World Conference on Timber Engineering Oslo 2023

FIRE SAFE USE OF WOOD IN BUILDINGS -GLOBAL DESIGN GUIDE

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ABSTRACT: Building codes around the globe dictate the design and construction of buildings. For most buildings, designers will follow prescriptive code provisions to demonstrate code compliance. However, some building codes allow the use of performance-based design to demonstrate code compliance. Performance-based design is usually more complex but allows for greater flexibility in the selection of materials and systems. Regardless of the code compliance methods, the combustibility of timber structures and wood products needs to be well-understood and properly accounted for in building designs. This paper describes the development of a new international guidance document on fire safety in timber buildings within the Fire Safe Use of Wood (FSUW) network, written by 13 lead authors assisted by more than 20 experts in over a dozen different countries.

KEYWORDS: Fire safety, mass timber, light timber frame, fire spread, encapsulation, structural fire design, active fire protection, performance-based design, robustness, building control, firefighting.

1 INTRODUCTION

Building codes around the globe dictate the design and construction of buildings. In a prescriptive building code, the type of building occupancy, the building floor area, the building height, and the presence of an automatic sprinkler system often dictates whether a timber structure is permitted and if timber surfaces can be exposed. For most buildings, designers follow prescriptive code provisions to demonstrate code compliance. Prescriptive design allows for a straightforward design and approval and reflects the academic training of most designers. However, some building codes allow the use of performance-based design (PBD) to demonstrate code compliance. PBD is usually more complex but allows for greater flexibility in the selection of materials and systems.

Regardless of the code compliance methods, the combustibility of timber structures and wood products needs to be well-understood and properly accounted for in building designs. This is of utmost importance when a PBD is being developed and where other aspects of fire science need to be considered, such as fire dynamics, reaction-to-fire, fire-resistance, and design to prevent the spread of fire within a building and to adjacent buildings.

2 OBJECTIVE

The objective of this international guideline, shown in Figure 1, is to present information for wood products in a wide range of new buildings [1]. It provides state-of-the-art scientific knowledge on a global level for practical applications. The guideline includes extended use of design codes and standards, practical guidance and examples of fire-safe design methods and principles of PBD. It is published both as a hard-bound book and as an

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https://doi.org/10.52202/069179-0603

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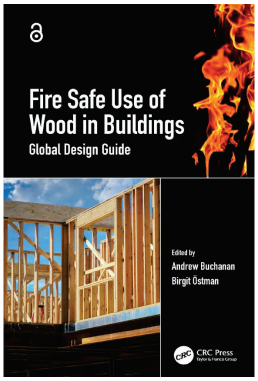

Figure 1: *Cover page of the Global Design Guide*

The guideline is based on the 2010 European guideline, Fire Safety in Timber Buildings – Technical Guidelines for Europe [2], enhanced with the latest outcomes from the recently completed COST Action FP1404 - Fire Safe Use of Bio-Based Building Products [3], to which many of the authors have actively contributed. This COST Action was intended to create a platform for networking, exchange and collection of research results and design skills, including performance data, design expertise, and many other factors which affect the design of bio-based building materials for fire safety.

This new international guideline was produced in the framework of the Fire Safe Use of Wood (FSUW) network. It is also inspired by recent code changes to allow taller and larger timber buildings in Australia, Canada, the US and elsewhere. The guide is supported by various eminent research centres and universities conducting research in this area.

The core audience is all those involved in the fire safety of timber buildings, including architects, engineers, firefighters, educators, regulatory authorities, insurance companies and others in the building industry.

2.1 INTERNATIONAL RELEVANCE

Many well-known fire scientists and engineers worldwide wrote the different chapters to ensure its quality and relevance for use in all countries, see Table 1. More than 20 expert co-authors supported the lead authors. The emphasis is on describing basic principles of fire science and fire engineering for buildings using timber as a structural or lining material, leading to practical solutions, rather than specific details of building regulations in any one country.

Future research topics in relation to fire safety in timber buildings are also proposed on an international level.

National and international building codes in different regions of the world are compared, but not explained in detail. The guideline is of benefit to design engineers in any country and will be of special interest to code writers in countries where timber buildings are not established and the use of modern structural timber elements are only just being considered.

2.2 TECHNICAL CONTENT

The guideline consists of 14 chapters, starting with a description of the various timber products, types of structures and their use in buildings, to a more in-depth chapter dealing with PBD, as shown in Table 1.

The guideline addresses structural fire engineering by providing the latest detailed guidance on structural design of separating and load-bearing elements of timber structures. It also contains guidance on design for surface flammability and limiting fire spread. The importance of proper detailing in building design is stressed with examples of practical solutions to limit the spread of fire or smoke. Active fire protection and building execution and control are presented as important means of fulfilling fire safety objectives. In the following, the key elements of each chapter are summarised.

2.2.1 Chapter 1: Timber structures and wood products

This chapter 1 introduces timber structures and wood products. The types of construction presented in this chapter may have different names in different countries, but the fundamentals and design principles remain essentially the same. Some building codes may limit the use of timber and wood products, either for structural elements or interior finish materials, but these materials are being used throughout the world in many types of buildings and occupancies. With the increasing demand for sustainable buildings and performance-based design, it is expected that timber will gain even more popularity in the near future. Fire performance of timber structures and wood products can be evaluated by the guidance and design methods detailed in the following chapters.

Figure 2: *Residential building made of light timber frame (photo: cecobois)*

Table 1: *List of chapters, lead* authors and co-authors (in alphabetical order)*

Chapters	Author (Affiliation, Country)
1. Timber structures and wood products	*Christian Dagenais (FPInnovations, Canada) Alar Just, Birgit Östman
2. Fire safety in timber buildings	*Andrew Buchanan (University of Canterbury, PTL Consultants, New Zealand) Andrew Dunn, Alar Just, Michael Klippel, Cristian Maluk, Birgit Östman, Colleen Wade
3. Fire dynamics	*Colleen Wade (Fire Research Group, New Zealand) Christian Dagenais, Michael Klippel, Esko Mikkola, Norman Werther
4. Fire safety in different regions	*Birgit Östman (Linnaeus University, Sweden) David Barber, Christian Dagenais, Andrew Dunn, Koji Kagiya, Eugenly Kruglov, Esko Mikkola, Peifang Qiu, Boris Serkov, Colleen Wade
5. Reaction to fire performance	*Marc Janssens (Southwest Research Institute, USA) Birgit Östman
6. Fire separating assemblies	*Norman Werther (Technical University of Munich, Germany) Christian Dagenais, Alar Just, Colleen Wade
7. Load bearing timber	*Alar Just (TalTech, Estonia) Anthony Abu, David Barber, Christian Dagenais, Michael Klippel, Martin Milner
8. Timber connections	*David Barber (Arup Fire, Australia) Anthony Abu, Andrew Buchanan, Christian Dagenais, Michael Klippel
9. Prevention of fire spread	*Esko Mikkola (KK-Fireconsult, Finland) Andrew Buchanan, Birgit Östman, Dennis Pau, Lindsay Ranger, Norman Werther
10. Active fire protection by sprinklers	*Birgit Östman (Linnaeus University, Sweden) David Barber, Christian Dagenais, Andrew Dunn, Kevin Frank, Michael Klippel, Esko Mikkola
11. Performance-based design	*Paul England (EFT Consulting, Australia) David Barber, Daniel Brandon, Christian Dagenais, Gianluca De Sanctis, Michael Klippel, Dennis Pau, Colleen Wade
12. Robustness in fire	*Michael Klippel (ETH Zürich, Switzerland) Andrea Frangi, Robert Jockwer, Joachim Schmid, Konstantinos Voulpiotis, Colleen Wade
13. Building execution and control	*Andrew Dunn (Timber Development Association, Australia) Ed Claridge, Esko Mikkola, Martin Milner, Birgit Östman
14. Firefighting considerations	*Ed Claridge (Auckland Council, New Zealand) Christian Dagenais, Andrew Dunn, Claudius Hammann, Kamila Kempna, Martin Milner, Jan Smolka

One of the main advantages of timber structures is the variety of systems that can be designed and constructed to suit almost any need and to provide the level of fire performance required in building codes. Traditional light timber frame construction are widely used in low-rise and mid-rise buildings (Figure 2). As shown in Figure 3, innovative systems such as modern post-and-beam construction, mass timber construction, long-span and hybrid structures allow for expanding the use of timber in impressive and innovative structures, such as taller buildings. Prefabrication of timber elements and modules is also gaining popularity, due to the speed of construction, increased building control and waste reduction at the job site.

Another factor facilitating the use of timber in buildings is the variety of products available to designers. A broad range of structural engineered wood products has been developed over recent years to provide high-valued timber products through more efficient use of the raw material. For most countries, timber and engineered wood products are required to be manufactured, tested and evaluated by applicable standards. Quality control procedures are usually required to ensure high-quality end products and buildings with acceptable fire safety. Given the large variety of timber products around the globe, some of the engineered wood products presented herein may not be available in all countries.

This chapter is not intended to provide an exhaustive historical review of timber constructions and wood products but rather aims to provide sufficient information for designers, builders, building officials/authorities and fire services to better understand and differentiate the various wood products and timber building systems available.

https://doi.org/10.52202/069179-0603

Figure 3: *Curved beams and decking at a commercial centre in Canada (photo: Western Archrib)*

2.2.2 Chapter 2: Fire safety in timber buildings

Chapter 2 provides an overall description of the strategy for delivering fire safety in timber buildings (Figure 4). As in the design of all buildings, the goals are to provide life safety for occupants, safe access for firefighters and protection of affected property. It is essential to control the severity and duration of any accidental fire and prevent it from spreading elsewhere in the building. An important design objective for timber buildings is to control the burning or charring of exposed timber or protected timber, because this can add to the fuel load, and it will reduce the load capacity of structural timber members due to loss of cross section. Many of the topics introduced here are expanded on in the following chapters.

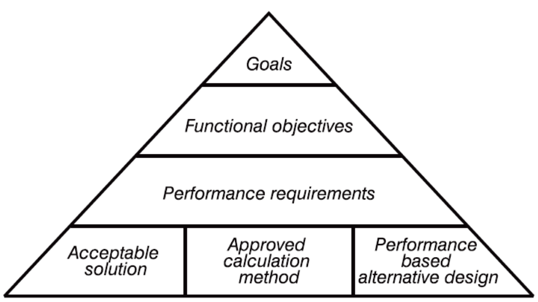

Figure 4: *Typical hierarchical relationship for fire safety design*

Fire safety during construction is a hazard for all timber buildings. Light timber frame buildings under construction are especially vulnerable before protective linings and other fire safety design features have been installed. Severe fires during construction have caused large financial losses in several countries. The construction fire hazard may be less severe in mass timber structures than in light timber frame buildings, but comprehensive fire precautions are essential. Management to control fires during construction is covered in Chapter 13.

2.2.3 Chapter 3: Fire dynamics

The third chapter provides information on fire dynamics in timber buildings. It summarises the fire behaviour in compartments with a focus on buildings with exposed timber structures and wood linings. It includes basic information on the pyrolysis and charring of wood, along with fire dynamics in compartments and the impact of having exposed timber surfaces. A description of common approaches to characterising post-flashover fires with parametric time–temperature curves is provided with guidance on a simplified design method to account for exposed timber surfaces based on parametric fire curves (Figure 5). Limitations in current knowledge are highlighted.

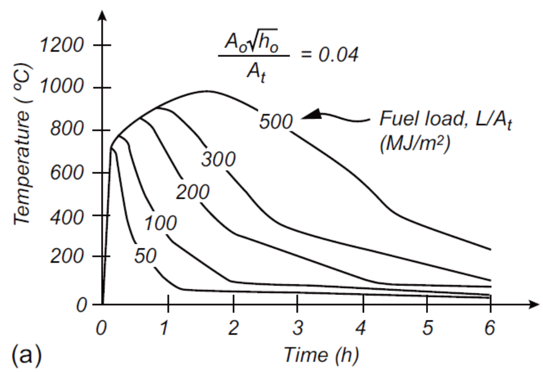

Figure 5: *Time-temperature curve for varying fuel load and constant ventilation factor*

2.2.4 Chapter 4: Fire safety in different regions

The regulatory control systems for fire safety design of buildings differ between regions around the globe, but it is based on the same principles of saving life and property and specifying requirements for structural and non-structural applications. This chapter 4 summarises the regulatory control systems for the fire safety design of buildings in different regions around the globe.

The possibilities for building in wood have gradually increased in recent decades in many countries, mainly due to the environmental benefits of using wood. But there are still restrictions in terms of fire regulations in many countries, especially for taller buildings. The situation has therefore been mapped in 40 countries on four continents as an update to a survey in 2002 (Figure 6). The main issues are how high buildings with load-bearing wooden frames may be built and how much visible wood may be used both inside and as façade claddings.

The requirements shown in this chapter apply primarily to prescriptive fire design according to so-called simplified design with detailed rules, which are mainly used for residential buildings and offices. For more complicated construction e.g. public buildings, shopping centres, arenas and assembly halls, performance-based design can be used by fire safety engineers using, for example,

https://doi.org/10.52202/069179-0603

engineering methods for predicting evacuation and smoke filling, which increases the possibilities of using wood in buildings.

In most countries, the possibilities of using wood in buildings increase if sprinklers are installed. More information on sprinklers is presented in Chapter 10.

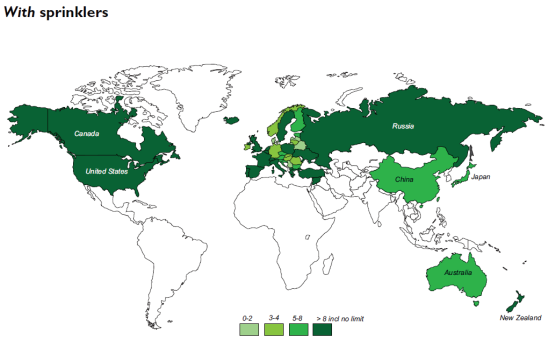

Figure 6: Maximum number of storeys allowed for structural timber elements in prescriptive residential buildings (with sprinklers)

Major differences between countries have been identified, both in terms of the number of storeys permitted in wood structures and of the 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 wooden buildings, mainly due to limited experience and lack of interest in using wood in taller buildings. The differences between countries are still large, and many countries have not yet started to use larger wood buildings despite supplies of forest resources.

Performance-based design may be used in several countries to verify further applications of wood (as presented in Chapter 11).

2.2.5 Chapter 5: Reaction to fire performance

This chapter 5 presents the reaction to fire performance of wood products used in buildings as internal surface finishes, exterior wall claddings, roof coverings and façade claddings. For façade claddings, the several different ways of assessing and regulating the fire performance of exterior wall systems are included. The chapter also describes the systems used for compliance with prescriptive regulations in different regions (Table 2), and the characteristics of wood products for performance-based design and methods for improving the reaction to fire performance of wood products.

2.2.6 Chapter 6: Fire separating assemblies

This chapter 6 describes the important role of fire-separating assemblies for passive fire protection in any type of building. Fire-separating assemblies provide essential compartmentation, which limits fire spread, contributing to both life safety and property protection. It gives design recommendations for providing fire resistance to timber- and wood-based separating assemblies, including walls, floors and roofs.

***Table 2:** Comparison of reaction to fire classification in different countries*

Product	United States	Australia / New Zealand	Europe	Japan
DF(1) plywood	C	Gr. 3	D	(4)
FRT(2) DF plywood	A	Gr. 1 or 2	C	(4)
OSB 1	C	Gr. 3	D	(4)
PSB 2	C	Gr. 3	D	(4)
White pine(3)	C	Gr. 3	D	(4)
White oak(3)	C	Gr. 3	D	(4)

(1) DF: Douglas fir
(2) FRT: Fire-retardant treated
(3) Timber planks
(4) Unclassified

In addition to maintaining the load-carrying capacity of the structure during a fire, the concept of compartmentation is one of the most effective passive measures for providing fire protection for life safety and property protection. Without firefighting or automatic fire suppression, the concept of compartmentation is the only way of preventing a fire from spreading beyond its room of origin. This concept has become an essential requirement in both prescriptive and performance-based building codes all over the world.

The main objective of applying fire-resistance rated separating assemblies is to limit the probability that fire or smoke will spread from the compartment of fire origin to other compartments at the same or other storeys in a building, or to neighbouring buildings, within a defined time. By an optimum arrangement of separating assemblies (Figure 7), the development and spread of fire is slowed down, property damage is reduced, fire exposure to multiple sites is limited, safety of occupants is improved, and firefighting and rescue operations will be more effective.

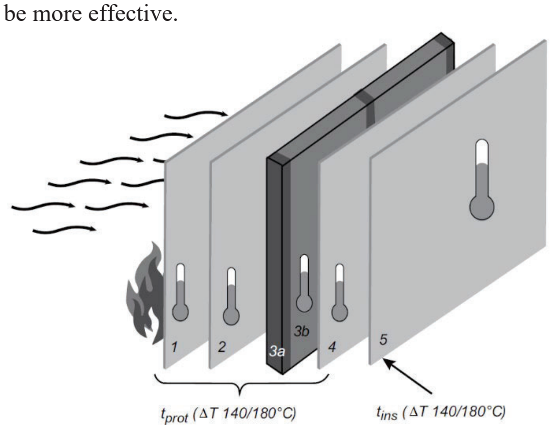

***Figure 7:** Design approach of the European Separating Function Method (SFM)*

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2.2.7 Chapter 7: Load bearing timber

Chapter 7 gives guidance for design of load-bearing timber members exposed to a standard fire. An overview of the principles needed to predict the effect of charring and heating is presented. Simplified design models around the world are described, including design models from the second generation of Eurocode 5.

The design objective in the event of a fire is determined by regulatory requirements and the fire safety strategy for the building. Most fire safety strategies are for load-bearing timber structures to resist the design loads for a specified fire exposure time. In this chapter, only the standard fire exposure is considered, according to e.g. ISO 834-1. Design of timber members in a standard fire situation requires an assessment of the reduction of cross-section caused by charring and the effect of heat on strength and stiffness of the residual cross-section. Charring may be influenced by protective linings and cavity insulation. For engineered timber members the glueline integrity in fire can also affect the rate of charring and load bearing capacity.

Unlike steel and concrete, thermal expansion of timber does not need to be taken into account because it is negligible. Timber members can be analysed individually without considering possible thermal actions from other timber members.

Fire resistance of structures can be assessed by fire testing or by simplified and advanced calculation methods. Calculation methods, as illustrated in Figure 8, typically give conservative results compared to fire testing. The design parameters for timber and protective materials are needed for calculation methods. If these parameters are unavailable or unknown, fire testing will be the only option for verifying the fire resistance.

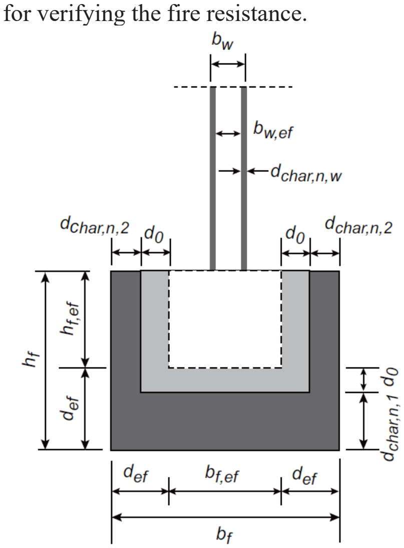

Figure 8: *Effective cross-section of the flange and web with cavity insulation*

Applicable fire exposures are stated in national building codes. For example, in Canada exterior walls are to be exposed on the interior side, interior walls on either side and floors are only exposed to fire on the underside. In Europe, Australia and New Zealand, walls delimiting a fire compartment are to be designed for fire exposure from one side, walls located within a fire compartment are to be designed for fire exposure from two sides, floors and roofs are usually to be designed for fire exposure from underneath. In some countries there are requirements to design floors for fire exposure from above (e.g. attics). In the UK and other countries there may be building types and storey heights where the stability of the structure is to be maintained in the event of a fire that is not controlled by firefighters, resulting in design of the load bearing timber structure to maintain its load-bearing function throughout fire decay until burnout.

Calculation examples of timber members are also presented. The examples demonstrate that for a timber product of similar strength and stiffness, the design for fire resistance will provide similar results whether the European, Canadian or US approach is used. However, design assumptions and load combinations must be consistent with the appropriate building codes and design standards.

2.2.8 Chapter 8: Timber connections

Chapter 8 introduces structural timber connections and provides information on potential failure modes and methods to provide fire resistance to connections exposed to a standard fire. Timber structures and their connections must be designed to have strength to resist all anticipated loads during the required fire resistance period and where required, to prevent the passage of heat and flames. Figure 9 shows an example of modern mass timber concealed connections.

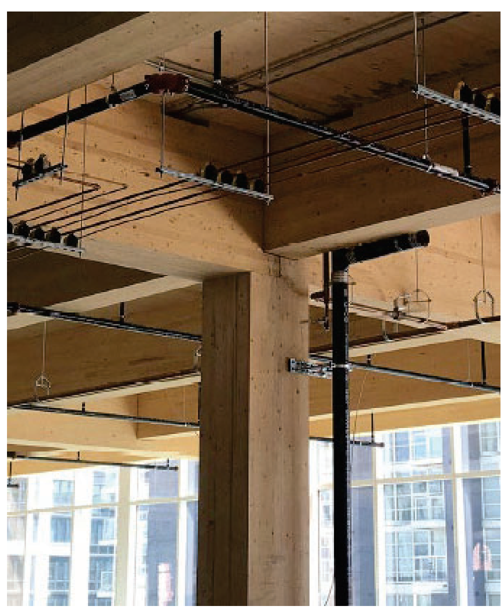

Figure 9: *Two-way glulam beams bearing on glulam column (photo: David Barber)*

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2.2.9 Chapter 9: Prevention of fire spread

Fire spread within the structure is one of the main challenges for the fire safety of timber buildings. This chapter describes means of preventing spread of fire and smoke between compartments in timber buildings. Much of this applies to all buildings independent of materials used, but some topics are especially relevant for timber buildings. The chapter highlights critical paths of possible spread of fire into, within and through timber structures including solutions and detailing to prevent uncontrolled spread of fire and smoke (Figure 10).

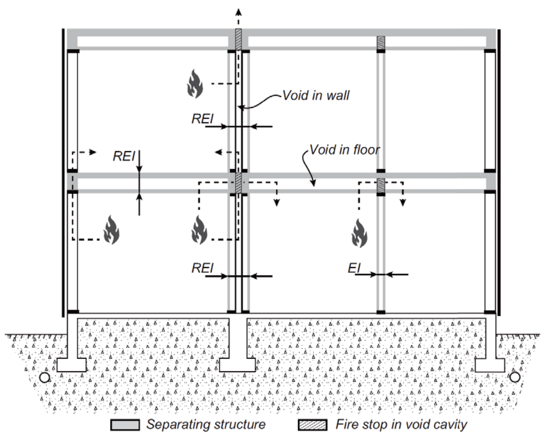

Figure 10: *Fire-stopping in voids – REI is for load-bearing and separating assemblies, EI is for separating assemblies*

It is important that the designers of all timber buildings consider prevention of fire and smoke spread through joints in and between building elements/assemblies, and through penetrations of building services and openings, including external walls. Chapter 9 is complementary to Chapter 6 which describes fire-separating elements and assemblies.

2.2.10 Chapter 10: Active fire protection by sprinklers

A wide variety of active fire protection systems are available to fire safety practitioners. In addition to passive fire protection measures, some level of active fire protection is normally required to meet the expected minimum level of fire safety in modern buildings. Active fire protection can also be used to increase the fire safety in order to achieve a more flexible fire safety design and an acceptable level of fire safety in buildings, especially in tall timber buildings. There are many types of active fire protection systems, but this chapter deals mainly with automatic fire sprinkler systems, since they are often used to facilitate the use of timber as structure, internal linings and external facades in large or complex buildings (Figure 12). Sprinklers, such as those shown in Figure 11, are required in some countries for taller timber buildings, as described in Chapter 4.

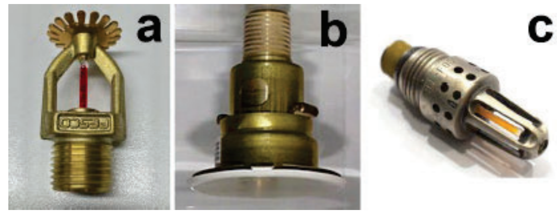

Figure 11: *Typical sprinkler heads for a) pendent, b) concealed pendent and c) water mist sprinklers*

An automatic fire sprinkler system can play an important role in the fire safety design of timber buildings. Provided that they are installed correctly and operate effectively, sprinklers will control or extinguish a fire at an early stage and prevent flashover. An increased use of sprinklers in residential buildings would considerably decrease the number of fire victims, independent of the construction materials used in those buildings. Building designs to incorporate sprinkler systems may facilitate increased use of timber, to be used as the structural material, the internal linings or the external facade. Reliable sprinkler systems are essential in tall buildings of any material, and especially so for tall timber buildings.

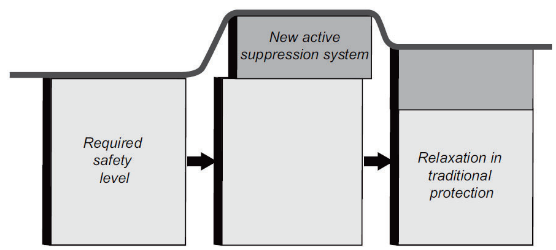

Figure 12: *Principle for fire safety design by sprinklers*

2.2.11 Chapter 11: Performance-based design

An overview of the application of performance-based approaches to the fire safety design of timber buildings is provided in Chapter 11. Performance-based designs, as illustrated in Figure 13, are relevant for the design of tall timber buildings and other timber buildings that vary from accepted prescriptive solutions. Performance-based design approaches are commonly categorised as deterministic or probabilistic and should be applied in accordance with the applicable regulations, building codes and standards. This chapter provides references to detailed information that should be consulted when undertaking performance-based designs or risk assessments.

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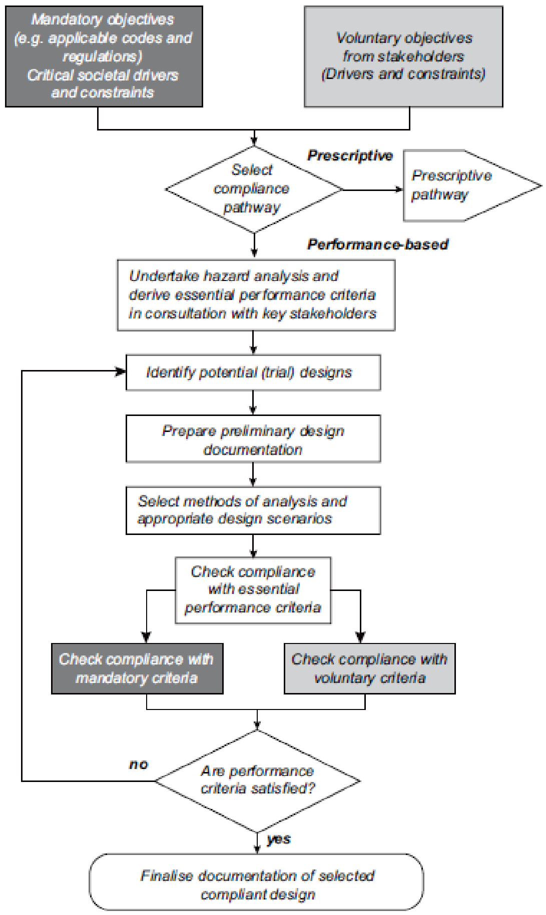

Figure 13: *Overview of a performance-based design process*

2.2.12 Chapter 12: Robustness in fire

With the increasing number of complex and tall timber buildings with a significant area of unprotected timber surfaces, questions arise about the robustness of these buildings in fire. In recent building projects, measures for robustness have been implemented on an ad hoc basis in agreement between the designers and the authorities. This chapter 12 discusses general approaches to achieve a robust fire safety concept which includes providing structural redundancy to prevent the failure of critical load-bearing elements such as isolated columns. Further, guidance is provided on how robustness of a fire safety concept can be enhanced for buildings using timber as a structural member.

2.2.13 Chapter 13: Building execution and control

Chapter 13 covers standards of workmanship and quality control of fire safety precautions during design and construction of timber buildings. Quality and inspection of workmanship are vital for high-quality buildings, whether of timber or other construction materials. Timber buildings require certain precautions due to the risk for greater exposure of combustible materials, namely hot works (Figure 14). Furthermore, not all fire safety measures for the final building will be in place throughout the construction period, so adequate processes are required to maintain the fire safety of building sites until the building is completed. All construction sites require formalised fire safety management systems, including auditing of contractors and subcontractors.

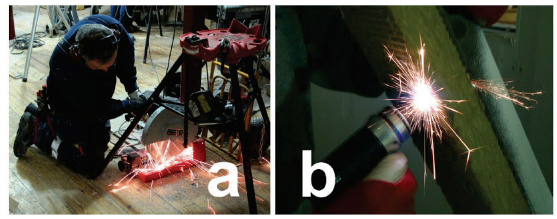

Figure 14: *Examples of hot works on a construction site (photos: Rohlén, Brandskyddslaget)*

2.2.14 Chapter 14: Firefighting considerations

Firefighting practices may be different in timber buildings compared with non-combustible construction. Internationally, fire services have raised concerns regarding the increased use of wood within buildings and specifically the use of timber structural elements of tall buildings. These concerns often stem from lack of knowledge of timber performance in fire, and firefighter experience from fires in non-combustible steel and concrete construction and traditional low-rise timber buildings. This chapter discusses relevant concerns of firefighters regarding large and tall timber buildings.

There is a significant lack of knowledge and practical experience with firefighting in tall timber buildings. The fire environment associated with exposed timber surfaces is different to non-combustible construction and may present new hazards and risks for occupants as well as for firefighters. There is a need for collection of data, knowledge and case studies from firefighting events, in order to develop a better understanding and new strategies and approaches for firefighting in tall timber buildings (Figure 15).

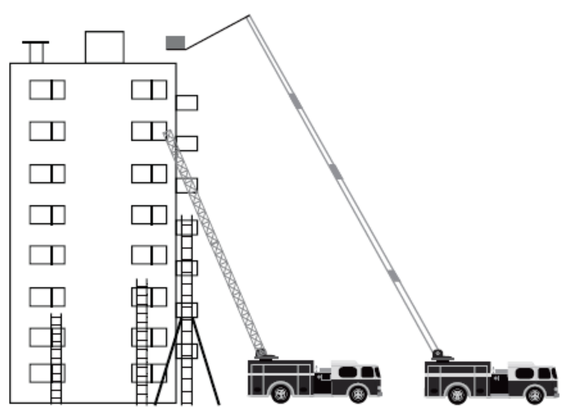

Figure 15: *Firefighting appliances for buildings up to about 8 storeys*

As combustible structures become larger, taller and more complex, the robustness and resilience of the buildings

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and their fire safety features also need to increase. This will require appropriate changes to national and international building codes.

There is a critical need for more understanding of the smouldering combustion of large timber elements after fire exposure. As structural concepts progress and move away from the traditional assumption of burnout, a greater reliance will inevitably be placed on firefighters to extinguish fires and ensure that continued smouldering of the timber structure does not occur.

Lastly, it is essential that all emergency responders be knowledgeable and have an understanding of how combustible structures and tall timber buildings perform in severe fires. Without sufficient fire-ground experience of mass timber buildings, the emergency response must be informed by education and research that considers the needs of the responders (Figure 16). As buildings evolve, so must the firefighter response, with new strategies to ensure the most favourable outcomes for all stakeholders.

Figure 16: *Firefighter team during a timber fire test scenario at the Technical University of Munich in 2021*

3 CONCLUSION

Further to the success of the 2010 European guideline, combined to the latest outcomes from the recently completed COST Action FP1404 - Fire Safe Use of Bio-Based Building Products, a new collaborative international effort was made to produce a Global Design Guide on Fire Safe Use of Wood in Buildings, with the main objective to provide state-of-the-art scientific knowledge on a global level for practical applications. More than 20 expert co-authors supported the 13 lead authors.

This new Global Design Guide is expected to be of use to a wide range of stakeholders involved in designing fire safety in timber buildings, including architects, engineers, educators, regulatory authorities, building industry personnel, the timber industry and building code writers.

The Global Design Guide is published both as a hard-bound book and as an open access version available for free PDF download via the Fire Safe Use of Wood website (www.fsuw.com).

ACKNOWLEDGEMENTS

The lead authors wish to thank all their co-authors and a large number of colleagues and reviewers in many countries who provided much assistance in the preparation of this guide. Melody Callahan produced the line drawings and managed the delivery of text and images to the publisher.

We also acknowledge the large number of consulting firms, research institutions, universities and professional organisations around the world who supported this project through in-kind support of authors and reviewers. Generous financial contributions were made by FPInnovations, Natural Resources Canada (Canadian Forest Service), Softwood Lumber Board, BRANZ, SFPE New Zealand, Federation of the Finnish Woodworking Industries and Linnaeus University, Sweden.

REFERENCES

[1] Fire Safe Use of Wood in Buildings - Global Design Guide. Andrew Buchanan and Birgit Ostman, editors. CRC Press, 2022. https://doi.org/10.1201/9781003190318

[2] Fire Safety in Timber Buildings - Technical Guidelines for Europe, Stockholm (Sweden), SP Technical Research Institute of Sweden, 2010.

[3] COST Action FP 1404, Documents available at: https://costfp1404.ethz.ch/ and www.fsuw.com.

https://doi.org/10.52202/069179-0603