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THE NIST INVESTIGATION RECOMMENDATIONS FOR CHANGES TO BUILDING CODES

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If you examine both the International Building Code (IBC) published by the International Code Council (ICC) and the Building Construction and Safety Code (NFPA 5000) published by the National Fire Protection Association (NFPA), you will note that the provisions which relate to fire safety and fire protection are very similar, and certainly the intent of both of these model codes is the same. Given that NFPA 5000 provides a more in-depth explanation of the intent of the code than does the IBC, a review of the general provisions contained in NFPA 5000 can be useful in developing not only a better understanding of NFPA 5000, but also of the International Building Code. Hence, a review of the general provisions contained in NFPA 5000 should be of interest to anyone involved with code development or making recommendations for changes (such as NIST) .

Code Fire Safety Goals

Section 1.2 in NFPA 5000 provides a general purpose statement for the code and reads as follows:

> "***Purpose.*** *The purpose of the Code is to provide minimum design regulations to safeguard life, health, property, and public welfare and to minimize injuries by regulating and controlling . . . .all buildings and structures. . .* "

Sections 4.1.3 provides further elaboration of the general purpose statement of the code and reads as follows:

> "***Safety.*** *The intent of the safety goal of this Code is to reduce the probability of injury or death from fire, structural failure and building use*."

> "***Safety from Fire Goal.*** *The fire safety goal of this Code is as follows:*

(1) *To provide an environment for the occupants inside or near a building that is reasonably safe from fire and similar emergencies.*

(2) *To provide reasonable safety for fire fighters and emergency responders during search and rescue operations.*"

"*Buildings shall be designed and constructed to protect occupants not intimate with the initial fire development for the time needed to evacuate, relocate, or defend in place.*"

"*Buildings shall be designed and constructed to provide reasonable safety for fire fighters and emergency responders during search and rescue operations.*"

"*Buildings shall be designed and constructed to reasonably protect adjacent persons and buildings from injury, death, or substantial damage as a result of a fire.*"

"*Buildings shall be designed and constructed to provide reasonable access to the building for emergency responders.*"

Section 4.2 in NFPA 5000 addresses the basic assumption of the code with respect to the fire safety provisions contained in the code:

"***Assumption-Single Fire Source.*** *The fire protection methods of this Code assume that multiple simultaneous fire incidents will not occur.*"

Section 4.4.1 in NFPA 5000 states a guiding principle of the code in the following excerpt:

"***Multiple Safeguards.*** *The design of every building or structure intended for human occupancy shall be such that reliance for property protection and safety to life does not depend solely on any single safeguard. An additional safeguard(s) shall be provided for property protection and life safety in case any single safeguard is ineffective due to inappropriate human actions, building failure or system failure.*"

Various sections in the chapter titled "Performance-Based Options", Chapter 5, in NFPA 5000 also outline concepts which should be incorporated into a performance design. Section 5.2.2 in NFPA 5000 include the following provisions:

"*Building shall be designed and constructed to reasonably prevent the spread of fire beyond the compartment of fire origin.*"

"*Buildings shall be designed and constructed to reasonably prevent structural failure under fire conditions for a time sufficient to protect the occupants*."

"*Means shall be provided to evacuate, relocate, or defend in place occupants of buildings for a time sufficient to prevent them from exposure to instantaneous or cumulative untenable conditions from smoke, heat, or flames.*"

"*Buildings shall be designed and constructed to reasonablely prevent structural failure under fire conditions for a time sufficient to enable fire fighters and emergency responders to conduct search and rescue operations.*"

It is important to note that the provisions of section 4.1.3 in the Code only speak to reducing "*the probability of injury or death from fire*", but not totally eliminating "*the probability of injury or death*". Further, it is also important to note that many of the provisions addressing fire safety goals excerpted above use the adjectives "*reasonable*" or "*reasonably*" when referring to fire safety. In other words, NFPA 5000 recognizes that the goal of completely eliminating the probability of death in a building fire is neither possible, nor cost effective. With this background regarding the fire safety goals and objectives of NFPA 5000 (and the International Building Code), the changes to building codes recommended by NIST can be discussed against the framework of the intent of the codes.

The NIST Recommendations

The portion of the draft final report released by NIST on June 23, 2005 includes 30 recommendations for changes to building codes and building construction procedures and practices in the United States. The following is a brief summary of the issues addressed in the NIST's recommendations:

Recommendations 1-3. Recommendations 1 through 3 address structural issues pertaining to progressive collapse provisions, wind loads and building sway.

Recommendations 4-7. Recommendations 4 through 7 address structural fire resistance issues for high rise buildings exceeding 20 stories in height, propose a review of ASTM E119, propose a study of the performance of spray-applied fireproofing materials and propose that codes address the structural fire protection requirements for the"structural frame" of a building, rather than for vertical and horizontal structural members separately. In addition, and perhaps most importantly, Recommendation 4 proposes that high rise buildings exceeding 20 stories in height be both protected by a sprinkler system and be compartmented into floor areas of 12,000 square feet or less in floor area.

Recommendations 8-11. Recommendations 8 through 11 address the development of mathematical models which can be used to predict the actual performance of a building structure to various fires, the development and testing of new fireproofing coatings for structural steel and basic structural materials which have improved structural properties at high temperatures. Recommendation 8 proposes that building structures be designed with sufficient structural fire resistance to prevent building collapse in the event that an uncontrolled fire spreads throughout the building.

Recommendations 12-15. Recommendations 12 through 15 address modifications to the design of sprinkler, standpipe, fire alarm/communications and smoke control systems used in high rise buildings to increase reliability of these systems and modifications to fire alarm and communications systems which will enhance decision-making capabilities of incident commanders.

Recommendations 16-20. Recommendations 16 through 20 address the design of egress facilities for high rise buildings and building evacuation drills. Recommendation 17 proposes that the egress system serving high rise buildings be designed for total evacuation.

Recommendations 21-24. Recommendations 21 through 24 address first responder operations at large-scale incidents. Recommendation 21 proposes that an elevator specifically designed to operate under fire conditions for fire department use be provided in high rise buildings and that further research into the use of elevators for evacuation purposes be conducted.

Recommendations 25-28. Recommendations 25 through 28 address code compliance in government-owned and operated buildings, code enforcement in existing buildings, the retention of construction documents and the involvement of fire protection engineers in the design of innovative structures.

Recommendations 29 and 30. Recommendations 29 and 30 address additional education in building fire safety design for architects, structural engineer and fire protection engineers.

Analysis

Considered as a package, NIST's 27 recommendations which address building fire safety represent what can only be described as a radical agenda of change in the way we protect high rise buildings (exceeding 20 stories in height) from fire. Unfortunately, NIST did not bother to include any technical justification for its recommendations in the draft final report despite working on the investigation and report for almost 34 months. Given the better than excellent fire safety record of high rise buildings since special provisions for high rise buildings were introduced in the model building codes used in the United States 30 years ago, not providing a technical justification for each of the recommendations in the report has to be considered to be a serious omission.

An in-depth review of each of the recommendations pertaining to high rise building fire safety is not possible given the constraints on space in this column , so let me focus on just a few of NIST's recommendations.

Recommendation 8 in the report indicates that the structural systems of a high rise building (exceeding 20 stories in height) should be protected by fireproofing materials so that the building structure can withstand a fire which spreads throughout the building. In addition, Recommendation 4 proposes that floors in high rise buildings be divided into compartments not exceeding 12,000 square feet in area. The purpose of the floor compartmentation (as stated in Finding 22, NIST NCSTAR 1-1, WTC Investigation) is to limit fire spread to a relatively small floor area so that the fire department can extinguish a fire using the standpipe system in the event of sprinkler system failure. Obviously, NIST's recommendation that the structural elements of a high rise building be sufficiently fire resistive to prevent a collapse in a building "burn-out" anticipates both the failure of the sprinkler protection and the recommended compartmentation of each floor. All of this is on top of the recommendations that the reliability of both sprinkler and standpipe systems be improved (Recommendation 12) and that the egress system serving the building be designed for total building evacuation, rather than a partial evacuation (Recommendation 17).

It seems obvious, based upon the above, that NIST doesn't seem to have very much confidence in sprinkler protection or, for that matter, compartmentation. Given the performance of high rise buildings protected throughout by sprinklers over the last 30 years, it is difficult to understand why NIST believes that the combination of both sprinkler protection and compartmentation is necessary, particularly when NIST is also recommending improvements in the reliability of sprinkler protection provided in high rise buildings. It would seem logical that there should be no reason to also recommend compartmentation if the reliability of sprinkler systems will be increased further by the implementation of Recommendation 12.

Just an observation, but the federal government presently permits aircraft carrying passengers (an assembly occupancy located 35,000 feet in the air) to fly over oceans without sprinkler protection, compartmentation or exits. Certainly, if none of the protection recommended by NIST is considered to be an acceptable level of safety for aircraft carrying passengers flying over oceans, it would seem that fire resistive high rise buildings protected by highly reliable sprinkler systems ought to be considered "reasonably safe" for a building which is only 1,400 feet tall.

Conclusion

Without technical justification for NIST's proposals for improvements in the fire safety of high rise buildings (which should include a loss history and an extensive cost/benefit analysis for each recommendation), NIST's recommendations are merely opinions. Can NIST's opinions be justified? NIST has promised to provide the technical justifications for its recommendations at a NIST technical conference in Gaithersburg, Maryland on September 13-15, conveniently 40 days after the 6 week period for public comment on the draft final report has ended.

President Bush's State of the Union address on February 2, 2005 included the following excerpt:

> *"The principle here is clear: Taxpayer dollars must be spent wisely, or not at all."*

In effect, the implementation of NIST's recommendations are "stealth" tax increases which will eventually "trickle down" to every citizen of the United States (in the form of higher costs for goods and services). Will the implementation of NIST's recommendations be a wise use of the dollars which we devote to safety, or could those dollars be spent more wisely, as the President suggested in his State of the Union address, say in fire safety in 1- and 2-family dwellings or highway traffic safety?

The NFPA fire statistics on fire fatalities in high rise buildings and 1- and 2-family dwellings and the National Highway Transportation Safety Administration (NHTSA) statistics on highway fatalities provide a clear and concise answer to that question which can easily be understood by the general public. Just a recommendation, but perhaps NIST should lay out the NFPA statistics on fire fatalities in high rise buildings and 1- and 2-family dwellings next to the NHTSA statistics on highway fatalities and then let President Bush decide whether or not we should spend additional dollars on high rise building fire safety or invest those dollars on fire safety in 1- and 2-family dwellings or in highway safety. Better not to spend our dollars on additional high rise building fire safety than to spend our dollars unwisely on additional high rise building fire safety.

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Note: The full text of NIST's recommendations can be found in section 9.2 of the draft final report designated as NIST NCSTAR 1, WTC Investigation. The report is available on the NIST website, wtc.nist.gov.