östman B et al: *FireInTimber - Fire resistance of Innovative Timber structures*. Newsletter December 2007.
76. Östman B et al*: FireInTimber - Fire resistance of Innovative Timber structures*. Newsletter November 2008. SP Info 2008:52.
77. Östman B: *FireInTimber - Fire resistance of Innovative Timber structures*, Poster at WoodWisdom-Net seminar, Stockholm, November 2009.
78. Östman B: *Fire safety in timber buildings - First European guideline*. Poster at Interflam 2010, Nottingham UK.
79. Östman B. *Fire safe timber structures.* SPs Byggdagar, Borås, Sweden. September 2010
80. Östman B. *Fire safety in timber buildings*. Brandskydd 2010. Conference, Stockholm, October 2010.
81. Östman B. *Guidelines on Fire safety in timber buildings*. SIS seminar, Stockholm, January 2011.
82. Stein R, Werther N, Winter S: *Brandverhalten innovativer Holzbausysteme – Vorstellung des europäischen Verbundvorhabens „Fire In Timber“,* Holzbau – die neue quadriga, Ausgabe 03/2010.
83. Stein, R, Werther N: *Brandverhalten innovativer Holzbausysteme - Vorstellung des europäischen Verbundvorhabens Fire In Timber, Forschungskolloquium Holzbau* – Forschung und Praxis, Stuttgart 03/2010.
84. Stein R, Werther N, Winter S: *Ausbildung von Bauteilanschlüssen in Holzbauweise aus brandschutztechnischer Sicht*, Seminar Neumünster Brandschutztag, 09/2010.
85. Werther N, Merk M, Stein R, Winter S: *Brandsicherheit haustechnischer Installationen*, Holzbau – die neue quadriga, Ausgabe 03/2010.

1.6 National and international cooperation

The FireInTimber project has emerged through a close co-operation with the BWW industry and national industries within the FSUW network with both industry representatives and researchers as members which is most essential for the implementation of new findings. BWW (Road Map 2010 initiative) provided guidance during a pre-study leading to the FireInTimber project. The close cooperation has been activated by the project and is being planned to continue after the project. National authorities via their Fire Experts are also being involved, since they play a key role in creating new building regulations. The aim is to include further European countries.

National projects in the participating countries have been coordinated with the FireInTimber project that has strengthed the cooperation. Industry representatives have been active both on national and European level.

The international cooperation has been facilitaed by active participation and presentation of project results at international scientific conferences and in international standardisation.