CHAPTER SIX

GUIDELINES ON EMERGENCY PREPAREDNESS

Escalating fires can cause extensive destruction and significant casualties. To mitigate the potential effects of arson, incendiary attacks, and post-attack fires, both in terms of loss of human life and structural damage, the NYPD recommends that Medium and High Tier buildings adhere to strict emergency preparedness standards related to fire resistance, emergency egress, and communication systems. Adherence to fire-resistance standards, including requirements related to fire-resistance ratings and thermal insulation of primary and secondary structural elements, can contribute to a building's structural stability. Adherence to communication system standards and emergency egress standards, including requirements related to the width, navigability, location, and impact resistance of stairwells, can enhance the potential for an orderly and safe evacuation.

Although the attacks of September 11, 2001, were the most dramatic example of an act of terrorism generating intense fires, terrorists have a long history of staging incendiary attacks. For example, a group of Islamist radicals launched an arson attack against Hotel Madimak in Turkey in July 1993, causing 37 deaths and 56 injuries.[1] On June 30, 2007, two terrorists attempted to deploy an incendiary-based VBIED against Glasgow Airport in Scotland; their jeep caught fire but failed to either detonate or penetrate the front entrance. And, on September 20, 2008, at least 40 people were killed and hundreds more wounded when attackers detonated a large VBIED along the security perimeter of the Marriott Hotel in Islamabad, Pakistan. Although the hotel's vehicle barrier provided some standoff between the VBIED blast and the hotel's facade, the device generated an intense fire that quickly engulfed and destroyed the hotel, dramatically increasing the casualty count.[2]

As for the attacks of September 11, 2001, the Introduction to *Engineering Security* references two NIST reports that detail the role that fire ultimately played in the collapse of WTC1, WTC2, and WTC7. The first report, published in 2005, found that although WTC1 and WTC2 successfully withstood the initial impacts of the two planes, the intense heat generated from fires stoked by the planes' fuel loads eventually compromised the buildings' primary steel structures.[3] The second report, published in 2008, found that the fires that followed the impact of debris from the collapse of WTC1 spread to WTC7, causing the failure of a key structural column and, ultimately, progressive collapse of the entire building.[4] Noting that the fires in WTC7 burned out of control, largely as a result of water-main failure following the collapse of WTC1 and WTC2, the NIST report of 2008 concluded that the collapse of WTC7 represented the first recorded instance of fires primarily causing the total collapse of a tall building.[5]

In addition to detailing the collapse of WTC1, WTC2, and WTC7, the NIST reports also set out a series of recommendations designed to enhance building and fire safety.[6] The 30 recommendations contained in the NIST report of 2005 identify specific improvements both to the way buildings are designed, constructed, maintained, and used; and to evacuation and emergency response protocols.[7] Although the NIST recommendations are not legally compulsory, the NYPD supports the adoption of many of them in High Tier buildings. Because municipal codes are written for general applicability, not tailored to the specific needs of High Tier buildings, the NIST recommendations impose more rigorous building and fire safety standards than most, if not all, municipal codes.

A handful of cities have updated their municipal codes to reflect some of the practices recommended in the NIST report of 2005. In fact, the New York City Building Code and Fire Code mandate improved fire protection, emergency egress, and communication system standards.[8] The Building Code, effective July 1, 2008, was modeled on the International Code Council's 2003 edition of the IBC, which was published prior to the finalization of the NIST report of 2005. While the New York City Building Code incorporates several of the recommendations of the NIST report, those not incorporated are being actively considered for incorporation in the upcoming round of revisions to the Building Code. Appendix B includes a table summarizing the extent to which the NIST

recommendations have been incorporated into the IBC and the New York City Building Code.

This chapter addresses certain NIST recommendations related to fire resistance, emergency egress, and communication systems in greater detail. Specifically, it focuses on the general principles contained in Recommendations 4, 7, 18, 19, and 22 of the NIST report of 2005. To the extent that the New York City Building Code and Fire Code do not yet incorporate these standards, the NYPD recommends their adoption in High Tier buildings.

Fire Resistance

The NYPD's fire-resistance recommendations fall into two general categories: those related to the fire-resistance rating of structural elements; and those related to the adhesion of thermal insulation. Both sets of recommendations contribute to a building's ability to withstand incendiary incidents, and its occupants' ability to safely evacuate in the event of an attack.

Fire-Resistance Rating

In accordance with the principles presented in Recommendation 4 of the NIST report of 2005, the NYPD recommends that High Tier buildings meet fire-resistance rating requirements that provide for the time required either for burnout without partial collapse or for full evacuation of building occupants;[9] this typically entails fire-proofing all primary and secondary structural elements based on the amount of time necessary for a building to be fully evacuated. For example, if a full evacuation requires three hours to complete, structural elements in the building should be fire-rated for as much time. The NYPD recommends that fire protection consultants assess fire-proofing requirements on a building-specific basis.

Furthermore, the NYPD recommends that both Medium and High Tier buildings employ the "structural frame" approach to fire-resistance ratings described in Recommendation 7 of the NIST report of 2005.[10] This approach requires building owners to ensure that all secondary structural elements having direct connection to primary structural elements achieve the traditionally higher fire-resistance ratings set for primary structural elements. The "structural frame" approach

ensures "consistency in the fire protection provided to all of the structural elements that contribute to overall structural stability."[11]

Thermal Insulation

The safety provided by a fire-resistance rating becomes meaningless when thermal protection or insulation does not remain in place during an attack. For example, on September 11, 2001, the impact of the planes on WTC1 and WTC2 dislodged a significant portion of the thermal insulation from structural elements.[12] Flying debris from an explosives attack can also dislodge thermal insulation. Without insulation, steel heats quickly, losing both its strength and stiffness.[13] Therefore, to ensure adequate protection of structural elements, the NYPD recommends the use of impact-resistant fire-proofing in High Tier buildings, to the extent that such fire-proofing can be commercially provided.

Emergency Egress

A swift evacuation of a building may be the single most important life-saving step in an emergency, but is a major challenge in any high-rise structure, particularly with regard to disabled or limited-mobility persons. The NYPD's emergency egress guidelines include recommendations related to stairwells and emergency elevators.

When installed and maintained properly, stairwells may serve as lifelines for occupants of high-rise buildings during emergencies. In the event of an attack, elevators may be shut down for fire service or rendered inoperable; but stairwells should always be available for egress by building occupants and ingress by emergency responders. Accordingly, the NYPD recommends that owners of Medium and High Tier buildings ensure compliance with certain requirements related to width, navigability, location within the building's core, and impact resistance of stairwells.

The NIST report of 2005 noted that descending evacuees in WTC1 reported slowing of their travel due to ascending first responders, suggesting that wider stairwells would have allowed for faster evacuation.[14] Moreover, both WTC1 and WTC2 were designed only for partial evacuation; had the buildings been fully occupied at the time of the attacks, complete evacuations would have taken as much as three hours, assuming access to all stairwells.[15] While the New York City

Building Code requires a stairwell width of not less than 44-inches, the NYPD recommends for all High Tier buildings and for Medium Tier buildings taller than 600 feet, a stairwell width of at least 66 inches, or a stairwell width informed by a time motion egress study that provides an equivalent building exit time.[16]

The NIST report of 2005 also addressed problems with stairwell navigability, noting that dense smoke limited visibility in the stairwells in WTC1 and WTC2. Several factors contribute to a stairwell's navigability, including signage, lighting, and layout. To facilitate rapid egress and building evacuation, the New York City Building Code requires stairwells in all high-rise buildings to have certain way-finding features, including illuminated exit signs and photo-luminescent exit path markings.[17] In terms of lighting and layout, the NYPD endorses Recommendation 18 of the NIST report of 2005, suggesting that egress systems should be designed with consistent layouts and standard signage and guidance so that systems become intuitive and obvious to building occupants during evacuations.[18]

With respect to stairwell location, the NIST report of 2005 found that the clustering of stairwells in the building core at impact level prevented many people above the impact floors from evacuating in WTC1.[19] By contrast, because the stairwells at impact level in WTC2 were more dispersed, located along different boundaries of the building core, evacuees had access to a greater number of stairwells, allowing more people to escape.[20] For all High Tier buildings and Medium Tier buildings taller than 600 feet, the NYPD endorses Recommendation 18 of the NIST report, which outlines the importance of remoteness and physical separation of stairwells on each floor without negatively impacting the average travel distance.[21] Additionally, the NYPD recommends that building owners incorporate two or more remotely located stairwells on each floor so that in the event the primary core stairwell becomes compromised, the other stairwells can be used for egress.[22]

The New York City Building Code provides for the use of emergency elevators, connected to emergency power supply, as an "accessible means of egress" to ensure adequate evacuation opportunities for disabled persons.[23] Additionally, the inclusion of smoke-proof elevators as part of a building's emergency egress design may enhance building evacuation efforts and facilitate emergency response.

Communication Systems

Communication systems that promote swift information sharing are vital to saving lives in the event of an attack on a large building. Some communication systems allow emergency-service personnel to give instruction or relay important safety information to building occupants (e.g., "shelter in place" or "evacuate"). Other communication systems allow emergency service personnel to coordinate a response and to better understand the nature of the damage to a building and the dangers they face.

Recommendation 19 of the NIST report of 2005 advises building owners, managers, and emergency responders to work together to develop a joint plan to ensure the accurate and timely communication of emergency information to building occupants and emergency responders in the event of an attack. According to the report, this can be accomplished through: better coordination of information among emergency responder groups; efficient sharing of information between emergency responder groups and building occupants; a more robust design of emergency public address systems; improved emergency responder communication systems; and the use of the Emergency Broadcast System (now known as the Integrated Public Alert and Warning System) and Community Emergency Alert Networks.[24]

With respect to emergency-responder radio communication, the NYPD, the New York City Fire Department (FDNY), and the Port Authority Police Department all reported difficulties with their hand-held units in the immediate aftermath of the attacks of September 11, 2001.[25] Recommendation 22 of the NIST report of 2005 addresses the installation, inspection, and testing of emergency-communication systems, radio communications, and associated operating plans to ensure their effective use in large-scale emergencies and their functionality in buildings with problematic radio-frequency propagation.[26] The vast majority of buildings in New York City have sufficient radio signal at and above grade for NYPD radios to function properly in case of emergency. Owners of Medium and High Tier buildings experiencing significant attenuation of radio signals, or owners of High Tier buildings with significant below grade estate, should consult with the NYPD Communications Division and FDNY before designing or installing in-building radio systems utilizing bi-directional amplifiers that retransmit NYPD and other emergency responder frequencies. To be authorized to install or activate an in-building radio system, a

building owner must develop a proposal that complies with NYPD and FDNY requirements as well as FCC regulations. The NYPD and FDNY will consult on whether installation of an in-building radio system is necessary; and if so, the design and installation standards that can minimize interference to incumbent outdoor FCC-licensed public safety and commercial land-mobile radio systems. Additionally, the NYPD recommends that critical emergency-responder radio systems installed in commercial buildings be connected to emergency power systems.


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