

# Global Design Guide on Fire Safe Use of Wood in Buildings - aspects for taller buildings

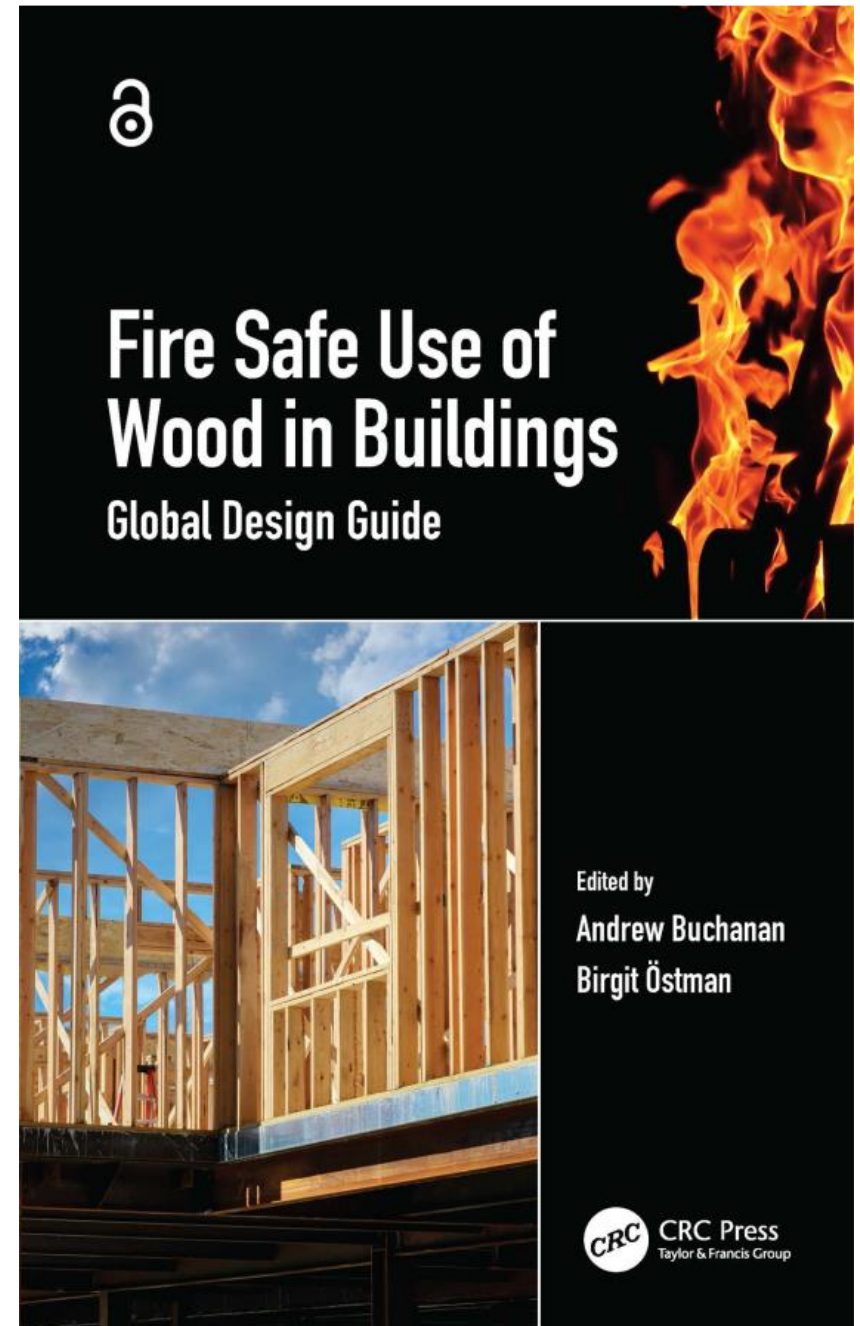
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# Topics

- Introduction
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- Taller timber buildings
- Requirements in different regions



# Introduction

- The book provides guidance and insights into the use of wood in construction, including fire science and international regulatory information
- All forms of wood products from traditional use of dimensional timber to modern wood products are covered
- The guide addresses the contributions of wood construction to the fire load as well as the impact of fire on the wood structural assemblies
- The diversity of requirements around the world and the differing approaches in achieving fire safety are also covered
- Robustness of fire design for timber buildings is essential

# Contents

## 1 Timber structures and wood products

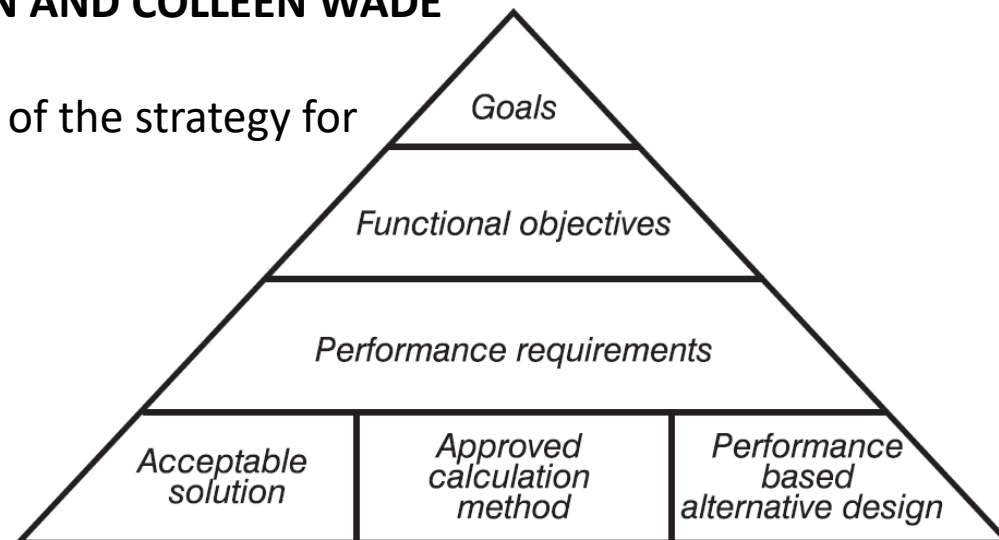
CHRISTIAN DAGENAIS, ALAR JUST AND BIRGIT ÖSTMAN

This chapter presents an overview of the occupancy groups in buildings and the types of structures and products that can be used to design and construct these buildings

## 2 Fire safety in timber buildings

ANDREW BUCHANAN, ANDREW DUNN, ALAR JUST, MICHAEL KLIPPEL, CRISTIAN MALUK, BIRGIT ÖSTMAN AND COLLEEN WADE

This chapter provides an overall description of the strategy for delivering fire safety in timber buildings



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## **3 Fire dynamics**

**COLLEEN WADE, CHRISTIAN DAGENAIS, MICHAEL KLIPPEL, ESKO MIKKOLA AND NORMAN WERTHER**

This chapter 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.

## **4 Fire safety requirements in different regions**

**BIRGIT ÖSTMAN, DAVID BARBER, CHRISTIAN DAGENAIS, ANDREW DUNN, KOJI KAGIYA, EUGENIY KRUGLOV, ESKO MIKKOLA, PEIFANG QIU, BORIS SERKOV AND COLLEEN WADE**

This chapter summarises the regulatory control systems for the fire safety design of buildings in different regions around the globe. The possible use of structural timber elements and visible wood surfaces in interior and exterior applications is presented in tables and map

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## **5 Reaction to fire performance**

**MARC JANSSENS AND BIRGIT ÖSTMAN**

This chapter presents the reaction to fire performance of wood products used in buildings as internal surface finishes, exterior wall claddings and roof coverings. It also covers methods for improving the reaction to fire performance of wood products.

## **6 Fire-separating assemblies**

**NORMAN WERTHER, CHRISTIAN DAGENAIS, ALAR JUST AND COLLEEN WADE**

This chapter describes the role of fire-separating assemblies for passive fire protection. Fire-separating assemblies contribute to both life safety and property protection. It gives design recommendations for providing fire resistance to walls, floors and roofs.



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## **7 Load-bearing timber structures**

**ALAR JUST, ANTHONY ABU, DAVID BARBER, CHRISTIAN DAGENAIS, MICHAEL KLIPPEL AND MARTIN MILNER**

This chapter gives guidance for design of load-bearing timber members exposed to a standard fire. 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.

## **8 Timber connections**

**DAVID BARBER, ANTHONY ABU, ANDREW BUCHANAN, CHRISTIAN DAGENAIS AND MICHAEL KLIPPEL**

This chapter introduces structural connection typologies and provides information on potential failure modes and methods to provide fire resistance to connections exposed to a standard fire.

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## **9 Prevention of fire spread within structures**

**ESKO MIKKOLA, ANDREW BUCHANAN, BIRGIT ÖSTMAN, DENNIS PAU, LINDSAY RANGER AND NORMAN WERTHER**

This 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 between compartments in timber buildings.

## **10 Active fire protection by sprinklers**

**BIRGIT ÖSTMAN, DAVID BARBER, CHRISTIAN DAGENAIS, ANDREW DUNN, KEVIN FRANK, MICHAEL KLIPPEL AND ESKO MIKKOLA**

This chapter deals 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.



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## **11 Performance-based design and risk assessment**

**PAUL ENGLAND, DAVID BARBER, DANIEL BRANDON, CHRISTIAN DAGENAIS,  
GIANLUCA DE SANCTIS, MICHAEL KLIPPEL, DENNIS PAU AND COLLEEN WADE**

This chapter provides an overview of the application of performance-based approaches to the fire safety design of timber buildings. Performance-based design methods are relevant for the design of tall timber buildings and other timber buildings that vary from accepted prescriptive solutions.

## **12 Robustness in fire**

**MICHAEL KLIPPEL, ANDREA FRANGI, ROBERT JOCKWER, JOACHIM SCHMID,  
KONSTANTINOS VOULPIOTIS AND COLLEEN WADE**

This chapter discusses general approaches to achieve structural robustness with regard to fire design and evaluates them to give guidance for fire design of complex and tall timber buildings with a significant area of unprotected timber surfaces.

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## **13 Building execution and control**

**ANDREW DUNN, ED CLARIDGE, ESKO MIKKOLA, MARTIN MILNER AND BIRGIT ÖSTMAN**

This chapter covers control of workmanship, fire safety during construction, responsibilities and enforcement, fire detection and suppression and emergency procedures. Certain precautions are needed due to exposure of wood products and because not all fire safety measures will be in place throughout construction.

## **14 Firefighting considerations for timber buildings**

**ED CLARIDGE, CHRISTIAN DAGENAIS, ANDREW DUNN, CLAUDIUS HAMMANN, KAMILA KEMPNA, MARTIN MILNER AND JAN SMOLKA**

This chapter discusses fire service considerations relevant especially to large and tall timber buildings in order to overcome concerns and lack of knowledge of timber performance in fire.

# Recommendations for taller buildings

High-rise and very high-rise buildings

- Full encapsulation so that no timber is exposed, or
- If significant area is exposed, the design should ensure that the fire compartment can withstand burnout, even in the unlikely event of sprinkler failure and unavailability of firefighters

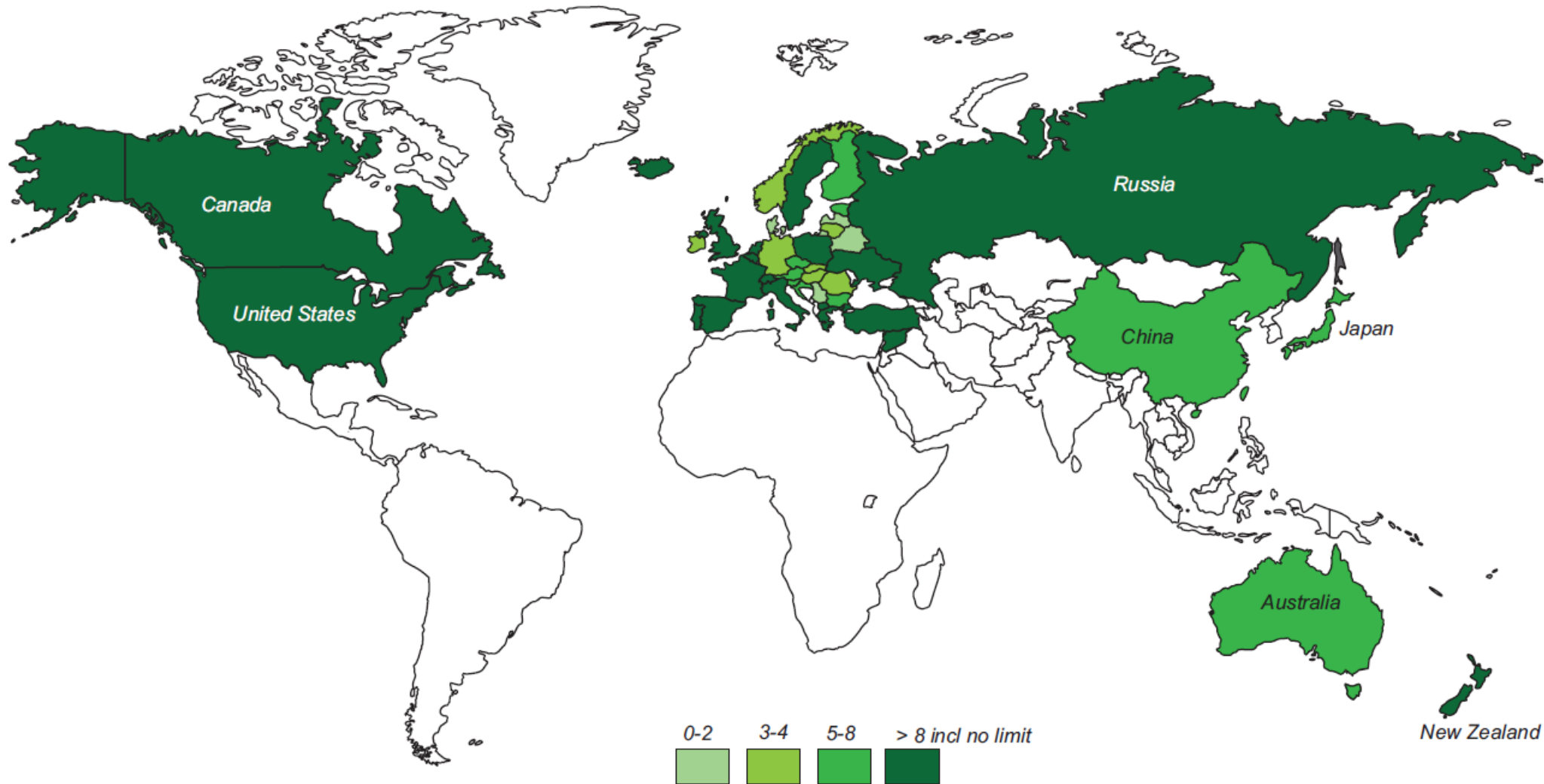
For medium-rise timber buildings, codes may allow more timber to be exposed, also with no requirement to withstand burnout

*Table 2.3* Approximate definitions of building height and typical fire resistance

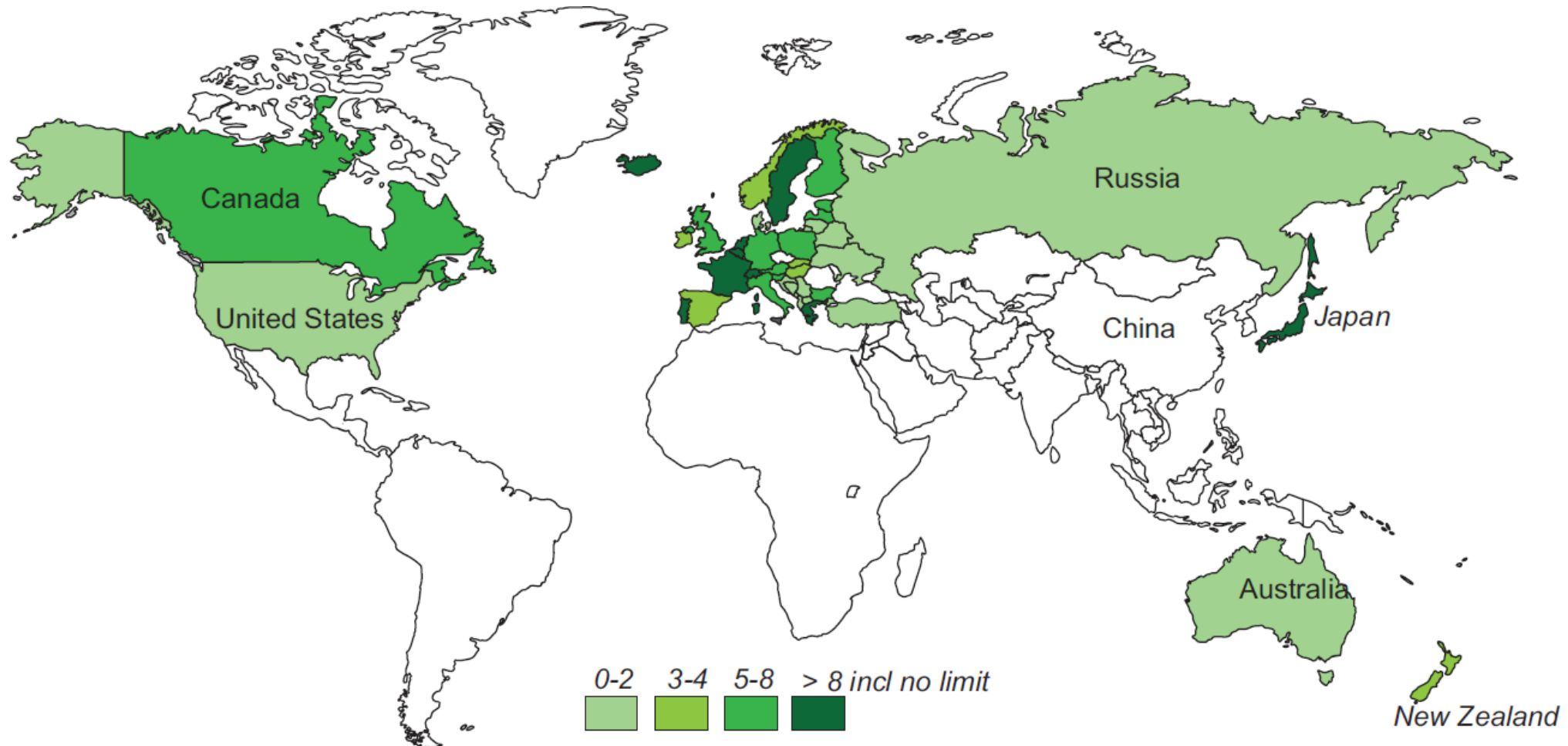
	<i>Height range*</i>	<i>Number of storeys</i>	<i>Typical fire resistance</i>
Low-rise	$H < 12 \text{ m}$	Less than 4 storeys	30 to 60 minutes
Medium rise	$12 \text{ m} < H \leq 25 \text{ m}$	4 to 8 storeys	60 to 120 minutes
High-rise	$25 \text{ m} < H \leq 60 \text{ m}$	9 to 20 storeys	90 to 180 minutes
Very high-rise	$60 \text{ m} < H$	More than 20 storeys	120 minutes or more

\*Height measures refer to height of the floor of uppermost storey

# Fire safety requirements in different regions



Maximum number of storeys allowed with load-bearing timber elements in *residential* buildings (prescriptive requirements) – With sprinklers



Maximum number of storeys with *wooden façade claddings* in residential buildings (prescriptive requirements) – With sprinklers



# Fire Safe Use of Wood in Buildings

## Global Design Guide



The book can be downloaded here:

<https://www.taylorfrancis.com/books/oa-edit/10.1201/9781003190318/fire-safe-use-wood-buildings>

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