



*A council of the National Institute of Building Sciences*

**BSSC  
Seismic  
Rehabilitation  
Project**

# **NEHRP COMMENTARY ON THE GUIDELINES FOR THE SEISMIC REHABILITATION OF BUILDINGS (FEMA PUBLICATION 274)**

**Prepared for the  
BUILDING SEISMIC SAFETY COUNCIL  
Washington, D.C.**

**By the  
APPLIED TECHNOLOGY COUNCIL (ATC-33 Project)  
Redwood City, California**

**With funding from the  
FEDERAL EMERGENCY MANAGEMENT AGENCY  
Washington, D.C.**

**October 1997  
Washington, D.C.**

# Preface

In August 1991, the National Institute of Building Sciences (NIBS) entered into a cooperative agreement with the Federal Emergency Management Agency (FEMA) for a comprehensive seven-year program leading to the development of a set of nationally applicable guidelines for the seismic rehabilitation of existing buildings. Under this agreement, the Building Seismic Safety Council (BSSC) served as program manager with the American Society of Civil Engineers (ASCE) and the Applied Technology Council (ATC) working as subcontractors. Initially, FEMA provided funding for a program definition activity designed to generate the detailed work plan for the overall program. The work plan was completed in April 1992 and in September FEMA contracted with NIBS for the remainder of the effort.

The major objectives of the project were to develop a set of technically sound, nationally applicable guidelines (with commentary) for the seismic rehabilitation of buildings; develop building community consensus regarding the guidelines; and develop the basis of a plan for stimulating widespread acceptance and application of the guidelines. The guidelines documents produced as a result of this project are expected to serve as a primary resource on the seismic rehabilitation of buildings for the use of design professionals, educators, model code and standards organizations, and state and local building regulatory personnel.

As noted above, the project work involved the ASCE and ATC as subcontractors as well as groups of volunteer experts and paid consultants. It was structured to ensure that the technical guidelines writing effort benefited from a broad section of considerations: the results of completed and ongoing technical efforts and research activities; societal issues; public policy concerns; the recommendations presented in an earlier FEMA-funded report on issues identification and resolution; cost data on application of rehabilitation procedures; reactions of potential users; and consensus review by a broad spectrum of building community interests. A special effort also was made to use the results of the latest relevant research.

While overall management has been the responsibility of the BSSC, responsibility for conduct of the specific

project tasks is shared by the BSSC with ASCE and ATC. Specific BSSC tasks were completed under the guidance of a BSSC Project Committee. To ensure project continuity and direction, a Project Oversight Committee (POC) was responsible to the BSSC Board of Direction for accomplishment of the project objectives and the conduct of project tasks. Further, a Seismic Rehabilitation Advisory Panel reviewed project products as they developed and advised the POC on the approach being taken, problems arising or anticipated, and progress made.

Three user workshops were held during the course of the project to expose the project and various drafts of the *Guidelines* documents to review by potential users of the ultimate product. The two earlier workshops provided for review of the overall project structure and for detailed review of the 50-percent-complete draft. The last workshop was held in December 1995 when the *Guidelines* documents were 75 percent complete. Participants in this workshop also had the opportunity to attend a tutorial on application of the guidelines and to comment on all project work done to date.

Following the third user workshop, written and oral comments on the 75-percent-complete draft of the documents received from the workshop participants and other reviewers were addressed by the authors and incorporated into a pre-ballot draft of the *Guidelines* and *Commentary*. POC members were sent a review copy of the 100-percent-complete draft in August 1996 and met to formulate a recommendation to the BSSC Board of Direction concerning balloting of the documents. Essentially, the POC recommended that the Board accept the documents for consensus balloting by the BSSC member organization. The Board, having received this recommendation in late August, voted unanimously to proceed with the balloting.

The balloting of the *Guidelines* and *Commentary* occurred between October 15 and December 20, 1996, and a ballot symposium for the voting representatives of BSSC member organizations was held in November during the ballot period. Member organization voting representatives were asked to vote on each major subsection of the *Guidelines* document and on each chapter of the *Commentary*. As required by BSSC procedures, the ballot provided for four responses:

“yes,” “yes with reservations,” “no,” and “abstain.” All “yes with reservations” and “no” votes were to be accompanied by an explanation of the reasons for the vote and the “no” votes were to be accompanied by specific suggestions for change if those changes would change the negative vote to an affirmative.

Although all sections of the *Guidelines* and *Commentary* documents were approved in the balloting, the comments and explanations received with “yes with reservations” and “no” votes were compiled by the BSSC for delivery to ATC for review and resolution. The ATC Senior Technical Committee reviewed these comments in detail and commissioned members of the technical teams to develop detailed responses and to formulate any needed proposals for change reflecting the comments. This effort resulted in 48 proposals for change to be submitted to the BSSC member organizations for a second ballot. In April 1997, the ATC presented its recommendations to the Project Oversight Committee, which approved them for forwarding to the BSSC Board. The BSSC Board subsequently gave tentative approval to the reballoting pending a mail vote on the entire second ballot package. This was done and the reballoting was officially approved by the Board. The second ballot package was mailed to BSSC member organizations on June 10 with completed ballots due by July 28.

All the second ballot proposals passed the ballot; however, as with the first ballot results, comments submitted with ballots were compiled by the BSSC for review by the ATC Senior Technical Committee. This effort resulted in a number of editorial changes and six additional technical changes being proposed by the ATC. On September 3, the ATC presented its recommendations for change to the Project Oversight Committee that, after considerable discussion, deemed the proposed changes to be either editorial or of insufficient substance to warrant another ballot. Meeting on September 4, the BSSC Board received the recommendations of the POC, accepted them, and approved preparation of the final documents for transmittal to the Federal Emergency Management Agency. This was done on September 30, 1997.

It should be noted by those using this document that recommendations resulting from the concept work of the BSSC Project Committee have resulted in initiation of a case studies project that will involve the

development of seismic rehabilitation designs for at least 40 federal buildings selected from an inventory of buildings determined to be seismically deficient under the implementation program of Executive Order 12941 and determined to be considered “typical of existing structures located throughout the nation.” The case studies project is structured to:

- Test the usability of the *NEHRP Guidelines for the Seismic Rehabilitation of Buildings* in authentic applications in order to determine the extent to which practicing design engineers and architects find the *Guidelines* documents themselves and the structural analysis procedures and acceptance criteria included to be presented in understandable language and in a clear, logical fashion that permits valid engineering determinations to be made, and to evaluate the ease of transition from current engineering practices to the new concepts presented in the *Guidelines*.
- Assess the technical adequacy of the *Guidelines* design and analysis procedures. Determine if application of the procedures results (in the judgment of the designer) in rational designs of building components for corrective rehabilitation measures. Assess whether these designs adequately meet the selected performance levels when compared to existing procedures and in light of the knowledge and experience of the designer. Evaluate whether the *Guidelines* methods provide a better fundamental understanding of expected seismic performance than do existing procedures.
- Assess whether the *Guidelines* acceptance criteria are properly calibrated to result in component designs that provide permissible values of such key factors as drift, component strength demand, and inelastic deformation at selected performance levels.
- Develop empirical data on the costs of rehabilitation design and construction to meet the *Guidelines* “basic safety objective” as well as the higher performance levels included. Assess whether the anticipated higher costs of advanced engineering analysis result in worthwhile savings compared to the cost of constructing more conservative design solutions necessary with a less systematic engineering effort.

- Compare the acceptance criteria of the *Guidelines* with the prevailing seismic design requirements for new buildings in the building location to determine whether requirements for achieving the *Guidelines* “basic safety objective” are equivalent to or more or less stringent than those expected of new buildings.

Feedback from those using the *Guidelines* outside this case studies project is strongly encouraged. Further, the curriculum for a series of education/training seminars on the *Guidelines* is being developed and a number of seminars are scheduled for conduct in early 1998. Those who wish to provide feedback or with a desire for information concerning the seminars should direct their correspondence to: BSSC, 1090 Vermont Avenue, N.W., Suite 700, Washington, D.C. 20005; phone 202-289-7800; fax 202-289-1092; e-mail [bssc@nibs.org](mailto:bssc@nibs.org). Copies of the *Guidelines* and

*Commentary* can be obtained by phone from the FEMA Distribution Facility at 1-800-480-2520.

The BSSC Board of Direction gratefully acknowledges the contribution of all the ATC and ASCE participants in the *Guidelines* development project as well as those of the BSSC Seismic Rehabilitation Advisory Panel, the BSSC Project Committee, and the User Workshop participants. The Board also wishes to thank Ugo Morelli, FEMA Project Officer, and Diana Todd, FEMA Technical Advisor, for their valuable input and support.

Eugene Zeller  
Chairman, BSSC Board of Direction

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