



Of the National Institute of Building Sciences

THE COUNCIL AND ITS PURPOSE

The Building Seismic Safety Council (BSSC) was established in 1979 under the auspices of the National Institute of Building Sciences as an entirely new type of instrument for dealing with the complex regulatory, technical, social, and economic issues involved in developing and promulgating building earthquake hazard mitigation regulatory provisions that are national in scope. By bringing together in the BSSC all of the needed expertise and all relevant public and private interests, it was believed that issues related to the seismic safety of the built environment could be resolved and jurisdictional problems overcome through authoritative guidance and assistance backed by a broad consensus.

The BSSC is an independent, voluntary membership body representing a wide variety of building community interests (see page 10 for a current membership list). Its fundamental purpose is to enhance public safety by providing a national forum that fosters improved seismic safety provisions for use by the building community in the planning, design, construction, regulation, and utilization of buildings. To fulfill its purpose, the BSSC:

- Promotes the development of seismic safety provisions suitable for use throughout the United States;
- Recommends, encourages, and promotes the adoption of appropriate seismic safety provisions in voluntary standards and model codes;
- Assesses progress in the implementation of such provisions by federal, state, and local regulatory and construction agencies;
- Identifies opportunities for improving seismic safety regulations and practices and encourages public and private organizations to effect such improvements;
- Promotes the development of training and educational courses and materials for use by design professionals, builders, building regulatory officials, elected officials, industry representatives, other members of the building community, and the public;
- Advises government bodies on their programs of research, development, and implementation; and
- Periodically reviews and evaluates research findings, practices, and experience and makes recommendations for incorporation into seismic design practices.

The BSSC's area of interest encompasses all building types, structures, and related facilities and includes explicit consideration and assessment of the social, technical, administrative, political, legal, and economic implications of its deliberations and recommendations. The BSSC believes that the achievement of its purpose is a concern shared by all in the public and private sectors; therefore, its activities are structured to provide all interested entities (i.e., government bodies at all levels, voluntary organizations, business, industry, the design profession, the construction industry, the research community, and the general public) with the opportunity to participate. The BSSC also believes that the regional and local differences in the nature and magnitude of potentially hazardous earthquake events require a flexible approach to seismic safety that allows for consideration of the relative risk, resources, and capabilities of each community.

The BSSC is committed to continued technical improvement of seismic design provisions, assessment of advances in engineering knowledge and design experience, and evaluation of earthquake impacts. It recognizes that appropriate earthquake hazard risk reduction measures and initiatives should be adopted by existing organizations and institutions and incorporated, whenever possible, into their legislation, regulations, practices, rules, codes, relief procedures, and loan requirements so that these measures and initiatives become an integral part of established activities, not additional burdens. Thus, the BSSC itself assumes no standards-making or -promulgating role; rather, it advocates that code- and standards-formulation organizations consider the BSSC's recommendations for inclusion in their documents and standards.

IMPROVING THE SEISMIC SAFETY OF NEW BUILDINGS

The BSSC program directed toward improving the seismic safety of new buildings has been conducted with funding from the Federal Emergency Management Agency (FEMA). It is structured to create and maintain authoritative, technically sound, up-to-date resource documents that can be used by the voluntary standards and model code organizations, the building community, the research community, and the public as the foundation for improved seismic safety design provisions.

The BSSC program began with initiatives taken by the National Science Foundation (NSF). Under an agreement with the National Bureau of Standards (NBS; now NIST, the National Institute for Standards and Technology), *Tentative Provisions for the Development of Seismic Regulations for Buildings* (referred to here as the *Tentative Provisions*) was prepared by the Applied Technology Council (ATC). As the ATC noted, the document was the product of a "cooperative effort with the design professions, building code interests, and the research community." Its purpose was to "...present, in one comprehensive document, the current state of knowledge in the fields of engineering seismology and engineering practice as it pertains to seismic design and construction of buildings." The document included many innovations, however, and the ATC explained that a careful assessment was needed.

Following the issuance of the *Tentative Provisions* in 1978, NBS released a technical note calling for ". . . systematic analysis of the logic and internal consistency of [the *Tentative Provisions*]" and developed a plan for assessing and implementing seismic design provisions for buildings. This plan called for a thorough review of the *Tentative Provisions* by all interested organizations; the conduct of trial designs to establish the technical validity of the new provisions and to assess their economic impact; the establishment of a mechanism to encourage consideration and adoption of the new provisions by organizations promulgating national standards and model codes; and educational, technical, and administrative assistance to facilitate implementation and enforcement.

During this same period, other significant events occurred. In October 1977, Congress passed the *Earthquake Hazards Reduction Act of 1977* (P.L. 95-124) and, in June 1978, the National Earthquake Hazards Reduction Program (NEHRP) was created. Further, FEMA was established as an independent agency to coordinate all emergency management functions at the federal level. Thus, the future disposition of the *Tentative Provisions* and the 1978 NBS plan shifted to FEMA. The emergence of FEMA as the agency responsible for implementation of P.L. 95-124 (as amended) and the NEHRP also required the creation of a mechanism for obtaining broad public and private consensus on both recommended improved building design and construction regulatory provisions and the means to be used in their promulgation. Following a series of meetings between representatives of the original participants in the NSF-sponsored project on seismic design provisions, FEMA, the American Society of Civil Engineers and the National Institute of Building Sciences (NIBS), the concept of the Building Seismic Safety Council was born. As the concept began to take form, progressively wider public and private participation was sought, culminating in a broadly representative organizing meeting in the spring of 1979, at which time a charter and organizational rules and procedures were thoroughly debated and agreed upon.

The BSSC provided the mechanism or forum needed to encourage consideration and adoption of the new provisions by the relevant organizations. A joint BSSC-NBS committee was formed to

conduct the needed review of the *Tentative Provisions*, which resulted in 198 recommendations for changes. Another joint BSSC-NBS committee developed both the criteria by which the needed trial designs could be evaluated and the specific trial design program plan. Subsequently, a BSSC-NBS Trial Design Overview Committee was created to revise the trial design plan to accommodate a multiphased effort and to refine the *Tentative Provisions*, to the extent practicable, to reflect the recommendations generated during the earlier review.

Trial Designs

Initially, the BSSC trial design effort was to be conducted in two phases and was to include trial designs for 100 new buildings in 11 major cities, but financial limitations required that the program be scaled down. Ultimately, 17 design firms were retained to prepare trial designs for 46 new buildings in 4 cities with medium to high seismic risk (10 in Los Angeles, 4 in Seattle, 6 in Memphis, 6 in Phoenix) and in 5 cities with medium to low seismic risk (3 in Charleston, South Carolina, 4 in Chicago, 3 in Ft. Worth, 7 in New York, and 3 in St. Louis). Alternative designs for six of these buildings also were included.

The firms participating in the trial design program were: ABAM Engineers, Inc.; Alfred Benesch and Company; Allen and Hoshall; Bruce C. Olsen; Datum/Moore Partnership; Ellers, Oakley, Chester, and Rike, Inc.; Enwright Associates, Inc.; Johnson and Nielsen Associates; Klein and Hoffman, Inc.; Magadini-Alagia Associates; Read Jones Christoffersen, Inc.; Robertson, Fowler, and Associates; S. B. Barnes and Associates; Skilling Ward Rogers Barkshire, Inc.; Theiss Engineers, Inc.; Weidinger Associates; and Wheeler and Gray.

For each of the 52 designs, a set of general specifications was developed, but the responsible design engineering firms were given latitude to ensure that building design parameters were compatible with local construction practice. The designers were not permitted, however, to change the basic structural type even if an alternative structural type would have cost less than the specified type under the early version of the *Provisions*, and this constraint may have prevented some designers from selecting the most economical system.

Each building was designed twice – once according to the amended *Tentative Provisions* and again according to the prevailing local code for the particular location of the design. In this context, basic structural designs (complete enough to assess the cost of the structural portion of the building), partial structural designs (special studies to test specific parameters, provisions, or objectives), partial nonstructural designs (complete enough to assess the cost of the nonstructural portion of the building), and design/construction cost estimates were developed.

This phase of the BSSC program concluded with publication of a draft version of the recommended provisions, the *NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings*, an overview of the *Provisions* refinement and trial design efforts, and the design firms' reports.

The 1985 Edition of the *NEHRP Recommended Provisions*

The draft version represented an interim set of provisions pending their balloting by the BSSC member organizations. The first ballot, conducted in accordance with the BSSC Charter, was organized on a chapter-by-chapter basis. 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.

All comments and explanations received with "yes with reservations" and "no" votes were compiled, and proposals for dealing with them were developed for consideration by the Technical Overview Committee and, subsequently, the BSSC Board of Direction. The draft provisions then were revised to reflect the changes deemed appropriate by the BSSC Board and the revision was submitted to the BSSC membership for balloting again.

As a result of this second ballot, virtually the entire provisions document received consensus approval, and a special BSSC Council meeting was held in November 1985 to resolve as many of

the remaining issues as possible. The 1985 Edition of the *NEHRP Recommended Provisions* then was transmitted to FEMA for publication in December 1985.

During the next three years, a number of documents were published to support and complement the 1985 *NEHRP Recommended Provisions*. They included a guide to application of the *Provisions* in earthquake-resistant building design, a nontechnical explanation of the *Provisions* for the lay reader, and a handbook for interested members of the building community and others explaining the societal implications of utilizing improved seismic safety provisions and a companion volume of selected readings.

The 1988 Edition

The need for continuing revision of the *Provisions* had been anticipated since the onset of the BSSC program and the effort to update the 1985 Edition for reissuance in 1988 began in January 1986. During the update effort, nine BSSC Technical Committees (TCs) studied issues concerning seismic risk maps, structural design, foundations, concrete, masonry, steel, wood, architectural and mechanical and electrical systems, and regulatory use. The Technical Committees worked under the general direction of a Technical Management Committee (TMC), which was composed of a representative of each TC as well as additional members identified by the BSSC Board to provide balance.

The TCs and TMC worked throughout 1987 to develop specific proposals for changes needed in the 1985 *Provisions*. In December 1987, the Board reviewed these proposals and decided upon a set of 53 for submittal to the BSSC membership for ballot. Approximately half of the proposals reflected new issues while the other half reflected efforts to deal with unresolved 1985 edition issues.

The balloting was conducted on a proposal-by-proposal basis in February-April 1988. Fifty of the proposals on the ballot passed and three failed. All comments and "yes with reservation" and "no" votes received as a result of the ballot were compiled for review by the TMC. Many of the comments could be addressed by making minor editorial adjustments and these were approved by the BSSC Board. Other comments were found to be unpersuasive or in need of further study during the next update cycle (to prepare the 1991 *Provisions*). A number of comments persuaded the TMC and Board that a substantial alteration of some balloted proposals was necessary, and it was decided to submit these matters (11 in all) to the BSSC membership for rebalot during June-July 1988. Nine of the eleven rebalot proposals passed and two failed.

On the basis of the ballot and rebalot results, the 1988 *Provisions* was prepared and transmitted to FEMA for publication in August 1988. A report describing the changes made in the 1985 edition and issues in need of attention in the next update cycle then was prepared. Efforts to update the complementary reports published to support the 1985 edition also were initiated. Ultimately, the following publications were updated to reflect the 1988 Edition and reissued by FEMA: the *Guide to Application of the Provisions*, the handbook discussing societal implications (which was extensively revised and retitled *Seismic Considerations for Communities at Risk*), and several *Seismic Considerations* handbooks (which are described below).

The 1991 Edition

During the effort to produce the 1991 *Provisions*, a Provisions Update Committee (PUC) and 11 Technical Subcommittees addressed seismic hazard maps, structural design criteria and analysis, foundations, cast-in-place and precast concrete structures, masonry structures, steel structures, wood structures, mechanical-electrical systems and building equipment and architectural elements, quality assurance, interface with codes and standards, and composite structures. Their work resulted in 58 substantive and 45 editorial proposals for change to the 1988 *Provisions*.

The PUC approved more than 90 percent of the proposals and, in January 1991, the BSSC Board accepted the PUC-approved proposals for balloting by the BSSC member organizations in April-May 1991.

Following the balloting, the PUC considered the comments received with "yes with reservations" and "no" votes and prepared 21 rebalot proposals for consideration by the BSSC member organizations. The rebaloting was completed in August 1991 with the approval by the BSSC member organizations of 19 of the rebalot proposals.

On the basis of the ballot and rebalot results, the 1991 *Provisions* was prepared and transmitted to FEMA for publication in September 1991. Reports describing the changes made in the 1988 edition and issues in need of attention in the next update cycle then were prepared.

In August 1992, in response to a request from FEMA, the BSSC initiated an effort to continue its structured information dissemination and instruction/training effort aimed at stimulating widespread use of the *NEHRP Recommended Provisions*. The primary objectives of the effort were to bring several of the publications complementing the *Provisions* into conformance with the 1991 Edition in a manner reflecting other related developments (e.g., the fact that all three model codes now include requirements based on the *Provisions*) and to bring instructional course materials currently being used in the BSSC seminar series (described below) into conformance with the 1991 *Provisions*.

The 1994 Edition

The effort to structure the 1994 PUC and its technical subcommittees was initiated in late 1991. By early 1992, 12 Technical Subcommittees (TSs) were established to address seismic hazard mapping, loads and analysis criteria, foundations and geotechnical considerations, cast-in-place and precast concrete structures, masonry structures, steel structures, wood structures, mechanical-electrical systems and building equipment and architectural elements, quality assurance, interface with codes and standards, and composite steel and concrete structures, and base isolation/energy dissipation.

The TSs worked throughout 1992 and 1993 and, at a December 1994 meeting, the PUC voted to forward 52 proposals to the BSSC Board with its recommendation that they be submitted to the BSSC member organizations for balloting. Three proposals not approved by the PUC also were forwarded to the Board because 20 percent of the PUC members present at the meeting voted to do so. Subsequently, an additional proposal to address needed terminology changes also was developed and forwarded to the Board.

The Board subsequently accepted the PUC-approved proposals; it also accepted one of the proposals submitted under the "20 percent" rule but revised the proposal to be balloted as four separate items. The BSSC member organization balloting of the resulting 57 proposals occurred in March-May 1994, with 42 of the 54 voting member organizations submitting their ballots. Fifty-three of the proposals passed, and the ballot results and comments were reviewed by the PUC in July 1994. Twenty substantive changes that would require rebaloting were identified. Of the four proposals that failed the ballot, three were withdrawn by the TS chairmen and one was substantially modified and also was accepted for rebaloting. The BSSC Board of Direction accepted the PUC recommendations except in one case where it deemed comments to be persuasive and made an additional substantive change to be rebaloted by the BSSC member organizations.

The second ballot package composed of 22 changes was considered by the BSSC member organizations in September-October 1994. The PUC then assessed the second ballot results and made its recommendations to the BSSC Board in November. One needed revision identified later was considered by the PUC Executive Committee in December. The final copy of the 1994 Edition of the *Provisions* including a summary of the differences between the 1991 and 1994 Editions was delivered to FEMA in March 1995.

1997 Update Effort

In September 1994, NIBS entered into a contract with FEMA for initiation of the 39-month BSSC 1997 *Provisions* update effort. Late in 1994, the BSSC member organization representatives and alternate representatives and the BSSC Board of Direction were asked to identify individuals to serve on the 1997 PUC and its TSs.

The 1997 PUC was constituted early in 1995, and 12 PUC Technical Subcommittees were established to address design criteria and analysis, foundations and geotechnical considerations, cast-in-place/precast concrete structures, masonry structures, steel structures, wood structures, mechanical-electrical systems and building equipment and architectural elements, quality assurance, interface with codes and standards, composite steel and concrete structures, energy dissipation and base isolation, and nonbuilding structures.

As part of this effort, the BSSC is developing a revised seismic design procedure for use by engineers and architects for inclusion in the 1997 *NEHRP Recommended Provisions*. Unlike the current design procedure, which is based on U.S. Geological Survey (USGS) peak acceleration and peak velocity-related acceleration ground motion maps developed in the 1970s, the new design procedure will be based on USGS spectral response maps presently being revised.

The proposed design procedure may take the form of a separate design map based on the new USGS hazard maps or may involve a process specified within the body of the *NEHRP Recommended Provisions* that uses the new USGS maps as a starting point. In developing the design procedure, the BSSC will utilize a process that includes a mechanism to allow for public input, and the draft design procedure will be submitted to the PUC for inclusion in the draft of the 1997 Edition for consensus balloting by the BSSC member organizations.

This task is being conducted with the cooperation of the USGS (the BSSC and USGS have signed a Memorandum of Understanding that formalizes the process) and is being guided by a five-member Management Committee (MC). A Resource Group (RG) consisting of interested members from the design, construction, and earth science communities also has been established to provide continuing input. A Seismic Design Procedure Group (SDPG) is responsible for development of the design procedure. In November-December 1995 the BSSC will conduct five regional workshops to solicit, examine, and resolve regional issues related to the development of the design procedure and to introduce and begin to obtain consensus on the framework of the design procedure. Workshops are planned for the following regions of the country: Northeast/Southeast, Central States, Wasatch Fault, Pacific Northwest, and California.

All final TS and SDPG proposals for change are expected to be submitted to the PUC by the fall of 1996. The PUC will meet twice to consider these proposals and to formulate its recommendations to the BSSC Board of Direction concerning proposals to be submitted to the BSSC member organizations for balloting. Two rounds of balloting are planned (in February-March 1997 and August 1997).

The balloting by the BSSC member organizations will be conducted according to the BSSC Charter. The results of this ballot will be assembled for review by the PUC and its TSs. These committees will assess the ballot results; resolve, insofar as practicable, any remaining issues for reballoting by BSSC member organizations; and, if necessary, identify technical issues in need of study during subsequent updating of the *NEHRP Recommended Provisions*.

The final consensus version of the 1997 *NEHRP Recommended Provisions* (including as an appendix a report on the differences between the 1994 and 1997 Editions) will be prepared, reviewed, and transmitted to FEMA no later than December 31, 1997.

Information Dissemination/Technology Transfer

In 1987 a special effort was mounted to stimulate widespread use of the *Provisions*. Particular emphasis was placed on developing the seismic hazard awareness of building owners, developers, insurers, and investors; building and community officials; and key public interest groups.

A series of *Seismic Considerations* handbooks was developed to generate interest in seismic hazard mitigation among the owners and other decision-makers and the design professionals responsible for five building types – apartment buildings, elementary and secondary schools, health care facilities, hotels and motels, and office buildings.

These specific efforts were supported by the participation of BSSC representatives in a wide variety of relevant meetings and conferences, BSSC participation in development of curriculum for a FEMA Emergency Management Institute course on the *Provisions* for structural engineers and other design

professionals, issuance of a number of press releases, development of in-depth articles for the publications of relevant groups, and the establishment of a computer data base to permit the quick retrieval of various types of information.

In October 1989, the BSSC received from FEMA a request for a proposal to continue its information dissemination effort with emphasis on promoting a seminar series on application of the *NEHRP Recommended Provisions* (based on the Train-the-Trainer Program prepared by FEMA's Emergency Management Institute with the assistance of several BSSC Board members and volunteers) among relevant professional associations, stimulating interest in cosponsorship of the seminars, and conducting the seminars in various locations.

The proposal for initiating this effort was submitted in December 1989, and a contract was received in March 1990. It provided for increasing substantive knowledge about the *NEHRP Recommended Provisions* among a variety of audiences through the organization and conduct of 12 seminars in a variety of locations. In June 1991, in response to a request from FEMA, the BSSC submitted a proposal for continuation of the series with an additional 12 seminars.

By October 1995, 82 seminars will have been held. Cosponsors included the AIA Building Performance and Regulations Committee, the American Society of Civil Engineers, the American Concrete Institute, the American Institute of Steel Construction, the Building Officials and Code Administrators International (BOCA), the Earthquake Engineering Research Institute Great Lakes Chapter, the Interagency Committee for Seismic Safety in Construction, the Maine Emergency Management Institute, the Masonry Institute of Tennessee, the Materials Handling Institute, the Mississippi State University Continuing Education Department, the Panama Canal Commission, the Portland Cement Association, the Southern Building Code Congress International and Rust International, the Structural Engineers Association of Colorado, the Structural Engineers Association of Illinois, the University of Arkansas Continuing Education Department, and the Virginia Structural Engineers Council.

Although it is difficult to determine precisely how effective these various efforts have been, the number of BSSC publications distributed certainly provides at least one measure of the level of interest generated. In this respect, the BSSC can report that more than 65,000 publications have been requested since December 1987, and this number is above and beyond those requests for BSSC documents directed to FEMA. Further, many requests for information and other forms of technical support are received and responded to monthly.

Further, in 1989, the Building Officials and Code Administrators International (BOCA) appointed an ad hoc committee to review and study the 1988 Edition of the *Provisions* in order to develop a comprehensive and consistent position on code requirements for earthquake loads reflecting technology, design practices, and national codes and standards. In addition to six building officials selected by BOCA, the committee included six individuals representing the BSSC (five of whom were Board members). By October 1990, this group had developed proposed code changes that reflect approximately 90 percent of the content of the *Provisions*. At its annual meeting in September 1991, BOCA adopted new seismic provisions for the *National Building Codes* based on changes proposed by the ad hoc committee. The Southern Building Code Congress International also acted to approve similar seismic provisions for the *Standard Building Code* on October 30, 1991, during its annual meeting. SBCCI's action on the new seismic provisions must be confirmed by a majority of the active members by written ballot. Thus, in essence all three model codes now reflect the *NEHRP Recommended Provisions*. In addition, the *NEHRP Recommended Provisions* were adapted for use in the 1993 Edition of Standard ASCE 7 (formerly ANSI A-58.1) and the process is continuing for the 1995 Edition.

IMPROVING THE SEISMIC SAFETY OF EXISTING BUILDINGS

In August 1991, NIBS entered into a cooperative agreement with FEMA for a comprehensive program leading to the development of a set of nationally applicable guidelines for the seismic rehabilitation of existing buildings. Under this agreement, the BSSC serves as program manager and will cooperate with the American Society of Civil Engineers and the Applied Technology

Council in what is expected to be a five-year effort. 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 are 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 document produced as a result of this project is expected to be formulated to serve as a primary resource on the seismic rehabilitation of buildings for the use of model code and standards organizations, state and local building regulatory personnel, design professionals, and educators. The project work, as delineated in the workplan, will, as a minimum, involve ASCE and ATC as subcontractors as well as groups of volunteer experts and paid consultants. The workplan covers all the tasks specified in the cooperative agreement in terms of accomplishment of the three project objectives. The work is structured to ensure that the technical guidelines writing effort will benefit from: consideration of the results of completed and ongoing technical efforts and research activities as well as societal issues, public policy concerns, and the recommendations presented in an earlier FEMA-funded report on issues identification and resolution; cost data on application of rehabilitation procedures; the reactions of potential users; and consensus review by a broad spectrum of building community interests.

To ensure continuing project oversight, a Project Oversight Committee (POC) is 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 composed of approximately 20 individuals (plus corresponding members) selected for their knowledge of various aspects of project work (architectural components, systems, cladding; codes and standards; concrete; contractors and constructors; earthquake research; economics; electrical; federal agencies; financing/insurance; historic properties; legal concerns; masonry; mechanical; property owners and managers; seismic hazards; societal concerns and public policy issues; state and local government; steel; structural design/analysis; wood) has been established to review project products and to advise the POC and, if appropriate, the BSSC Board, on the approach being taken, problems arising or anticipated, and progress being made.

While overall management remains the responsibility of the BSSC, responsibility for conduct of the specific project tasks will be shared by the BSSC with ASCE and ATC. Specific BSSC tasks are being completed under the guidance of a BSSC Project Committee.

An earlier FEMA-funded project was designed to provide consensus-backed approval of publications on seismic hazard evaluation and strengthening techniques for existing buildings. This effort involved identifying and resolving major technical issues in two preliminary documents developed for FEMA by others – a handbook for seismic evaluation of existing buildings prepared by the Applied Technology Council (ATC) and a handbook of techniques for rehabilitating existing buildings to resist seismic forces prepared by URS/John A. Blume and Associates (URS/Blume); revising the documents for balloting by the BSSC membership; balloting the documents in accordance with the BSSC Charter; assessing the ballot results; developing proposals to resolve the issues raised; identifying any unresolvable issues; and preparing copies of the documents that reflect the results of the balloting and a summary of changes made and unresolved issues. Basically, this consensus project was directed by the BSSC Board and a 22-member Retrofit of Existing Buildings (REB) Committee composed of individuals representing the needed disciplines and geographical areas and possessing special expertise in the seismic rehabilitation of existing buildings. The consensus approved documents (the *NEHRP Handbook for the Seismic Evaluation of Existing Buildings* and the *NEHRP Handbook of Techniques for the Seismic Rehabilitation of Existing Buildings*) were transmitted to FEMA in mid-1992.

The BSSC also was involved in the joint venture with the ATC and the Earthquake Engineering Research Institute to develop an action plan for reducing earthquake hazards to existing buildings. The action plan that resulted from this effort prompted FEMA to fund a number of projects, including those described above.

IMPROVING THE SEISMIC SAFETY OF NEW AND EXISTING LIFELINES

Given the fact that buildings continue to be useful in a seismic emergency only if the services on which they depend continue to function, the BSSC developed an action plan for the abatement of seismic hazards to lifelines to provide FEMA and other government agencies and private sector organizations with a basis for their long-range planning. The action plan was developed through a consensus process utilizing the special talents of individuals and organizations involved in the planning, design, construction, operation, and regulation of lifeline facilities and systems. Five lifeline categories were considered: water and sewer facilities, transportation facilities, communication facilities, electric power facilities, and gas and liquid fuel lines. A workshop involving more than 65 participants and the preparation of over 40 issue papers was held. Each lifeline category was addressed by a separate panel and overview groups focused on political, economic, social, legal, regulatory, and seismic risk issues. An Action Plan Committee composed of the chairman of each workshop panel and overview group was appointed to draft the final action plan for review and comment by all workshop participants. The project reports, including the action plan and a definitive six-volume set of workshop proceedings, were transmitted to FEMA in May 1987. In recognition of both the complexity and importance of lifelines and their susceptibility to disruption as a result of earthquakes and other natural hazards (hurricanes, tornadoes, flooding), FEMA subsequently concluded that the lifeline problem could best be approached through a nationally coordinated and structured program aimed at abating the risk to lifelines from earthquakes as well as other natural hazards. Thus, in 1988, FEMA asked the BSSC's parent institution, the National Institute of Buildings Sciences, to provide expert recommendations concerning appropriate and effective strategies and approaches to use in implementing such a program.

The effort, conducted for NIBS by an ad hoc Panel on Lifelines with the assistance of the BSSC, resulted in a report recommending that the federal government, working through FEMA, structure a nationally coordinated, comprehensive program for mitigating the risk to lifelines from seismic and other natural hazards that focuses on awareness and education, vulnerability assessment, design criteria and standards, regulatory policy, and continuing guidance. Identified were a number of specific actions to be taken during the next three to six years to initiate the program. In September 1990, FEMA asked for additional NIBS guidance concerning the feasibility of establishing a national lifelines seismic safety council.

MULTIHAZARD ACTIVITIES

Multihazard Assessment Forum

In 1993, FEMA contracted with NIBS for the BSSC to organize and hold a forum intended to explore how best to formulate an integrated approach to mitigating the effects of various natural hazards under the National Earthquake Hazards Reduction Program. More than 50 experts in various disciplines concerning natural hazards risk abatement participated in the June 1994 forum and articulated the benefits of pursuing an integrated approach to natural hazards risk abatement. A BSSC steering committee then developed a report, *An Integrated Approach to Natural Hazards Risk Mitigation*, based on the forum presentations and discussion that urged FEMA to initiate a program definition and initiation effort to create a National Multihazard Mitigation Council structured and charged to integrate and coordinate public and private efforts to mitigate the risk from natural hazards. All public and private agencies and organizations with a significant interest in natural hazards risk mitigation are to be involved in establishing the council and in drafting its detailed mission statement and workplan. This report was delivered to FEMA in early 1995.

EMI Multihazard Building Design Summer Institute

In 1994, NIBS, at the request of FEMA's Emergency Management Institute (EMI) of FEMA, entered into an additional contract for BSSC to provide support for the administration, management, development and delivery of the EMI Multihazard Building Design Summer Institute (MBDSI). The MBDSI is attended by university and college professors of engineering and architecture and is intended to provide them with instructional tools for use in creating/updating building design

courses. The aim is to encourage widespread use of mitigation techniques in designing and rehabilitating structures to withstand forces generated by both natural and technological hazards. The 1995 MBDSI conducted in July consisted of four one-week courses focusing on designing building fire safety, earthquake protective design, flood protective design, and wind protective design.

BSSC PUBLICATIONS

Available in limited quantity free of charge from the Building Seismic Safety Council, 1201 L Street, N.W., Suite 400, Washington, D.C. 20005

New Buildings

The NEHRP (National Earthquake Hazards Reduction Program) Recommended Provisions for Seismic Regulations for New Buildings, 1994 Edition, 2 volumes and maps (FEMA Publications 222A and 223A).

The NEHRP (National Earthquake Hazards Reduction Program) Recommended Provisions for the Development of Seismic Regulations for New Buildings, 1991 Edition, 2 volumes and maps (FEMA Publications 222 and 223).

Guide to Application of the 1991 Edition of the NEHRP Recommended Provisions in Earthquake Resistant Building Design, Revised Edition, 1995 (FEMA Publication 140) – 1995

A Nontechnical Explanation of the NEHRP Recommended Provisions, Revised Edition, 1995 (FEMA Publication 99) – 1995

Seismic Considerations for Communities at Risk, Revised Edition, 1995 (FEMA Publication 83) – 1995

Seismic Considerations: Apartment Buildings, Revised Edition, 1995 (FEMA Publication 152) – 1995

Seismic Considerations: Elementary and Secondary Schools, Revised Edition, 1990 (FEMA Publication 149)

Seismic Considerations: Health Care Facilities, Revised Edition, 1990 (FEMA Publication 150)

Seismic Considerations: Hotels and Motels, Revised Edition, 1990 (FEMA Publication 151)

Seismic Considerations: Office Buildings, Revised Edition, 1995 (FEMA Publication 153) – 1995

Societal Implications: Selected Readings, 1985 (FEMA Publications 84)

Existing Buildings

NEHRP Handbook of Techniques for the Seismic Rehabilitation of Existing Buildings, 1992 (FEMA Publication 172)

NEHRP Handbook for the Seismic Evaluation of Existing Buildings, 1992 (FEMA Publication 178)

An Action Plan for Reducing Earthquake Hazards of Existing Buildings, 1985 (FEMA Publication 90)

Lifelines

Abatement of Seismic Hazards to Lifelines: An Action Plan, 1987 (FEMA Publication 142)

Abatement of Seismic Hazards to Lifelines: Proceedings of a Workshop on Development of An Action Plan, 6 volumes:

Papers on Water and Sewer Lifelines, 1987 (FEMA Publication 135)

Papers on Transportation Lifelines, 1987 (FEMA Publication 136)

Papers on Communication Lifelines, 1987 (FEMA Publication 137)

Papers on Power Lifelines, 1987 (FEMA Publication 138)

Papers on Gas and Liquid Fuel Lifelines, 1987 (FEMA Publication 139)

Papers on Political, Economic, Social, Legal, and Regulatory Issues and General Workshop Presentations, 1987 (FEMA Publication 143)

Multihazard Considerations

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