DEVELOPMENT OF SEISMIC SAFETY CODES

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The history of the codes and standards system in the United States is an interesting one; however, of greater importance in this context is what it can tell us about the likely future course of codes and standards development, and the wisdom of working within that system to effect nationwide change in building hazard mitigation practices.

The first model code, the National Building Code, was prepared in 1905 by the National Board of Fire Underwriters, now the American Insurance Association. Concerned about the huge fire losses in American cities and towns, the Board drafted the code with the hope that it would be adopted into law by these cities and towns. Of course, the code dealt with more than fire safety, so it also held the promise of helping reduce the wide variations in the content of building codes--a problem that already was becoming apparent as community after community made a tailored response to perceived public health and safety needs and to public demands for such protection. As early as 1921, a U.S. Senate committee called attention to the high costs of construction that it felt were a consequence of the growing number of municipal codes and the lack of uniformity among those codes. Therefore, the lack of uniformity in building codes, as well as the extent and adequacy of their coverage, is hardly a new concern--just one that is rediscovered from time to time.

In 1927, the first edition of the Uniform Building Code was published by what today is the West Coast headquartered International Conference of Building Officials (ICBO).

In 1939, it was the U.S. National Bureau of Standards that issued a report calling for greater code uniformity. At the same time, it called for the use of nationally recognized building standards in building codes and for the development of means for the acceptance of new materials and methods--the concept of a total system for both regulation and the introduction of technology.

Following World War II (in 1946), the Southern Building Code Congress (SBCC), headquartered in Alabama, was formed and its model code, the Standard Building Code, was first published. Then, in 1950, the Building

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Officials and Code Administrators (BOCA), which was created in 1915 and is headquartered in Chicago, published its model code, the Basic Building Code.

There now were four model codes--the National Building Code, the Uniform Building Code, the Standard Building Code, and the Basic Building Code. The latter three were and are prepared by building officials with input from the building community.

The National Building Code was last revised in 1976, and in 1980, the National Conference of States on Building Codes and Standards--a body that received its impetus from the National Bureau of Standards--obtained the rights to the code and proposed to develop it as a consensus document in the manner of standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI). Although the concept of a consensus code--as distant from a document produced with building officials as the sole decision-makers--was lauded by many and a degree of progress was made in organizing for the task, the concern for the creation of yet another model code, just as it appeared that the number would be reduced to three, led to the ultimate abandonment of the effort. Today, BOCA has the rights to the national building code name.

The three model code bodies have been quite aggressive and competitive in seeking adoptions of their respective codes. Nevertheless, there still are communities across the country that have no code, particularly communities in rural and newly developing areas, and areas where the code treats only or principally facilities involving public use or occupancy. Also, many of the communities that have adopted one of the model codes have not done so without additions, deletions, and modifications --not infrequently, extensive such deviations. Further, not all codes are up to date by any means, which leads to even further lack of uniformity among various jurisdictions.

The difficulty was compounded by a move in the late 1960s and early 1970s to foster more state rather than local codes--leaving us with a greater mixture of both. Finally, many of our nation's largest cities continue to have their own code. Thus, the dream of uniformity or, what is perhaps a better way of phrasing the need, harmony of provisions is far from a reality.

As early as 1949, the model code organizations, together with several national organizations such as ASTM, the American Insurance Association and the Underwriter's Laboratories, several federal agencies, and the National Research Council of Canada formed the Joint Committee on Building Codes (JCBC) to seek greater code uniformity. In 1959, the JCBC became the Model Codes Standardization Council (MCSC) and the design professions became advisory members. The MCSC was further expanded in 1970 to include construction industry representatives, also as advisory members.

With all of this, progress was still painfully slow on the issue of uniformity and/or harmonization. The nation and building technology were growing rapidly and there still were strong feelings that codes

were growing rapidly and there still were strong feelings that codes were a major deterrent to progress and a cause of increased building costs. As a result, Congress created the National Commission on Urban Problems--more popularly known as the Douglas Commission after its chairman, the late Senator Paul Douglas of Illinois. The Douglas Commission made a rather exhaustive study of the codes and standards situation across the United States. Its findings were detailed in a 1969 report, and one of those findings was that an entirely new instrument was needed to address the problem--one that would have the backing of the Congress and the clear mission of bringing about a more rational and responsive building regulatory environment and a nationwide system for facilitating the introduction of new technology. The new instrument was designated the National Institute of Building Sciences (NIBS) by the Commission.

NIBS was a long time coming into being. Not only did the Congress have to be convinced that it was needed--particularly in the form of a private, nongovernmental body authorized by the Congress--but the many diverse and divided public and private interests in the building community itself had to be convinced that NIBS was necessary or at least worth a try.

It took from 1969 until 1974 to be authorized by the Congress, and until mid-1976 for the President of the United States to appoint its first Board of Directors. NIBS received its first of five start-up capital appropriations from the Congress in late 1977 and effectively began operations at the beginning of 1978. And, during these years, the building community and the code bodies were not idle.

In 1972, the three model code bodies formed the Council of American Building Officials (CABO), and CABO in turn created the Board for the Coordination of Model Codes (BCMC) and the National Research Board (NRB) to begin a process for reviewing and recognizing building products and systems. This was not the first effort made by the three model codes to find a way to work together but it has been the only one to have withstood the test of time to date. No doubt the creation of NIBS and the events that surrounded it provided considerable impetus to succeed.

One example of CABO achievements is that it succeeded in creating a one- and two-family dwelling code that, because of its adoption by reference by the three parent model code bodies, has become a nationwide model. It must be pointed out at this juncture, however, that there are few who are familiar with the regulatory scene in this country who would like to see a national model code--or, perhaps it would be more to the point to say that there are a few who would want to see a single national model code that could easily become a national building code by legislative action. The building community has gained a healthy respect for the value of divided authority whether private or public. This is not to say, however, that there is not a desire for greater harmonization of the provisions of both model and actual codes. The same can be said for working to eliminate needless overlap, duplication, and conflict among the standards referenced and available for referencing in codes.

For example, when NIBS recommended the gradual phasing-out of the HUD Minimum Property Standards in favor of an improved CABO One- and Two Family Dwelling Code for that type of housing and any of the three nationally recognized model codes or their equivalent for multifamily housing, a great opportunity was created for achieving increased harmonization of code provisions, at least in this one area of building regulation. Both HUD and CABO have followed through with this recommendation. Further, because the One- and Two-Family Dwelling Code process is more open to building community participation than is the case with the model codes themselves, there has been the opportunity to bring a diversity of building industry talents to bear on at least one area of model code formulation in a manner akin to that of voluntary consensus standards development.

With this gradual movement toward greater harmonization of the model codes, there also has been a gradual movement toward the adoption of these model codes by the nation's states and communities. However, it must be stressed again that adoptions are by no means universal and certainly not adoptions without modification; that most of the major cities continue to have a code that is in many ways unique to that city and reflective of its history and political character, that not all jurisdictions keep their codes up to date, and that appeals and resulting variances make it virtually impossible to be able to say that provisions that even appear to be the same are truly the same at any given point in time.

Therefore, with perhaps as many as 16,000 code issuing jurisdictions in the country, some at the state level, some at the local level and some at both, and with all of these forces at work, there remains a great deal of disharmony among the resulting codes and code provisions in force. It also is the case that many federal agencies have their own construction requirements which add to the lack of harmony. As an aside, the relatively recent action of the Office of Management and Budget in issuing a bulletin that calls upon all federal agencies to rely on voluntary consensus standards to the maximum extent possible is helping the cause of harmonization significantly.

It should be clear at this point that there is no one point of entry for effecting code changes even though input through the model code change process can have a significant effect on the whole of code practice. It always must be remembered that ultimately it is the body having political jurisdiction that must decide what performance level will be sought and what specific requirements will be imposed to achieve that level of performance. This applies to the location, design, construction, and rehabilitation of its own facilities as well as to those under private ownership.

These decisions--that is, whether and how to provide protection against any potential natural or man-made destructive force--are political simply because determining the level of risk and the costs and benefits that are likely to flow from taking any given set of protective measures is so much a matter of judgment. The challenge to the professional community, then, is to provide political decision-makers with ever more reliable information and recommendations to assist them in their awesome

task of assessing the risks and establishing the costs and benefits of one decision over the other. This implies, of course, that the professional community will be able to reach a reasonable agreement on what information and recommendations are to be provided. And in this regard, the nation is at a turning point with regard to earthquake technology and its proper application.

Today, there is a major debate concerning how realistic the risk of damaging earthquakes is in much of the eastern two-thirds of the country and an even greater debate on what regulatory provisions can best address those perceived risks.

It is important to recognize that perhaps 80 percent of a building code is made up of reference standards or materials that have come from standards. In the United States, most of these standards are either voluntary consensus standards or industry standards; however, there continues to be reliance on a number of government standards as well, particularly standards promulgated by federal agencies for their own use or for regulatory purposes. Therefore, it is to these criteria and standards that one also must look if building practices are to be changed or influenced. It was not too many years ago that the sources of information and data on seismicity and seismic effects were numerous. Today, these sources are fewer.

At this point it might be best to refer to the June 1978 publication, Tentative Provisions for the Development of Seismic Regulations for Buildings, prepared by the Applied Technology Council of the Structural Engineers Association of California. Popularly known as ATC 3-06, this document has become the focus of proposed changes in seismic standards and codes because of its sponsorship by the National Science Foundation and wide participation by design professionals and representatives of code bodies, governmental agencies at all levels, and the materials industry.

The program effectively began with a workshop on disaster mitigation sponsored by NSF and the National Bureau of Standards (NBS) in Boulder, Colorado, in August 1972. Therefore, the current effort to upgrade disaster mitigation through improved codes and standards is already 12 years old. After ATC 3-06 was published, there was much debate as to the appropriateness of some of the proposed provisions, as to the extent of the proposed application of the provisions, and as to the usefulness of the document itself for the purpose implied in its title--i.e., as provisions for regulatory purposes--because of its mixture of criteria, design procedures, and commentary. Actually, it is clearly stated in the foreword to the document that:

> These provisions are tentative in nature. Their viability for the full range of applications should be established. We recommend this be done prior to their being used for regulatory purposes. Trial designs should be made for representative types of buildings from different areas of the country and detailed comparisons made with costs and hazard levels from existing design regulations.

Concern for a better way to assure consensus among all of the interested parties became a significant issue toward the end of the 1970s; therefore, in 1979, after much discussion among the key building community organizations and federal agencies, the Building Seismic Safety Council (BSSC) was created under the auspices of the aforementioned National Institute of Building Sciences. Today, BSSC operates within NIBS as an independent, voluntary body of some 58 separate organizations. The trial designs recommended by ATC are some 58 separate organizations. The trial designs recommended by ATC are well under way with funding by FEMA--indeed, the second series of these designs is now nearing completion. The next phase of the program will entail getting agreement of the members of the Council on any changes proposed by its committees as a result of previous balloting on the tentative provisions and any changes that seem needed as a result of the trial designs. Publication of the agreed upon seismic safety provisions will follow. It also will include an assessment of the socio-economic impact that could be expected as a consequence of implementing and utilizing the provisions, especially in communities east of the Rocky Mountains that to-date have been largely unconcerned with the seismic safety aspects of building design; a study of the likely impact of the provisions on building regulatory practices; and development of materials and plans for encouraging maximum use of the provisions. Next will come the arduous tasks of seeking changes in the model and actual codes and the appropriate reference standards and educating designers and other building community participants in their use. A good start on this latter task will already have been made because of the involvement of local firms across the country in the trial designs.

In the meantime, the federal government, working through an interagency committee, has been proceeding with applications for federal construction. And, it appears that the National Bureau of Standards, as the Secretariat for an American National Standards Institute standards committee known as A-58.1, already has introduced elements of ATC 3-06 into the 1982 edition of A58.1. For example, the A58.1-1982 seismic zone maps--i.e., maps of the 50 states and Puerto Rico which identify geographic areas of differing earthquake hazard (from 0 to 4)--is derived from maps contained in ATC 3-06.

It appears likely that seismic design procedures will be considerably different if the current work stays on course. At present, the seismic force factors used in ANSI A58.1-1982 are quite similar to those used in the 1982 edition of the Uniform Building Code (UBC) and, because the UBC is the model code most used in the West where earthquakes of significant magnitude are a matter of fairly recent memory, the UBC is typically the most responsive to changes in earthquake engineering technology. The Standard Building Code (SBC) simply references the provisions of A58.1 and must be updated to reference new editions or to introduce other provisions. The lateral force factors in the Basic Building Code (BBC) are specified and are somewhat different from those in the UBC and A58.1-1982. The risk maps in the SBC and BBC are different than those in A59.1-1982. It might be reasoned that all of these standard reference works will come into greater harmony if not actually share the same provisions once the work of BSSC is finished and a reasonable consensus has been achieved on the seismic safety provisions thus

recommended. However, even if this does occur, that is not to say that all states and communities will readily adopt the provisions appropriate to their area.

It does seem, however, that with the greater acceptance of decision-making processes such as those employed by the Building Seismic Safety Council and A58.1 (which deals with all dead, live, and environmental loads on buildings and not just earthquakes), the opportunity exists to influence those political bodies that ultimately must make the risk-taking decisions in the areas of public health, safety, and welfare. By bringing together representatives of all vital interests and expertise, the likelihood of finding adequate authority outside the process to challenge the collective judgments of those involved decreases dramatically.

One would think that concern for the potentially devastating effects of earthquakes would engender an eagerness to apply the regulatory provisions offered by technical experts. This simply has not been the case. Regardless of what the technical experts say, the evidence has not been sufficient to convince a lay public that has never experienced an earthquake or is aware that there has not been an earthquake of significance in their area in recorded history, that one of potentially devastating effect could occur tommorrow. And, perhaps more to the point, the lay public may not perceive the odds that such an earthquake will occur in their area during their lifetime to be great enough to justify spending large sums of public and/or private funds to provide or upgrade protection. A finding that the costs of providing adequate protection are minimal or within reason, would go a long way toward allaying these concerns--at least with new construction.

Unfortunately, much the same skepticism can be found with many design professionals and others directly involved with the building community who have never been taught seismic design and who are not required to possess such knowledge to be able to practice or fulfill their other roles in building. Such knowledge simply is of little use in an area where it is not needed for survival in the marketplace.

The answer to the question of whether there are problems that can be addressed by education, therefore, is a resounding yes. There is a big job of public education to be done. There is need to expand the education of building design professionals in seismic design practices. There is need to educate all those who would participate in housing, building, and planning on the state of the art in seismic technology. And, there is need to continue to educate everyone on the importance of achieving a voluntary consensus--one that includes the executive branches of government--on the standards and regulatory provisions that are to be recommended to the appropriate legislative bodies.

It appears that the knowledge and tools will soon be ready for making the next step up on seismic building design, construction, and rehabilitation practice. What is needed is a game plan for bringing those tools into play in an atmosphere of rationality--something that has not been done too well in the building arena in the past. Experience has shown that once a change is perceived as desirable or possible by those di-

rectly involved, the federal government has all too frequently agreed to lead the charge--not in a studied manner but in a rush and with an outsized and often frantic program with unreal goals and timetables. I hope I have indicated that the building community and the body politic as it deals with housing, building, and planning issues simply does not respond well to this kind of pressure.

What usually happens after one of these frantic efforts has been tried and fails is that the legislators that voted the resources and the consumers that have been stimulated to great expectations either become convinced that one cannot get from here to there or simply fall back to sleep. The effort is aborted and the goal is farther from achievement than if the program had never been launched--witness Operation Breakthrough and the Building Energy Performance Standards.

A continuation of the cooperative program already under way, with a steady hand on the tiller, will undoubtedly prove in the long run to have been the best course to follow. The old adage "haste makes wastes" certainly should not be forgotten in the case of the earthquake hazard reduction program. Its going well. Let's not break it.