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THE NIST WTC FINAL REPORT

By Richard C. Schulte
Schulte & Associates

The National Institute of Standards and Technology (NIST) released the final report on its investigation into the collapse of the World Trade Center (WTC) towers at a hearing of the House Committee on Science in Washington on October 26, 2005. The chairman of the Committee, Congressman Sherwood Boehlert (R-NY), opened the hearing with brief remarks which included the following excerpts:

“The issues raised in NIST’s report go far beyond a single, horrific terrorist incident, and indeed beyond terrorism as a phenomenon. The report raises fundamental questions about what we know about the behavior of buildings and their contents, what we know about the behavior of individuals in emergencies, and about whether buildings are well enough designed for any large emergency. This is not about making every building strong enough to survive a plane crash.”

“That said, NIST’s conclusion that the Trade Center buildings could have survived even the massive insult of a plane crash if the fireproofing had remained in place is at once both chilling and promising – chilling because the massive loss of life was not inevitable; promising because it is an indication we can do more to protect lives in the future.”

“But our focus now has to be on whether everyone is doing enough to translate the report into specific, concrete steps that will prevent future tragedies.”

“The protection of life is the highest responsibility of public officials. And our hearing today is about that responsibility, just as much as any hearing on the military or homeland security would be.”

Having studied and written extensively on the collapse of the WTC towers and the NIST investigation for over 3 years now, I am in agreement with Congressman Boehlert’s statements that the NIST investigation goes “*far beyond*” the collapse of the towers (as a result of a terrorist attack) and also that “*the protection of life is the highest responsibility of public officials.*” And, it is exactly for these two reasons that I am in opposition to the implementation of most of NIST’s 30 recommendations for improvements in the way high rise buildings are designed, constructed and maintained.

Before discussing the NIST final report and Congressman Boehlert's statements further, first let's review statistics which were presented at the NIST Technical Conference on the WTC investigation held on September 13-15, 2005 in Gaithersburg, Maryland:

Statistic 1. In the 21 years between 1980 and 2000, the number of responses by [US] fire departments increased by roughly 89 percent, however, the number of responses to actual fires decreased by roughly 42 percent.

Statistic 2. In 1977, the NFPA estimates that there were 7,395 civilian fire fatalities in the United States. In the year 2000, the NFPA estimates that there were only 4,035 civilian fatalities-a decrease of roughly 45 percent. [In 2004, the number of US civilian fire deaths in 2004 was estimated to be 3,900-a decrease of 47 percent when compared to 1977.]

Statistic 3. In 1977, the NFPA estimates that there were 157 firefighter fatalities. In recent years, the number of firefighter fatalities which occur in the U.S. has been reduced to roughly 100-a decrease of roughly 35 percent. The leading cause of firefighter fatalities is heart attacks caused by overexertion, not fire, smoke or building collapses. The second leading cause of firefighter fatalities is traffic accidents. [In recent years, typically, 10 or fewer firefighters have died annually as a result of fire, smoke or building collapses.]

Statistic 4. In recent years, fire fatalities in 1- and 2-family dwellings have accounted for more than 60 percent of total number of fire fatalities occurring in the U.S. and residential occupancies have accounted for more than 80 percent of the total fire fatalities. [In 2004, 68.7 percent of US fire fatalities occurred in 1- and 2-family dwellings and 82.6 percent occurred in residential occupancies.]

Statistics 5. A NFPA study of fires in high rise buildings released in September 2001 indicated that in the 14 years period between 1985 and 1998, only 7 fire fatalities occurred in all of the high rise office buildings in the United States. In that same 14 year period, more than 560 thousand Americans died in traffic accidents. The ratio of US highway fatalities to US fire fatalities in high rise office buildings in that 14 year period is 80,000 to 1.

Statistic 6. The NFPA estimates that approximately 80 fire fatalities occurred in commercial (nonresidential) buildings in 2004. [Roughly 2.1 percent of the total number of fire fatalities occurring in the US in 2004.]

Statistic 7. In the 30 years since the installation of sprinkler protection has become common place in US high rise buildings, not a single major high rise building fire has occurred in a high rise building protected throughout by a sprinkler system.

Statistic 8. According to the NFPA, in the 5 year period between 1994 and 1998, no fire fatalities occurred in any hotel/motel (both low rise and high rise) in the US protected throughout by a sprinkler system.

Statistic 9. Since the three regional model building codes included provisions which permit atriums in buildings which are protected throughout by a sprinkler system in the late 1970's, not a single major fire has occurred in a building which contains an atrium and which is protected throughout by a sprinkler system.

Statistic 10. Based upon data and conclusions included in a paper titled "*Reliability of Automatic Sprinkler Systems*" written by William E. Koffel, it has been reported that sprinkler systems fail to control 1 in 6 fires occurring in buildings protected by sprinklers. This statistic is at odds with the statistics for sprinkler protection in high rise buildings and buildings which contain atriums cited above. A more recent study by the NFPA released on September 9, 2005, indicates that sprinkler system successfully operate 93 percent of the time. Given the fact that a major fire has never occurred in a high rise building which has been protected throughout by a sprinkler system, it is likely that the reliability of sprinkler systems protecting high rise buildings is actually greater than the average reliability statistic recently published by the NFPA.

The reason why it is necessary to review these statistics prior to a discussion of the NIST investigation final report is that, even though the NIST investigation report is 10,000 pages in length, no where in the report does NIST define the high rise safety "problem" in the United States. Nor does the report include the rationale for many of its recommendations for improvements in the level of safety provided for high rise buildings. Given the excellent fire safety record for high rise buildings (and non-residential buildings in general) cited in the statistics above, it would seem that providing the basis for the need to implement the recommendations made by NIST would be an essential part of the final report.

At the House Committee on Science hearing on the collapse of the World Trade Center towers on March 6, 2002, the director of NIST justified the need to perform an in-depth investigation into the collapse of the WTC towers based upon the need to "harden" buildings against terrorism. Somewhere during the course of the investigation, NIST abandoned the "terrorism" justification for the investigation and representatives of NIST have publically stated a number of times that the NIST recommendations are not intended to address terrorist attacks on high rise buildings. If the NIST recommendations are not intended to address terrorist attacks and the fire safety record of US high rise buildings, particularly high rise buildings protected throughout sprinklers, is excellent, just what are NIST's justification for its recommendations?

NIST presented its rationale for its recommendations in the last half hour of its Technical Conference on the WTC collapse investigation held in mid-September (2005) stating that it was NIST's opinion that a "multi-hazard" approach to the design of buildings is necessary to provide an even higher level of safety than is already provided to occupants of tall buildings because of the risk. The "multi-hazard" design approach envisioned by NIST assumes that a fire and another hazard will occur simultaneously, however, NIST has neither identified, nor quantified, the other hazard or hazards to be included in its "multi-hazard" design approach concept in its final report.

While it is relatively easy to make a case for the general concept of a “multi-hazard” approach, from an engineering standpoint, it makes sense to ask NIST to both identify and quantify the hazards for which a high rise building should be designed. At the Technical Conference, NIST suggested that we design high rise buildings for simultaneous exposure to a fire and a hurricane and simultaneous exposure to a fire and a tornado, however, in my opinion at least, these hazard combinations make little sense. Our present ability to predict the path of hurricanes allows us to evacuate coastal cities 24 to 48 hours in advance (i.e. the evacuation of Galveston and Houston as Hurricane Rita approached the Texas coast). Hence, the probability that a hurricane would strike an occupied high rise building should be zero. With regard to a tornado, it’s not possible to design a building to withstand a direct strike from a tornado so there is really no need to address the hazard combination of a simultaneous fire and tornado (not to mentioned that this scenario has never occurred).

Our real world experience with “multi-hazards” in New Orleans beginning on August 29 also lends support for the opinion that there is little need for a “multi-hazard” design approach. The City of New Orleans was first struck by a hurricane, followed almost immediately by flooding and then struck by a third hazard, looting and the intentional setting of fires. One such intentionally set fire was at a high rise building located on Canal Street near the Mississippi River, Canal Place. Although the flooding of the city damaged the water supply system for the city and the sprinkler system protecting Canal Place was more than likely inoperative, the hazard to the occupants of the building posed by the fire was essentially zero because the building had already been evacuated in advance of the hurricane.

One combination of “multi-hazards” which perhaps makes sense is the combination of seismic activity and fire where a fire is caused by damage inflicted on a building by an earthquake. Certainly, NIST can point to the San Francisco earthquake and fire which occurred a century ago as an example of fires caused by seismic activity, however, the City of San Francisco which existed in 1906 was constructed prior to adoption of building codes. The fact is that major fires have not occurred as a result of seismic activity in the United States since 1906.

A second combination of “multi-hazards” which makes some sense is the combination of an explosion (other than terrorist-related), followed by a fire. While such events as boiler and electrical transformer explosions were common events in the first half of the twentieth century, I don’t recall a major fire in a high rise building occurring as a result of a boiler or electrical transformer explosion in my 29 years of experience in the fire protection field.

In defense of the “multi-hazards” design approach concept, NIST has argued that such “multi-hazard” exposures to high rise buildings are indeed rare events, however, since “multi-hazard” events are unpredictable and the magnitude of the consequences of such events may be extraordinarily large, designing high rise buildings for such events is both “realistic” and achievable”. Perhaps, but if “multi-hazard” exposures to high rise buildings are rare events (i.e. once every 100 years or once every 1,000 years), how can we predict the magnitude of such events? An excellent example is the attack on the World Trade Center towers on September 11th—who would have predicted that hijacked aircraft would be used as missiles and intentionally flown into the WTC towers back in the 1960's when the towers were being designed? Even if the design of the WTC towers had anticipated almost simultaneous missile attacks on both towers, would the modifications to the design of the towers been adequate for the actual event 30 years in the future? Given this, isn't it more logical to concentrate on known hazards which occur on a daily basis?

According to National Highway Traffic Safety Administration (NHTSA) more than 40,000 Americans typically die as a result accidents on our roads and highways each year and, according to the National Fire Protection Association, roughly 2,680 Americans died as a result of fire in 1- and 2-family dwellings in 2004. This means that more than 170,000 Americans have died in highway accidents and more than 10,000 Americans have died in fires in 1- and 2-family dwellings since September 11th. Obviously, the number of Americans who die in high rise buildings as a result of fires, “multi-hazards” or terrorism pales in comparison. Given this, it seems logical that reducing the number of deaths due to highway accidents and fires in 1- and 2-family dwellings ought to take precedence over the adoption and implementation of NIST's recommendations to address “multi-hazard” exposure in America's high rise buildings.

Will Congressman Boehlert perform “*the highest responsibility of public officials*” and put highway safety and fire safety in our homes ahead of implementing the NIST recommendations or will Congressman Boehlert continue to ignore the slaughter on our highways and in our homes in favor of making headlines in New York? Well Congressman, the choice is yours.

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