

Seismic Design and Assessment of Bridges

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Seismic Design and Assessment of Bridges

Inelastic Methods of Analysis
and Case Studies

 Springer

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Preface

Bridges are the most critical component of transport systems with respect to several criteria, including those related to earthquake response. Furthermore, their number, and hence the size of the bridge stock exposed to seismic risk, keeps increasing; as an example, within the European Union, the motorway network expanded from 39,200 km in 1990 to 49,200 km in 1999, and the figure keeps increasing at a fast rate. Nevertheless, the literature devoted to these important engineering structures, and in particular their seismic performance, design, and assessment, is quite limited compared to that related to building structures. Meanwhile, assessment of seismic performance of existing bridges, some of which clearly fail to satisfy the requirements of modern codes, has been the focus of substantial research efforts worldwide, particularly during the recent years. As a result of such concerns, programmes for retrofitting seismically deficient bridges have originated in several European countries, notably in Italy, and similar efforts are underway in the US and Japan.

This book is intended as a contribution to the limited literature related to the seismic behaviour of bridges. It focuses on a topical issue, the use of inelastic analysis methods for the seismic assessment and design of bridges, on which substantial work has been carried out in recent years, but not been collected in a single volume. In particular the most advanced inelastic analysis methods that emerged during the last decade are currently found only in the specialised research-oriented literature, such as technical journals and conference proceedings. Hence the key objective of this book is twofold, first to present all important methods belonging to the aforementioned category in a uniform and sufficient for their understanding and implementation length, and to provide also a critical perspective on them by including selected case-studies wherein more than one methods are applied to a specific bridge, and by offering some critical comments on the limitations of the individual methods and on their relative efficiency. In this respect, this book should be a valuable tool for both researchers and practising engineers dealing with seismic design and assessment of bridges, by both making accessible (and, hopefully, comprehensible) the methods and the analytical tools available for their implementation, and by assisting them to select the method

that best suits the individual bridge projects that each engineer/researcher faces. A ‘guided tour’ to the individual chapters of the book can be found in Chap. 1 – Introduction.

This book is the outcome of a genuinely collective effort. The idea for preparing a state-of-the-art document on the topical issue of inelastic analysis methods for bridges originated in 2007 during the first meeting of the (then) newly formed Task Group 11 “Seismic Design, Assessment, and Retrofit of Bridges” of the EAEE (European Association of Earthquake Engineering). Several members of this international group have contributed initially to the pertinent discussions and subsequently to the collection of material coming from their recent, or even ongoing, research. It was not long before it was realised that the need for a book on this topic was clear and the material that gradually accumulated formed a good basis for such a book. Discussions with the Secretary General of the EAEE Atilla Ansal and later with Springer’s Senior Publishing Editor Petra Steenbergen were quite encouraging and have eventually led to the decision for producing this volume. As should be clear from comparing the Contributors’ list with the TG11 membership (<http://eaee-tg11.weebly.com/membership.html>), this book has been written, almost exclusively, by members of the Group. Having said this, the material included here derives from research conducted all over the world, especially in North America and Europe, where inelastic analysis methods for bridges have been the subject of extensive scrutiny and research. Since all the available methods have been discussed (to the largest feasible extent) within TG11, the material presented in this book can also be considered as a consensus view of the research community on issues that remain, to a certain extent, still open to discussion and further improvement.

The editors of the book, all of them members of EAEE’s TG11, wish to thank all those who participated to the several discussions that took place within the Group, as well as contributed material to it. In addition to the contributors to the individual chapters, who are listed under each chapter, the Editors would like to acknowledge the contributions of the following individuals:

- Dr Anastasios Kotsoglou from Democritus University of Thrace, Olympia Taskari, Doctoral Candidate at the Aristotle University of Thessaloniki (AUTH), and Karin Saxon, Executive Administrative Assistant, University of Nevada, Reno, for their assistance in preparing Chap. 2.
- Dr Göktürk Önem, from KOERI, Boğaziçi University for his assistance in preparing Chap. 3.
- Themelina Paraskeva, Doctoral Candidate at AUTH, Mauro Popeyo Nino Lazaro, from UNAM, Mexico City, and Drs Giuseppe Perrone and Salvatore Sofia from University of Basilicata, for their assistance in preparing Chap. 4.

Clearly, several other researchers have produced results that are included in the various chapters of this book; their contribution is acknowledged in the usual way, by reference to their pertinent publications in the international literature.

All chapters of the book have been subjected to external peer review; special thanks are due to the reviewers Prof. Paolo Pinto, Prof. Bozidar Stojadinovic, and Dr Martin Koller.

Last but not least, the editors would welcome comments from the readers of this book. As mentioned earlier, issues that are still open to discussion and further improvement are addressed in this volume, hence any comments made by the reviewers will be duly taken into account in a second edition that might emerge in the future.

Thessaloniki

Andreas J. Kappos

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