CHAPTER

1 The Purpose of Controls

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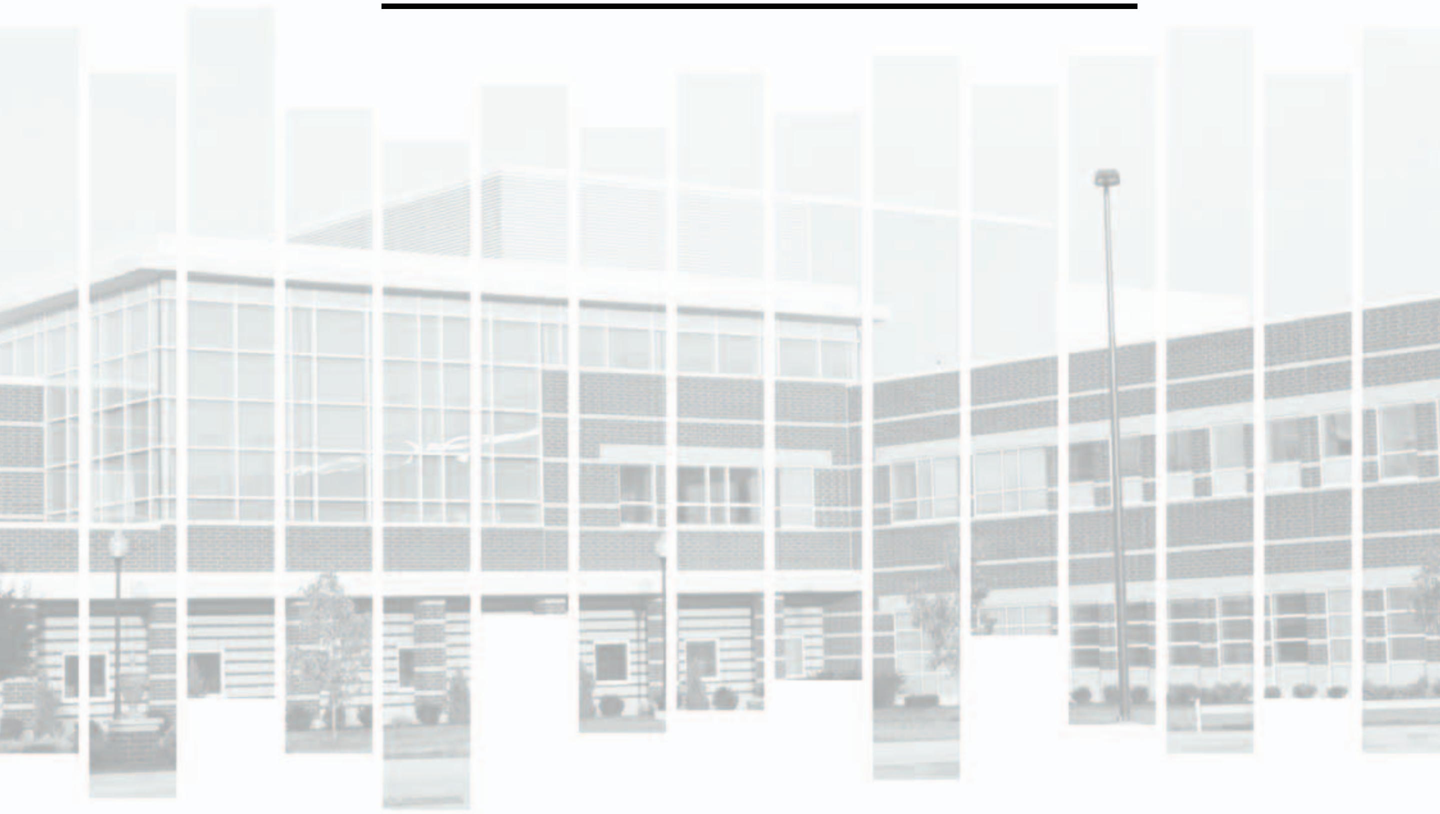

For at least five thousand years, man has exercised some limited controls over the construction and use of buildings and structures throughout the civilized world. Evolving controls were only partially effective—considering the burning of Rome during the reign of Emperor Nero, the destruction of London in 1666 and the Chicago fire of 1871. There were, of course, many, perhaps thousands, of destructive fires that struck cities and towns all over the world, but these three are best remembered by most people.

From 1800 to 1900, eleven major American cities were devastated by fires that took an unrecorded number of lives and damaged or destroyed property worth hundreds of millions of dollars. Since then there have been many more disastrous fires, but overall damage by fire has become less and less of an occurrence. There are some who will say that a combination of improved building inspection and greater fire prevention efforts working together should be credited equally, while others will say that we have achieved a safer environment because of the improvement in fire protection systems such as alarms and sprinklers devices. There is little doubt that more buildings are now required to have automatic sprinklers, and this has contributed a great deal to reducing the numbers of large-loss fires. Moreover, improved fire-protection systems have reduced the dollar amount associated with loss of property through fires and most definitely have reduced the number of lives lost.

The effect of each successive conflagration has served to strengthen laws, where such laws were already in existence, and to bring about some controls in areas where there were none previously. It is a sad commentary that disaster is necessary before appropriate regulations are adopted. A building official attempting to secure support in a proposal for necessary legislation would be well advised to call attention to this fact. A classic example of this type of reaction was the adoption of the *Basic Building Code* in 1979 by the State of Kentucky after the disastrous fire that took 165 lives at the Beverly Hills Supper Club on May 28, 1977. The objective of this action was to replace an antiquated, poorly maintained state code with a modern and adequately maintained model code. A more recent example of this kind of reaction is the one to the fast-moving fire that swept through The Station, a night club in West Warwick, Rhode Island, in February of 2003. That event was something that never should have happened, and as a result the government of Rhode Island formed committees and charged them with devising ways to make Rhode Island the safest state in the nation.

Did You Know?

Fire was not the only disaster that caused devastation in recent history. Other disasters such as earthquakes, floods and hurricanes, as well as the study of their effects, influenced the evolution of other parts of the model building codes.

Historical Background

The building code is not a modern concoction. As previously mentioned, building regulation and codes extend back thousands of years, but because it is neither dramatic nor romantic the history can be difficult to retrace. Historians did, however, record some of it. We find mention of building laws from the time of the ancient Babylonian empire of Hammurabi about 2,000 B.C. through Nero's Rome to twelfth-century Europe, to England in the 1600s and to America as soon as urban life indicated the need.

Hammurabi

The building code of Hammurabi, founder of the Babylonian Empire, is the earliest known code of law. Figure 1-1 depicts, in the cuneiform writing of the Babylonians, an excerpt from the Hammurabi code pertaining to buildings, translated as follows:

> 228: If a builder build a house for a man and complete it, that man shall pay him two shekels of silver per sar of house as his wage. 229: If a builder has built a house for a man and his work is not strong, and if the house he has built falls in and kills the householder, that builder shall be slain. 230: If the child of the householder be killed, the child of the builder shall be slain. 231: If the slave of the householder be killed, he shall give slave for slave to the householder. 232: If goods have been destroyed, he shall replace all that has been destroyed; and because the house was not made strong, and it has fallen in, he shall restore the fallen house out of his own material. 233: If a builder has built a house for a man and his work is not done properly and a wall shifts, then that builder shall make that wall good with his own silver.

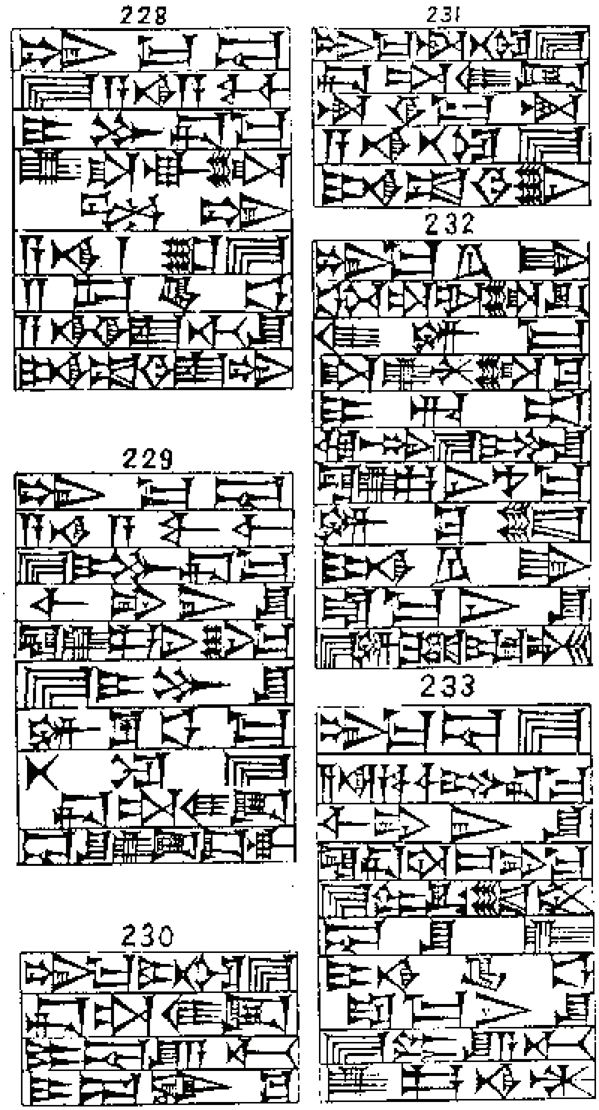

Figure 1-1
The Code of Hammurabi

Historians did not clearly differentiate between "building laws" and "building construction specifications," and it is possible that reference to ancient "laws," except for those of Hammurabi, should refer instead to building specifications. The important point is that there were controls, however narrow or limited their scope.

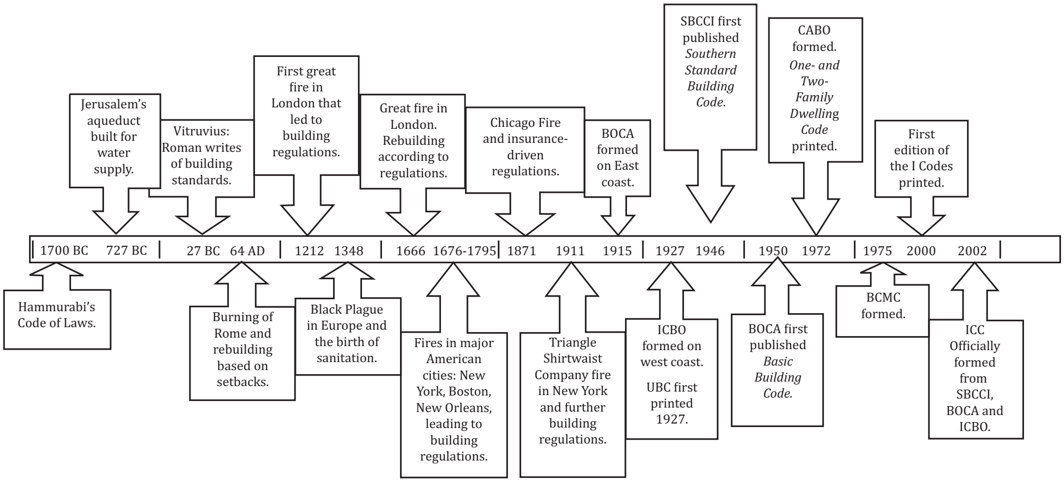

Figure 1-2
Timeline of building controls

The Historical Perspective

The Burning of Rome

Even before the fire that burnt Rome, standards for construction existed that were enforced by the aediles, who were the building inspectors of that day. It was their duty to oversee construction, put out fires and generally protect the public from the danger of poor construction.

But not every building in Rome was built to high standards. In fact, some buildings collapsed under their own weight while they were being constructed. Many poorly-built, highly combustible structures were packed together so tightly that the famous fire took its toll. After the tragic fire that may have been caused by Nero on July 18, 64 A.D., Rome was rebuilt. Hasty and irregular construction during the rebuilding was forbidden. Rome was rebuilt according to a master plan developed by Nero's chief architects, Severus and Celar. Building lines were maintained, and height was limited to double the width of the adjoining street. Building standards improved the safety and appearance of Rome.

History has cast Emperor Nero in the role of a cruel, obese and truculent tyrant. Perhaps he was, but he was also apparently a man of intelligence and vision who could comprehend the full meaning and apparent dangers inherent in unregulated construction. Prior to Nero's coming to power, Rome lavished its wealth and resources on the construction of public edifices but ignored construction of almost all other buildings. Poorly constructed tenements were being erected, mostly without controls of any type. Many of these monstrosities collapsed even before they were completed, killing and maiming workmen by the score. It is not too difficult to envision the chaotic state of affairs, relative to housing, that was Rome in 64 A.D.

Emperor Nero had a master plan for a new Rome prepared sometime prior to the fire that destroyed much of Rome, and his attitude toward the existing conditions was well known. Consequently, the charges that he deliberately ordered Rome's destruction are conceivable. To his credit, it must be stated that the rebuilding of Rome was accomplished in accordance with sound principles of construction, with particular emphasis on fire resistance, sanitation and usefulness. What is important to code history is that until the final downfall of Rome, the construction of both public and private buildings in that city was closely monitored and controlled. This burning may have been the world's first urban renewal project, on that would significantly impact the history of building safety.

The Great Fire of London

In 1660 London was crowded with combustible buildings. In the early 1600s, many buildings had balconies or cantilevered roof structures that projected to near the center of the street. More than likely, many building owners were reluctant to tear down their buildings on account of the law requiring them to rebuild with brick or stone. The fire may have started in a ramshackle neighborhood near the Tower of London. It was a modest fire until it hit a group of warehouses storing animal fat and alcohol.

London was almost two-thirds destroyed in the great fire of 1666. Some historians have stated that the destruction was more of a blessing than a calamity, for London was a crowded, filthy city of low timber-framed warehouses, churches and houses. Most thoroughfares had open drains that carried raw sewage, and housewives threw their garbage into the narrow cobblestone streets. Overcrowding was a way of life, and sanitation was practically unknown. Under these circumstances it is little wonder that epidemics were common. London had been ravaged by bubonic plague for nearly a year prior to the fire, and people were dying at the rate of a thousand a week.

The fire is reported to have started in a run-down neighborhood near the Tower of London. It attracted little attention, for fires were not uncommon in the city, and only half-hearted attempts to control it were made. It finally spread to warehouses where highly combustible tallow, oil and alcoholic spirits were stored. The fire then increased in its intensity and was soon engulfing even the London Bridge. King Charles attempted to halt the spread of fire by ordering the demolition of yet undamaged buildings in the path of the fire, but its advance was relentless. Even the magnificent Cathedral of St. Paul suffered extensive damage. The fire raged for five days and nights. It destroyed fifteen thousand buildings, including eighty-four churches. Miraculously, only six lives were lost in accidents directly attributable to the fire.

It took Parliament two years to enact controls for building, called the "London Building Act." The law applied only to the boundaries of the City of London, leaving the balance of England with no controls over building. While Parliament was wrestling with the problem of "code" writing, London began to rise again, almost at the whim of individual builders. Besides being an astronomer, Christopher Wren was also an architect. Wren's plan for rebuilding London included wide streets and spacious parks. It is the first modern city planning document on record. However, Parliament passed a law the next year that did not include wide streets but with other protective provisions in place. In fact, it may be regarded as the first modern building code.

DID YOU KNOW?

The London Building Act included four sorts of buildings that were defined and regulated as to their proximity:

1. *Those fronting on bylanes*
2. *Those fronting streets and lanes of note*
3. *Those fronting high and principal streets*
4. *Mansion houses for persons of extraordinary quality, not fronting either of the three ways*

The Chicago Fire

The most devastating and costly fire in American history was the fire that almost destroyed Chicago in 1871. Chicago at that time consisted of about sixty thousand buildings, more than half of which were of wooden construction. Lloyds of London, alarmed by the extent of combustible construction, warned its underwriters of the conflagration potential. But small heed was paid to Lloyds' warnings, and insurance companies continued to issue fire insurance coverage.

The initial fire, blamed, as every schoolchild knows, on Mrs. O'Leary's cow, started on October 7, 1871 and was thought to be under control, but on the night of October 8 a new fire broke out and, fanned by winds coming off the lake, was soon raging out of control. Measures were employed by the U.S. Army, under the command of General Sheridan, that included the use of explosives to create fire breaks. Before the fire was extinguished two days later, seventeen thousand buildings had been destroyed and two hundred fifty lives had been lost. Almost one hundred thousand persons were homeless. Without the outpouring of help that soon arrived from every corner of the world, thousands might have died from exposure, starvation or disease because winter was approaching.

The Chicago fire devastated not only a major portion of the city but the financial reserves of many insurance companies, sixty of which went into bankruptcy. Those that survived financially threatened to leave the city *en masse* unless adequate laws regulating building were enacted. It took a little more time for the city fathers to overcome resistance to new controls, but in 1875 a building code and a fire-prevention ordinance became effective.

These condensed versions of episodes in world history indicate that building regulation as we know it today is the result of an evolutionary process that has its roots deeply embedded in disaster and tragedy. Those responsible for the absence of controls and the absence of enforcement must share accountability for the needless loss of lives and property. When the question is asked, "Why do we need building laws?", it would be appropriate to answer that lives and property have been lost because of their absence.

Early Controls in the United States

In America, a familiar cycle of needs and dangers arose out of unregulated construction followed by scattered laws, ordinances and codes seeking to correct the conditions. This cycle repeated in a span of some three hundred years the experiences of much older countries. For example, the colonists took whatever building materials were at hand and at first were content with hastily improvised shelters. Early accounts tell of fires that originated in log chimneys imperfectly protected with layers of mud. These experiences resulted in laws forbidding such dangerous practices.

English common law formed the basis for American legal philosophy. In fact, colonial building laws in the Americas were a result of regulation progress in England. The colonies were not necessarily bound by laws passed in England, unless those laws were specifically mentioned. Building codes seemed less important than commercial or criminal law to the early American colonists. The first building codes in the United States were based on an attempt to prevent the spread of fire. Individual cities passed ordinances that took aim at fire prevention. A general requirement for building chimneys (albeit wood with mud parging) in buildings at Jamestown was said to be the first-ever building code in the new world. The first building law recorded was passed by the City of New Amsterdam (later New York), in 1625 when its population stood at around 200. The first building inspector was entitled *Surveyor*, and the first fire marshal was called *Firemaster*. Their duties often overlapped. Building regulations appeared in the 1630s in Plymouth, Massachusetts. Thatched roofs were required to be removed and replaced with boards or palings. Hartford, Connecticut rules required a ladder to the roof, but allowed a nearby tree to substitute. A fine of five shillings per month could be assessed for a lack of roof access. A law in Boston in 1630 stated that no chimney may be built of wood, nor may a homeowner cover his roof with thatch.

DID YOU KNOW?

In 1639 the Governor of Massachusetts issued a declaration that *. . . in the future no chimneys could be constructed of wood.*

In 1657 orders complained that the previous requirements had been "obstinately and carelessly neglected by many of the inhabitants" and called for the removal of both wooden chimneys and thatched roofs. A fire district was established in 1766 where "all buildings shall be made of stone or brick and roofed with tile or slate."

In 1648 Governor Peter Stuyvesant, Governor of New Amsterdam (later New York), appointed four men to act as fire wardens. They were empowered to inspect chimneys and to fine violators. A few years later, volunteers, who were called the *rattle watch*, patrolled the streets late at night to alert residents of a fire. When they detected a fire, they would rattle the spin, and the rattles would direct residents to form bucket brigades. This appears to be the forerunner of organized fire alarms and fire-fighting. Cities in other regions of the early nation adopted similar regulations that attempted to prevent damage from fire or shoddy workmanship. Colonial Virginia adopted an early building law in 1662 entitled, *An Act for Building a Towne*. It described the settlement of Jamestown, establishing the size, shape and materials prescribed for each building. The thickness of walls was ordered, and slate or tile was prescribed for the roof covering.

Figure 1-3
Plan of the City of Washington

Washington, D.C. is an example of a city that was designed before any settlement was established. Pierre Charles L'Enfant developed a master plan for the new city. Because the plan seemed too expensive for the new nation, he was removed from the project after the first year. After discussions between George Washington and Thomas Jefferson, official building regulations were promulgated by the Department of State on October 17, 1791.

Some of these early regulations required brick and stone for outer, or party, walls. Building roof heights were limited to 40 feet unless they were built of wood that was limited to 12 feet in height. Wooden buildings were also limited to a maximum area of 328 square feet. Washington had some influence over the adoption of building regulations and appears to have been influenced by his familiarity with regulation in Philadelphia. New Orleans was founded by Lemoyne d'Iberville in 1718 as a seat of government for the French Territory of Louisiana. The original city was platted as 66 blocks that went 300 feet each way. Each block was further divided into 60 by 150 foot lots. In 1722, the population of this township stood at 200 residents. Fires between 1788 and 1795 destroyed much of the settlement. Attorney General Don Miguel Fortier ordered that future two-story apartments be built of brick or stone to prevent fire. In 1803, the United States acquired the Louisiana Territory, and the first legislature took action that divided the territory into 12 parishes and allowed for the township of New Orleans to be incorporated. Building law evolved within the city over the next several years and included length structural regulations, fire districts and fire prevention requirements.

DID YOU KNOW?

A law passed in 1856 may have been the first to call for the periodic inspection of existing buildings. The law, in part, stated: "The Mayor and Surveyor shall examine theaters and places of public resort for structural stability, and to take suitable measures to prevent accidents that might result from any negligence in the construction of the building or from any mismanagement of the proprietors."

After the birth of the republic and the decision to erect a national capital on the banks of the Potomac an opportunity existed to control construction from the very beginning of a city's development in a way often dreamed of but seldom granted. That the statesmen of that time were not blind to this opportunity is apparent from correspondence found in the collection of the Department of State. Apparently, there was concern, not only about conflagration and structural collapse, but also about the appearance of buildings. George Washington drew up a list of his thoughts on the subject, and Thomas Jefferson talked it over with the newly appointed commissioners of the capital. Washington wrote the questions; Jefferson found the answers. It appears that George Washington was influenced considerably by observations he made in Philadelphia, for there are distinct traces that show an intimate relationship between the construction techniques and architecture of the two cities.

The requirements for outside walls and party walls of brick and stone were rescinded shortly thereafter; one explanation offered is that the requirements made housing too expensive for "worthy mechanics" who were needed in the extensive construction programs going on. The changes took the form of permitting wood-frame structures not over twelve feet high and not over 328 square feet in area—certainly not a very generous concession.

The following century saw an increasing emphasis on certain features of construction. It was not until 1862, when the population had exceeded 800,000, that a real building code existed in the sense that we know it today. Whereas earlier laws emphasized measures to reduce fire hazards, about this time exit requirements began to become prominent. Plumbing regulations followed around 1880, and regulations for elevators and hoists appeared in 1883. A series of regulations limiting the height of non-fireproof buildings was initiated in 1885. In 1896 precautions for workers' safety were introduced through a requirement for covering the floors of buildings under construction with planks to prevent accidental falls to lower floors.

The building code as we know it today has grown through such a process of accretion. It represents a catalog of those features of construction that experience has proved require the imposition of public authority in order to curb the activities of the less informed, the careless or those who are unscrupulous and may try to cut corners.

Intent of Codes

The primary intent of building regulation is to provide *reasonable* controls for the design, construction, use, occupancy and maintenance of buildings and their facilities and various components. Thus, such codes provide for a minimum level of safety. Using provisions of "police power," this enforcement tool cannot legally be made to require construction of a quality more than necessary to furnish a *reasonable* degree of safety. Attempts to impose construction requirements that might exceed those minimums in all probability would not be upheld if taken into court. The term *minimum* should not be misconstrued to mean the acceptance of inferior or shoddy work. It simply means work that provides the very minimum acceptable level of safety. Whatever is designed and constructed must contain these basic elements. That which exceeds the minimum is encouraged but not required.

Building codes should be based on what is generally accepted as good standards of construction. Only those provisions that are reasonable, practical or necessary can be legally enforced. Personal standards set out by an inspector enforcing a requirement or specification that exceeds minimum code requirements may not be legally enforced. A building inspector has no authority to impose any requirement or standard that exceeds the minimum standard that is printed in adopted law.

Authority for Enforcing Codes

The authority for code enforcement is based on police power, whether the enforcement agency is the state, county, province, town, village or municipality. Police power is conferred upon the states by the United States Constitution; and the states, in turn, give such power to their own political subdivisions to enact whatever laws are necessary to protect their citizens within the scope of the police power. The authority to regulate the construction and use of buildings and structures through the application of codes is a valid and proper exercise of police power, but the provisions of such codes must be reasonable and certain. They must not be arbitrary, capricious, oppressive or discriminatory.

Scope of Codes

Properly written codes will contain provisions requiring that buildings and structures be designed, erected, used and maintained in a manner that reduces the risk to human life and safety to an acceptable minimum. These codes should also make provisions for the proper disposition of dilapidated or dangerous buildings or elements of buildings or other structures.

The aesthetics of a building are not recognized as a proper subject for municipal control under a building code. When the building code addresses the design of buildings, it is limited to structural, architectural, fire and life safety aspects of that design. The abatement of objectionable odors, appearance, vibrations or noise is a legitimate subject for the use of police power and is often regulated locally by zoning control, but is not subject to control by the building code. There are some exceptions to this statement, notably in planning, deed restrictions or local "design" ordinances. Some planning departments and homeowners' associations or neighborhood committees have succeeded in placing and enforcing requirements that can successfully influence and perhaps control aesthetics.

A prime example is found in controls over advertising signs. The proliferation of such signs has been almost uncontrolled for many years with the result that some of our business sections have practically been inundated with advertising signs, all competing for attention. Such competition has created discordant and unpleasant vistas along some of our commercial boulevards. Some planners as well as citizen boards and committees have been able to convince legislative bodies that such situations actually contribute to unsafe driving conditions in two ways: first, by diverting a driver's attention away from the road, and second, by obscuring traffic signs and signals. Resulting controls have been upheld by the courts, which in the past have steadfastly refused to give credence to local ordinances that were based solely on aesthetic considerations. Properly-worded ordinances, based on demonstrable public safety, will almost always prevail in court.

Attitudes Toward Building Regulations

Although building regulations are one of the oldest and most enduring of governmental functions, ranging from ancient times to the present, some elected leaders do not assign a high priority to such regulations. This attitude is due, in part, to the highly technical, complex and sometimes rather obscure role played by building regulatory agencies. Buildings will be designed and built whether building-safety regulations exist or not. Indeed, there are untold thousands of buildings still in use that were built without the influence or control of a building department. Such structures may appear as any other to the untrained eye, but close examination by a trained observer would probably reveal the presence of dangerous conditions.

Inadequately Staffed Building Departments

Building officials often experience frustrations for their attempts to hire the additional personnel needed to adequately fulfill their responsibilities. This is an almost universal complaint from building officials. The main reason for not enough personnel are cost-saving strategies by management and the perception that cuts in personnel will not result in a reduction in public safety or customer service. Management may not always know how much is at stake. It is up to the building official to make that argument. This is where many managers fail to achieve a full staff. The building official must make the argument for staff needs in an objective, dispassionate manner. The results of insufficient staff must be clearly defined: lower customer service, likelihood of code violations resulting in people getting hurt, increased turnover because of overwork, as well as poor morale.

In the face of opposition from members of the legislative body who are sensitive to increased taxes or chief administrative officers who are ever mindful of their obligation to keep the budget at an acceptable level, it is difficult for the building official to present persuasive arguments. However, administrators of a building department have little choice. If they fail to emphasize the need for adequate staff along with salaries sufficiently high to attract people of high caliber who have the potential to absorb the significant amount of training required to attain a reliable level of technical proficiency, no one else will. The municipality that has relegated its building department to the status of a nonentity and handicapped it with an unrealistic manning authorization is performing a disservice to its citizens.

The salaries offered by some municipalities to building department personnel reflect the jurisdiction's historical value of the position. The building official must make the case for a high-quality building safety professional through demonstrating resulting increase in efficiency and quality of customer service. The target is an adequate salary for each position based on national and state trends.

Emergence of the Modern Building Department

The modern building department developed, as did its predecessors, when the need for such a grouping of functions became apparent to the decision makers. New degrees of specialization became necessary. Poorly planned assignment of these specialty functions to different departments of government sometimes led to failure. One division of government might insist on a particular type of construction specifically prohibited by another. Such conflicts resulted at times from nothing more than petty rivalries, which created needless delays and expenses. It became evident to some administrators that functions as closely related to a building as the plumbing and electrical inspections should be correlated with all of the regulations that govern the structure itself. When these functions were finally placed within a single agency, the first building safety department was born. The first building departments originated around the turn of the century in large cities such as New York, Boston, Chicago, Phoenix, Seattle and Los Angeles.

Further Development and the Growth of Building Regulations

As technological advances led to more complex buildings, the codes regulating construction became more complex as well. With urban growth, building and zoning regulations became more commonplace, and as a practical necessity, building departments began to screen plans submitted for permits of more and more varieties of specialized buildings. Such diverse fields as grading and excavation, licensing, occupancy of a public right-of-way, utility requirements and fire prevention all began to be part of construction regulation over the 20th century.

The growth of construction regulation has taken place more in urban than rural communities and has followed a patchwork pattern. These regulations have only been developed as the need for them became apparent. The most common and obvious impetus for controls has been tragedy. Fire-resistive standards have been developed following the horrors of major fires; design standards for earthquake resistance and buildings have emerged after cataclysmic earth tremors; and requirements for the proper venting of heating appliances employing fossil fuel have been established in response to hundreds of tragic deaths that were due to carbon monoxide poisoning.

These and many related catastrophes, which have resulted in the formulation of building regulations, have occurred at different times and in different sequences. Each corrective regulation, when developed, has been assigned to the department that seemed at that time and in that particular governmental entity to be the best able to perform the duties the regulation created. Regulatory authority was thus scattered among many different agencies of government

Conflicting Jurisdictions and Interests

Cities have played a major role in this regulatory field; however, they have not been the only governmental agencies to take action aimed at reducing the occurrence of tragedies resulting from building failures. The federal government, states and counties too have entered this field. In many instances, several levels of government or even several agencies at a single governmental level have created regulations covering essentially the same areas. Unfortunately, these various regulatory agencies have not always been carefully monitored or correlated. As a result, conflicting regulations and confusion have resulted. State governmental agencies have, on occasion, developed building regulations and charged cities with the responsibility of administering and enforcing them, sometimes even spelling out the particular department that must perform the function.

DID YOU KNOW?

Today, government entities in the United States almost entirely use codes based on model codes. Several states, such as California, New York, Florida, North Carolina, Ohio and others, have adopted and publish their statewide building codes based on International Code Council model codes.

Not all construction regulations have stemmed from a desire to reduce hazards to life and limb. Fragments of plumbing regulations may be found in the records of health departments, water departments and city engineer's departments. Similar evidence can be found in almost any area of construction regulations.

More often than not, the builder must meet the requirements of several departments, combining different arrangements of regulatory functions pertaining to fire prevention, plumbing, mechanical or electrical work, boilers, elevators, health and zoning. Each of these departments has police authority. Again, the coordination between departments is often inadequate. Sometimes interdepartmental rivalries and frictions cause hardship upon both the owner and the builder. Attempts at solutions to this fractured process include a One-Stop-Shop where representatives from every department or agency that regulates construction are gathered in a single office setting. This allows a builder to make one stop to get a permit and improves the chances of getting a permit in a timely manner.

The Effects

Governmental efficiency is adversely affected by departmental immaturity or the lack of vision by management. This affects both owner and builder by delays that translate to increased costs. Administrative inefficiencies often result in irate builders and citizenry, which leads to the promotion of ideas that would eliminate the essential elements of the code altogether. As buildings become more complex and municipalities become more densely populated, the costs of errors in this field will become greater in terms of both lives and property if the necessary regulatory functions do not keep pace. A way to avoid this is to establish and maintain good customer service and maintain a high-quality building safety platform. Technical accuracy, effective regulation, customer service and timeliness are key quality principles for a building department.

ICC Evaluation Service

Code officials are often faced with unfamiliar building products either during plan review or at the job site. They may be truly innovative or copies of products often used. ICC Evaluation Service®, LLC. (ICC-ES®), a subsidiary of the International Code Council® (ICC®), issues evaluation reports on building products. ICC-ES subjects the technical data submitted by the report applicant in support of the product to a rigorous review process. The International Codes are the base documents used in determining compliance with specific and broad requirements that will be described later in more detail. The evaluation report provides code officials with independent technical justification to support an approval decision. ICC-ES has the evidence and technical staff to support its evaluation report findings if challenged.

The history of product evaluation for the benefit of code enforcement had its beginning in 1932 when a regional group of building departments recognized the need for uniformity and technical independence in evaluating building products. At that time, voluntary building department personnel observed the preparation of specimens that in turn were tested by laboratories at cost, in the interest of public safety. World War II brought a temporary hold to this program, which was resumed in earnest soon after by the three legacy code groups. In 1975, the first national organization, composed of the three organizations, commenced operations under the National Research Board name. This name was changed in 1984 to the National Evaluation Service (NES), which was then incorporated in 1992. Simultaneous with the birth of ICC in February of 2003, all three legacy evaluation services were consolidated into ICC-ES as it operates today.

Figure 1-4
The creation of an ICC-ES Acceptance Criteria starts with the development of a new building product or method, which if developed and accepted, can then be incorporated into the next cycle of codes and/or standards.

ICC-ES has over 1,500 evaluation reports on materials, products and components. These reports have been requested by manufacturers who have sought independent verification of code compliance. The verification process is quite simple for a product adequately addressed in the code. An example would be an interior, non-structural wall panel for which the flame spread and smoke-developed indices would be needed when tested under the ASTM E 84 standard. This along with installation procedures would be the extent of technical justification necessary. The same holds true for steel truss plates for light wood trusses for which structural values are developed under the TPI 1 standard.

DID YOU KNOW?

ICC Evaluation Service was created for code officials by code officials.

When innovative products or those not adequately addressed by the code are submitted for recognition, a very rigorous process is followed to ensure technical responsibility, fairness and protection for report users. In order to gather the most current and recognized information available, public hearings are held by an evaluation committee composed of practicing code officials. The hearings consider acceptance criteria developed by ICC-ES technical staff with input from the applicant and other sources available to ICC-ES. The acceptance criteria address the specific technical data, test standards and manufacturing quality-control items that are needed to justify approval of a product. The criteria are developed considering the broad concepts of life safety and preservation of property along with code requirements for like-product uses. They are then posted on the ICC-ES website thirty days before the hearing date for public viewing and comments. Because ICC-ES provides a method for code recognition long before standards are developed to address innovative products, technical experts in varied fields of expertise follow these hearings. The committee and staff evaluate written and verbal comments received during the hearings, and the process may go through several cycles before the committee is prepared to approve the criteria. Committee input is necessary to assure that the needs of the code official in the field are addressed. After approval, the criteria are posted on the ICC-ES website so that all interested parties can determine what type of justification must be submitted to properly evaluate the referenced product. At this point, the evaluation report applicant submits data for ICC-ES staff review, and again the process may go through several cycles before the application is approved.

To provide better assurance that products subsequently manufactured comply with evaluation reports and retain the necessary properties, quality control considerations are an integral part of the evaluation process. Where the product is under a listing program, the listing agency assumes the responsibilities of maintaining quality through the monitoring of records and unannounced inspections at least four times annually. In these instances, the listing or inspection agency should be accredited under ISO Standard 17020 by an agency that is in turn properly accredited by a recognized body. International Accreditation Service® (IAS®), another ICC subsidiary, is an organization that possesses the necessary credentials. The inspection agency must be accredited to inspect the type of product under consideration. In other words, an approved inspection agency for steel fabrication is not recognized for quality control inspection work involving reinforced concrete. Use of an approved listing/inspection agency is a condition of product approval and is named in the ICC-ES evaluation report. The agency's name is also a part of the product identification for field purposes.

Where a listing agency is not required for a product recognized in an ICC-ES evaluation report, a quality control program is still a part of the evaluation report process. In these instances, quality documentation covering the product materials and manufacture is a part of required data for an initial application. The documents are reviewed and an inspection of the manufacturing facility is conducted to ensure that the quality control process specified in the manual is in place. Thereafter, quality control is monitored by ICC-ES, and there is at least an annual on-site inspection.

DID YOU KNOW?

ICC-ES criteria are routinely revised and updated as building technology advances.

When the application for an evaluation report is approved, the report is posted on the ICC-ES website. All ICC-ES evaluation reports and acceptance criteria can be downloaded at any time with the assurance that the material is current. This procedure has replaced the outmoded process of distributing hard copy reports that might later be revised, unbeknownst to the user.

ICC-ES evaluation reports are formatted to provide a description of the product along with technical information, codes and the code sections on which recognition is addressed, and conditions of use. The purpose is to provide information that allows proper use in complying with a code. See Appendix A for a sample report.

ICC-ES evaluation reports issued for the first time expire after twelve months unless renewed. Thereafter, the reports can be requested for renewal without significant change for one-year or two-year periods. Any significant change to an existing report requires an application for revision and submittal of all necessary supporting data.

At the building department level, where time is always at a premium, the permitting process and field inspections weigh heavily on customer satisfaction. With all the other items that must be considered, the question of building product or system compliance is not necessarily a high priority. Often, during the plan checking phase, this potential problem is addressed by the checker noting on plans that the product is recognized in an ICC-ES evaluation report. This puts the onus on the inspector in the field who would not necessarily have access to the evaluation report to review the required conditions that must be addressed by the product. The classic example might be joist hangers or hold-down anchors; the inspector could not be expected to know what loads would be imposed on the product. This in turn would expose the building department to potential problems. In this instance the specific manufacturer and type of hanger would have to be known for the inspector to responsibly make a judgment. Through experience and knowledge, valid judgments can be made. A fire door is an example. The plans might state a one-hour rating for the door, but in the field, the inspector's knowledge that the listing agency for the fire door being installed is a responsible organization that has tested and labeled the door as one hour allows him or her to accept the door. Additionally the agency would have a follow-up inspection program to ensure that the door at the job site had the same qualities as the test specimen. Acceptability of fire-resistive floor, roof or wall assemblies should be determined during the plan check phase insofar as access to a fire-resistive listing manual issued by a responsible testing and inspection agency would be more accessible within the office. The fire-resistive assemblies so indicated and described deal with proprietary products. Use of these assemblies with substitute materials raises the question of whether the alternates exhibit or exceed the properties of the listed product. The code official approving these substitutions must be aware of the responsibility he or she assumes.

The question of accepting new or innovative products is again the code official's responsibility. Knowledge of the code and experience go a long way in helping the code official make good decisions. However, having an ICC-ES evaluation report addressing the product and its use provides a very strong basis on which the code official can base her or his decision of approval, if this is her or his direction. The resources of ICC-ES, its technical process and justifying data required for recognition provide excellent support if the code official's decision is challenged.

The code official is invariably faced from time to time with innovative products at the job site that have not been subjected to an independent technical review by a recognized agency for compliance with construction codes. ICC-ES provides a service exclusively to building jurisdictions that involves the evaluation of technical data that the product manufacturer has in support of acceptance. This is called the Building Department Service (BDS) process. Only the building jurisdiction can authorize this service, which results in a presentation of written findings to the jurisdiction concerning code compliance. Once receiving the authorization to proceed, ICC-ES works directly with the building departments and product manufacturers in gathering the needed information. The written findings are forwarded to the building jurisdiction within approximately two weeks of receipt of data from the responsible party. A minimum fee is assessed to start the review. Any additional time required is charged on an hourly rate. These fees can be paid by either the manufacturer or the building jurisdiction. The technical findings provide the jurisdiction with evidence on which it can make a valid decision of acceptance or rejection.

International Accreditation Service

The adoption and administration of the model codes by ICC-member governmental jurisdictions is the process by which building construction regulations are created for the public safety and welfare. An integral part of the administration of the model codes is providing local building officials with a means to approve testing laboratories, inspection agencies and fabricators. Effective enforcement of the codes requires careful attention to the qualifications of these entities. The competency, quality and experience of laboratories, inspection agencies and fabricators are critical to the accuracy and reliability of the reports they generate. Therefore, any technical shortcomings in the process used to qualify them could directly affect the safety of structures built within a jurisdiction.

The *International Building Code*® (IBC®) broadly defines testing and inspection service providers as "approved agencies" but only gives minimal guidelines for evaluating their qualifications. In the early stages of consolidation of the legacy code agencies, the founding members of ICC realized that effective code enforcement requires critical support services. Testing laboratories, inspection agencies and fabricators are prime examples of these critical services.

International Accreditation Service, Inc. (IAS), a subsidiary of ICC, was established in 2002 to manage all accreditation-related functions needed to fully support proper enforcement of codes. IAS operates exclusively for the promotion of social welfare under the definition of Section 501(c)(4) of the Internal Revenue Code. The exempt purpose of IAS, as stated in its Articles of Incorporation and its Bylaws, is to lessen the burdens of government through the performance of certain accreditation functions for the benefit of federal, state and local governments in connection with the administration of building laws and regulations. IAS is the only accreditation body in the United States that focuses primarily on the building and construction field.

To this day, in many parts of the United States, reports issued by a testing laboratory or an inspection agency are rarely questioned as long as they are signed off by a registered engineer (P.E.). Since the early 1990s the United States has recognized that, for the World Trade Organization's "free trade" concept to work effectively, all trading partners must embrace equivalent accreditation practices for their testing, calibration, inspection and certification activities. To facilitate the free trade concept, the International Organization for Standardization (ISO) published several new standards establishing minimum requirements for operation of testing and calibration laboratories and inspection bodies. These standards have been accepted by the federal government, state and local governments, and all major practitioners of accreditation in the United States.

Most countries have a single national accreditation body operating under the auspices of the national government. However, the United States' free market system permits competition in the accreditation field. Knowledgeable accreditation practitioners recognize that competition in accreditation generally tends to lower the standard of quality because accreditation bodies may compete on price by offering programs that are less comprehensive or lack appropriate field oversight. From the code official's perspective, the minimum requirement for acceptance of testing and inspection agencies should be that the bodies accrediting them be a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA). ILAC and IAF are the apex bodies internationally that evaluate and monitor accreditation bodies to ensure that they meet the equivalent level of competence of all other national bodies worldwide and are not subject to competitive influences. To initially qualify for ILAC or IAF signatory status, accreditation bodies are required to be evaluated by an internationally recognized team of experts. Through the MRA and MLA, ILAC and IAF provide a method for worldwide recognition of the services of those entities that have been accredited by ILAC or IAF signatories.

Accreditation services provided by IAS are a practical means available to building officials to obtain the necessary information to make their findings in evaluating the performance of new and innovative building materials and products and to ensure that on-site inspection functions are carried out by competent inspection agencies. Without these services, it would be necessary for each governmental agency charged with enforcing model codes to maintain a staff of trained assessors and engineering specialists qualified to review and evaluate newly-introduced materials and products as well as to review and evaluate laboratories, inspection agencies and fabricators. IAS accreditation programs are developed with direct oversight from code officials.

Accreditation Process for Testing and Calibration Laboratories

Testing and calibration laboratories are required to comply with international standard ISO/IEC 17025, which stipulates that laboratories be assessed on-site to ensure that they operate under a well-documented quality management system, have sufficient qualified staff and are equipped with all needed apparatus and support systems to ensure competent testing and calibration. Typically, an ILAC-recognized accreditation body will assess the following areas of a laboratory's operations:

- Adequacy of resources
- Freedom from external and internal pressures
- Impartiality and integrity
- Quality policy and quality objective statements
- Contract review procedures
- Subcontracting, if practiced by the laboratory
- Complaints and complaint handling
- Technical records

- Internal audits and management reviews
- Staff competence and skills based on observation of actual tests as well as one-on-one interviews with staff
- Educational qualifications, training and certification of staff
- Participation in interlaboratory comparison and proficiency testing
- Procedure for estimating uncertainty of measurements
- Assuring quality of testing and calibration results
- Reporting of results
- Opinions and interpretations

Assessment teams consist of quality management experts and technical subject-matter experts matched to the laboratory's requested scope of accreditation. Assessment visits involve careful scrutiny of all aspects of the laboratory's operations. Laboratories with a very small staff often demand greater scrutiny, as key elements are handled by a single individual who often has to "change hats" to cover every area of the standard. In such cases, great care is exercised by the assessment team to ensure that issues such as conflict of interest, impartiality and integrity are properly addressed to ensure valid results. See Appendix B for flowcharts illustrating the accreditation process.

As the product of a test is the result; the accuracy of the result is a key indicator of a laboratory's performance. Evaluation of uncertainties commonly referred to as measurement uncertainties is the heart of testing and calibration work. Participation in proficiency testing and inter-laboratory comparisons (PT/ILC) are key elements of laboratory accreditation. For a PT/ILC exercise to be meaningful, it is essential that very nearly identical samples are circulated to different laboratories or to different individuals within the same laboratory and tested in a standard format using similar equipment and processes. The results of these exercises are carefully reviewed and statistically evaluated to determine consistency of results to consensus values and outliers. Laboratories with outlying results are required to carefully analyze their test protocol and isolate the problem or deficiency that resulted in the outlying results. ILAC-recognized accreditation bodies collaborate with national and international partners to ensure that appropriate PT/ILC are available for laboratories in all fields.

Accreditation Process for Special Inspection Agencies

Currently, there is a lack of accreditation bodies that accredit special inspection agencies as defined in the code. One exception is the IAS program. Inspection agencies are required to comply with international standard ISO/IEC 17020. Based on this international standard, IAS has developed the IAS Accreditation Criteria for Special Inspection Agencies (AC 291). Both of these documents stipulate that assessments be conducted at both the corporate office and in the field to observe the agency's inspectors in practice. Assessment of the corporate offices is required to ensure that the agency operates under a well-documented quality management system, has adequate qualified staff and is appropriately equipped with all needed apparatus and support systems to ensure competent inspections, while observations in the field provide important insight into the inspection practices and report writing processes of the inspection agency.

As with the accreditation of testing and calibration laboratories, assessment teams for inspection agencies consist of quality management experts as well as subject matter experts matched to the inspection scope requested. Most inspection agencies have a small full-time staff but rely on contract inspectors for the field work. As Special Inspection Agencies (SIAs) make extensive use of contract inspectors, great care must be exercised by the assessment team. Issues such as conflict of interest, impartiality, integrity and inspector competence must all be properly evaluated to ensure valid outcomes.

Accreditation of Fabricator Inspection Programs

Chapter 17 of the *International Building Code* (IBC) specifically requires approval of any fabrication activities that are conducted off-site without continuous special inspection. Some aspects of construction, such as structural welding, reinforcing concrete, high-strength bolting and metal building manufacturing, are so critical to safeguarding public welfare that special inspections are required by the applicable building code. Typically, special inspections are made by special inspectors at the construction site. Increasingly, however, some phases of construction requiring special inspections are performed at a fabrication facility away from the construction site, including outside the United States. When this occurs, the code official has the difficult responsibility of determining whether the special inspections are being conducted in accordance with the code. IAS assists the building official in this regard through its Fabricator Inspection Accreditation and Metal Building Inspection Accreditation Programs. IAS evaluates the inspection activities at the fabrication facilities, including internal quality management systems and third-party inspection procedures, to determine compliance with the code and applicable IAS accreditation criteria. The criteria include a detailed review of the fabrication procedural manual, spot-testing of key quality-control procedures at the fabrication facility and evaluation of the competence of staff. IAS conducts an initial joint on-site assessment of the facility with the designated accredited inspection agency. Following this, the designated accredited inspection agency conducts quarterly unannounced inspections of the facility. This periodic monitoring determines on an ongoing basis that the fabrication activities are in compliance with the procedural manual.

Building Department Accreditation

Increasingly, building and safety departments are embracing the IAS Building Department Accreditation Program to assist cities, counties and states in evaluating the performance of their building code enforcement activities. IAS also operates accreditation programs for fire prevention and life safety departments and third-party building department service providers. These accreditation programs are under the control of governmental bodies that regulate construction and are overseen by a Board of Directors made up of building-regulator representatives of governmental jurisdictions. For detailed information about building and fire prevention department accreditation see Chapter 6.

Summary

This chapter emphasizes the "minimum" nature of codes, a description that is based on contemporary law and attitude. This does not mean that building officials should adopt an unalterable acceptance of the definition. On the contrary, those involved in the field of building regulation should develop and retain sensitivity to needed changes that may seem to exceed the current interpretation of "minimum." When such changes seem to lack consonance with the intent of the enabling statutes, it may be necessary for code writers to undertake a re-evaluation of such intent, measuring its value against contemporary needs. Many requirements, adopted at a propitious time, remain inviolate because too many persons are willing to accept things as they are, even though the conditions and needs for such requirements no longer exist.

Dramatic revelations, spotlighted by reference to statistical data, are sometimes the most effective means of illustrating a point. The reference to past disasters and the growth of building regulations intended to avert tragedies to every extent possible might leave the impression that major disasters belong to the past. Not so. A look at some current statistics should dispel any feelings of satisfaction or security related to our current sophisticated society and its modern laws.

Building officials have a responsibility not only to administer properly their own departments, but also to participate actively in any attempts to bring about awareness of the importance of adequate building control. In 1980 the National Conference of States on Building Codes and Standards (NCSBCS) initiated a program to focus attention on the importance of codes and code enforcement through a national program entitled "Building Safety Week." The objective was to secure publicity on the importance of building regulation through a series of campaigns. These included requesting the governors of states to proclaim their own Building Safety Week and requesting the news media and other devices to bring about an awareness of the reason for codes via a slogan that simply read, "Building Safety Is No Accident." This activity is now actively supported and endorsed by the International Code Council.

Given the importance of building safety to homeland security, our personal safety and the economic well-being, as of 2011 the previously week-long Building Safety program has been extended to an entire month. Natural disasters and countless accidents still occur, involving public and private structures across the U.S. and globally, wherever construction codes are poorly understood or not competently enforced. The expanded Building Safety month will help bridge these gaps and provide a broader platform to share knowledge among designers and skilled craftsmen to enhance safety in the built environment.