

ATC-34

**A Critical Review of Current Approaches
to Earthquake-Resistant Design**

by

APPLIED TECHNOLOGY COUNCIL
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Preface

In 1991, the Applied Technology Council (ATC) was awarded a contract by the National Center for Earthquake Engineering Research Center (NCEER) to evaluate structural response modification factors and other critical seismic design code issues (ATC-34 project). The initial objectives of the project were three-fold, namely (1) updating and completing the ATC-19 report on structural response modification factors, (2) enumeration of the primary shortcomings in current seismic design codes, and (3) the identification of key issues necessary to improve the practice of seismic design in the United States. The objectives were modified over the last three years to (1) update and complete the ATC-19 report on structural response modification factors, (2) research the history of seismic design practice in the United States, (3) review the state-of-the-practice in the earthquake-resistant design of buildings, (4) enumerate the primary shortcomings of current practice, (5) describe on-going efforts to develop guidelines for performance-based earthquake engineering, (6) present a vision for the future of seismic design in the United States, and (7) recommend studies to improve the practice of seismic design in the United States. This report summarizes the studies completed by the project team through the end of 1995.

The initial focus of the project was structural response modification factors (*R* factors). These factors were introduced into seismic design provisions in the late 1970s in ATC 3-06 (ATC, 1978) and subsequently into the *NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings* in 1985 (BSSC, 1985). Studies in the last 10 years have brought into question the formulation of response modification factors, and the values assigned to the factors in building codes. The ATC-19 report, updated and completed as part of the ATC-34 project, summarizes the pertinent studies and presents a draft formulation for the response modification factor. The reader is referred to the ATC-19 report (ATC, 1995) for detailed information on response modification factors. Relevant information on *R* factors presented in the ATC-19 report, developed with ATC-34 project funding, is reproduced in this report only as necessary.

This ATC-34 report, the second product of the ATC-34 project, provides an overview of seismic design

codes in the United States, a review of current U. S. seismic design practice, a discussion on future directions for seismic codes, and conclusions and recommendations pertaining to seismic design practice in the United States. The report is based on lengthy discussions amongst the project participants, research on the contents and history of current U. S. codes and standards of practice, and several internal specially prepared background reports, including discussion papers on “deficiencies and strengths of current code approaches” and on “goals that a new seismic code should achieve.”

The primary audiences for this report are civil and structural engineers familiar with both current basic building seismic design criteria and structural dynamics. Terms that enable as broad an audience as possible to understand the report are used to produce a strong impact on design professionals and the code-change process. The secondary audience is the academic/research community.

This report was prepared under the direction of Andrew S. Whittaker, a senior-level earthquake engineering researcher and practitioner from Northern California, who served as Project Director. Overview and guidance were provided by a Project Engineering Panel consisting of Vitelmo V. Bertero, Ian G. Buckle, Sigmund A. Freeman, Peter Gergely (deceased), Gary C. Hart, Howard H. M. Hwang, Helmut Krawinkler, Onder Kustu, Ronald L. Mayes, Andrew T. Merovich, Joseph P. Nicoletti, Guy J. P. Nordenson, Masanobu Shinozuka, John C. Theiss, and Yi-Kwei Wen. Nancy Sauer and Peter Mork provided editorial and publication preparation assistance. The affiliations of these individuals are provided in the list of project participants.

The report is dedicated to the late Peter Gergely, who served on the NCEER Research Committee and played a key role in acquiring NCEER support for the ATC-34 project.

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Christopher Rojahn
ATC Executive Director

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