

communication and control paths in buildings need to be designed and installed to have the same resistance to failure and increased survivability above that specified in present standards. *Affected Standards:* NFPA 1, NFPA 72, and NFPA 101. *Model Building and Fire Codes:* The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.

Recommendation 14. NIST recommends that control panels at fire/emergency command stations in buildings be adapted to accept and interpret a larger quantity of more reliable information from the active fire protection systems that provide tactical decision aids to fireground commanders, including water flow rates from pressure and flow measurement devices, and that standards for their performance be developed. *Affected Standards:* NFPA 1, NFPA 72, and NFPA 101. *Model Building and Fire Codes:* The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.

Recommendation 15. NIST recommends that systems be developed and implemented for: (1) real-time off-site secure transmission of valuable information from fire alarm and other monitored building systems for use by emergency responders, at any location, to enhance situational awareness and response decisions and maintain safe and efficient operations;³⁵ and (2) preservation of that information either off-site or in a black box that will survive a fire or other building failure for purposes of subsequent investigations and analysis. Standards for the performance of such systems should be developed, and their use should be required. *Affected Standards:* NFPA 1, NFPA 72, and NFPA 101. *Model Building and Fire Codes:* The performance standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.

9.2.5 Group 5. Improved Building Evacuation

Building evacuation should be improved to include system designs that facilitate safe and rapid egress, methods for ensuring clear and timely emergency communications to occupants, better occupant preparedness regarding their roles and duties for evacuation during emergencies, and incorporation of appropriate egress technologies.³⁶

Recommendation 16. NIST recommends that public agencies, non-profit organizations concerned with building and fire safety, and building owners and managers develop and carry out public education and training campaigns, jointly and on a nationwide scale, to improve building occupants' preparedness for evacuation in case of building emergencies. This effort

³⁵ The alarm systems in the WTC towers were only capable of determining and displaying: (a) areas that had at some time reached alarm point conditions; and (b) areas that had not. The quality and reliability of information available to emergency responders at the Fire Command Station was not sufficient to understand the fire conditions. The only information transmitted outside the building was the fact that the building had gone into alarm. Further, the fire alarm system in WTC 7, which was transmitted to a monitoring service, was on "test" the morning of September 11, 2001, because routine maintenance was being performed. Under test conditions (1) the system is typically disabled for the entire building, not just for the area where work is being performed, and (2) alarm signals typically do not show up on an operator console.

³⁶ This effort should include standards and guidelines for the development and evaluation of emergency evacuation plans, including best practices for both partial and full evacuation, and the development of contingency plans that account for expected conditions that may require adaptation, including the compromise of all or part of an egress path before or during evacuation, or conditions such as widespread power failure, earthquake, or security threat that restrict egress from the building. Evacuation planning should include the process from initial notification of the need to evacuate to the point the occupants arrive at a place where their safety is ensured. These standards and guidelines should be suitable for assessing the adequacy of evacuation plans submitted for approval and should require occupant training through the conduct of regular drills.