Earthquake Design Practice for Buildings

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Fourth edition

Damian Grant and Edmund Booth

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Foreword

Congratulations to Damian and Edmund for this very welcome contribution which I believe is an essential read for practitioners and students with interest in earthquake engineering. My own interest in the subject began in earnest some thirty years ago when, as an MSc student, I had the opportunity to join a reconnaissance team to examine the aftermath of the Loma Prieta earthquake in California. I was struck by the immensity of the damage inflicted on buildings and infrastructure, and the wider societal consequences. Since then, the subject has advanced beyond recognition and, as a result, there has been growing expectation that our built environment and communities would be seismically resilient, and that students and practitioners are educated and trained to address this. I have worked closely with the two authors for many years, through activities including teaching and training, code development and standardisation, and seismic design of real structures. Their vast collective experience in design, research, fieldwork, teaching and code committees make them ideally placed to offer unique insights into the fundamentals as well as advances and intricacies of the practical earthquake design of buildings.

This is the fourth edition of the book, and follows on from three widely read earlier editions published in 1998, 2006 and 2014. This edition includes significant additions that incorporate recent developments related to the seismic design, assessment, and rehabilitation of buildings. The main ingredients from the earlier versions are retained and updated, including aspects related to seismic risk and hazard, conceptual design approaches, static and dynamic analysis procedures, soil effects and design of foundations, and the design and strengthening of reinforced concrete, steel, masonry, and timber buildings. Apart from updates to the design procedures throughout the book, reflecting recent developments in codes of practice, there are notable additions to the chapters related to the design of masonry and timber buildings. The new aspects introduced in this edition, with respect to the background and application of performance-based earthquake engineering, are also particularly useful. Other highly valuable additions include those related to the use of modern seismic-protective technologies as well as the performance of non-structural components, both of which are vital for pursuing the growing drive towards providing resilient and low-damage seismic design.

This book succeeds in achieving the difficult balance of being relatively straightforward to follow for an engineer with limited background in the subject, whilst being very informative and engaging for more experienced readers who want to update their knowledge and skills in seismic design. Although the main focus of the book is on the behaviour, design and assessment of buildings, it also raises awareness of the wider economic and societal considerations related to earthquake resilience. The book meets the needs of a wide international audience, as there is emphasis on explaining the underlying fundamental concepts without reliance on a specific code of practice. Nonetheless, the basis and procedures of a number of international design standards are presented, discussed and compared, including those from the European, North American, Indian and Chinese seismic codes. Overall, the knowledge, experience and insights shared in this edition make it a very valuable and highly recommended resource for those involved in the teaching of earthquake engineering and in the practical seismic design and assessment of buildings structures.

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About the authors

Damian Grant is an Associate Director in Arup's Advanced Digital Engineering group, in London, UK, and leads the group's earthquake engineering team. He has a PhD in earthquake engineering from the ROSE School in Pavia, Italy. Since joining Arup in 2005, Damian has been responsible for the seismic design and assessment for a diverse range of projects, including buildings (from single-storey dwellings to super-tall skyscrapers), industrial facilities, offshore platforms, storage tanks, bridges and other special structures. He specialises in seismic risk assessment, performance-based earthquake engineering, and the application of seismic protective systems such as isolators and supplemental damping devices.

After 20 years with Arup and 5 years on site in the UK and West Africa, **Edmund Booth** has for 25 years run his own consultancy, specialising in seismic design, assessment and code development. He has been a visiting professor at Oxford University and is a fellow of the Royal Academy of Engineering. Edmund has prepared two books on earthquake engineering, including the second and third editions of this publication.

Damian and Edmund are involved in the development of the next editions of Eurocode 8, through the British national committee (B/525/8) and the European Working Group 'Future Directions for Eurocode 8'. They both lecture on the Imperial College MSc course in earthquake engineering, and have made numerous contributions to journals, courses, conferences and books.

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Previous editions of this book (of which much material remains in this fourth edition) benefited substantially from contributions by two very old friends of Edmund Booth, the second author – Jack Pappin and Richard Fenwick – who provided comprehensive reviews of material now found in Chapters 6 and 7 (Jack) and Chapter 8 (Richard), and generously allowed some of the text in these chapters to be based on material originally prepared by them.

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