



Edited by

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# SUSTAINABLE STEEL BUILDINGS

A Practical Guide for Structures and Envelopes

**WILEY** Blackwell

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## **A Practical Guide for Structures and Envelopes**

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## Preface

Sustainability has been established for over one decade in building construction. It has become a high priority and is well established amongst professionals and authorities involved in design and construction. So why would one need another book explaining the same again? This is required because detailed information on the sustainability credentials of steel as a construction material is scattered over a wide range of publications, reports or company data. Hence, this book focuses on design and construction of sustainable steel buildings, looking at steel as a construction material, on steel structures, and steel envelopes and illustrates all this with many practical examples. For this purpose, we have brought together European experts and professionals from various fields.

The book starts with general introductory information on the background of sustainable construction, followed by highlights of the legal and normative frame. A discussion of basic concepts of sustainability assessment, such as life-cycle thinking and environmental product information in general and for steel construction products specifically, is the next focus, followed by the methods and design tools to deliver sustainable steel buildings and construction in general. Topics and structural elements that are crucial for sustainable steel buildings are addressed at. This comprises, for example, topics such as flexibility, benefits of high strength steel or design for deconstruction, and hot-dip galvanising and fire-protective coatings. In addition, the efficient design of structures and elements is discussed, such as multistorey buildings, bridges, and renewable energy structures, as well as columns, beams, floor systems and envelopes. Various sustainability certification labels have been established. The major labels DGNB, LEED and BREEAM are introduced and the performance of steel in these certification schemes is explained. Finally, several examples of sustainable steel buildings and contemporary case studies provide further guidance to the practitioner.

This book would not have been possible without the numerous contributions of authors from all over Europe with widespread backgrounds such as architectural or structural engineering practice, sustainability, steel production, steel construction, academia or various kinds of associations. Further thanks go to my coeditors Markus Kuhnhenne, Mark Lawson and Milan Veljkovic for the fruitful

discussions and good cooperation in preparing this book. I thank particularly Raban Siebers, who has done most of the actual work of bringing together all the different authors and contributions.

Sustainable Steel Buildings shows specifiers, contractors, building authorities, lecturers and students how steel can be used to deliver buildings and structures with a high level of inherent sustainability.

Bernhard Hauke

February 2016

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## Chapter 1

# What does ‘sustainable construction’ mean? An overview

Sustainable construction is a relatively new subject with which many of those involved in planning and construction are not familiar. It has been covered in numerous technical papers, but few of them present specific measures for implementing sustainability in the building and construction industry. This publication aims to improve the information available to those working in the construction sector using examples and guidance on steel construction in particular. The background and basic principles of how to achieve sustainable construction are presented and dealt with in a clearly structured manner. This publication also aims to convey a comprehensive understanding of sustainability and identifies the opportunities and essentials that can result from sensible implementation of sustainable steel construction strategies. The latest developments in steel construction provide a means to measure the success of the building and construction industry.

## 1.1 INTRODUCTION

Diana Fischer, Bernhard Hauke, Luis Braganca, Joana Andrade and Ricardo Mateus

The term ‘sustainable’ was first used in forestry to convey the idea that only as many trees could be felled in a given time period as were capable of growing again during the same period. A definition of the term ‘sustainability’ that is common today in the context of society can be found in the Brundtland report of the United Nations, which was published in 1987: ‘Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ [1]. These needs can be of an ecological, economic or social nature. A development or action is only sustainable if a minimum level of satisfaction is achieved in all areas and can be maintained in the future.