

National Construction Safety Teams Annual Report

Fiscal Year 2006

Introduction

In October 2002, the President signed into law the National Construction Safety Team (NCST) Act (P.L. 107-231), which authorized the Director of the National Institute of Standards and Technology (NIST) to establish National Construction Safety Teams for deployment after events causing the failure of a building or buildings that has resulted in substantial loss of life or that posed significant potential for substantial loss of life.

The purpose of these investigations is to improve the safety and structural integrity of buildings in the United States. A team shall:

- (A) establish the likely technical cause or causes of the building failure;
- (B) evaluate the technical aspects of evacuation and emergency response procedures;
- (C) recommend as necessary, specific improvements to building standards, codes, and practices based on the findings made pursuant to subparagraphs (A) and (B); and,
- (D) recommend any research and other appropriate actions needed to improve the structural safety of buildings, and improve the evacuation and emergency response procedures, based on the findings and recommendations of the investigation.

Under Section 10 of the NCST Act, NIST is to provide by February 15 of each year a report that includes:

- (1) a summary of the investigations conducted by Teams during the prior fiscal year;
- (2) a summary of recommendations made by Teams in reports issued under Section 8 during the prior fiscal year and a description of the extent to which those recommendations have been implemented; and,
- (3) a description of the actions taken to improve building safety and structural integrity by the National Institute of Standards and Technology during the prior fiscal year in response to reports issued under Section 8.

This report summarizes NIST's activities under the NCST Act for Fiscal Year 2006.

Investigations Conducted by Teams during Fiscal Year 2006

No new investigations were undertaken during Fiscal Year 2006. NIST issued the final report on the federal building and fire safety investigation of the World Trade Center Towers in October 2005. The final report, and the 42 supporting project and technical topic reports are available on the NIST WTC web site, <http://wtc.nist.gov>. NIST's investigation of the collapse of World Trade Center 7 continued during 2006 and NIST anticipates releasing the draft final report on the investigation in the spring of 2007.

Recommendations Made by Teams and the Extent of Implementation

NIST has conducted its building and fire safety investigation of the World Trade Center disaster of September 11, 2001, under the authority of the National Construction Safety Team Act (15 USC 7301 et seq.). The National Construction Safety Team's final report is required by the Act to include recommendations that address (1) specific improvements to building standards, codes, and practices, (2) changes to, or the establishment of, evacuation and emergency response procedures, and (3) research and other appropriate actions needed to help prevent future building failures.

As a part of its investigation of the World Trade Center disaster, NIST issued thirty recommendations that identified specific improvements in the way buildings are designed, constructed, maintained, and used in evacuation and emergency response procedures. Recommendations were made in eight areas:

- (1) Increased Structural Integrity
- (2) Enhanced Fire Endurance of Structures
- (3) New Methods for Fire Resistant Design of Structures
- (4) Improved Active Fire Protection
- (5) Improved Building Evacuation
- (6) Improved Emergency Response
- (7) Improved Procedures and Practices
- (8) Education and Training

These recommendations are documented in Chapter 9 of NIST's Final Report on the Collapse of the World Trade Center Towers (NIST NCSTAR 1, September 2005). In addition, NIST maintains a status of the implementation of these recommendations on the NIST WTC web site (<http://wtc.nist.gov/recommendations/index.htm>). The current status of the implementation of the recommendations from the World Trade Center investigation is shown in Appendix 1.

NIST conducted its investigation of the Station Nightclub Fire under the authorities of the NCST Act. The final report on the investigation was issued in June 2005 and included ten specific recommendations to improve building safety. NIST tracks the status of the implementation of recommendations resulting from its investigation of the Station Nightclub Fire. The current status of the implementation of these recommendations is shown in Appendix 2.

Actions Taken to Improve Building Safety and Structural Integrity

NIST has undertaken a number of actions to improve the safety and structural integrity responding to the recommendations resulting from the World Trade Center Investigation. NIST contracted with the National Institute of Building Sciences (NIBS) to assemble a group of code experts to review the recommendations resulting from the World Trade Center Investigation and develop proposals for code changes where appropriate. NIST technical experts provide technical support to the NIBS Code Experts Committee.

The members of the committee submitted nineteen proposals for change to the International Code Council in March of 2006 for consideration at the September 2006 Code Hearings. Four of the proposals (those related to improved fireproofing installation practices, bond strength, and inspections and one on the fire rating of the primary structural frame) were voted favorably by the technical committee. Also, the proposal to require special elevators for firefighter access in high-rise buildings was voted favorably by assembly action (overturning the negative vote of the technical committee).

In addition, there was positive movement on three other code change proposals. While the committee voted down the current proposal on progressive collapse, a coalition of relevant industry groups has formed to develop an alternative proposal and the group's representative committed to submitting a proposal by August 2007 deadline for the next code change cycle. The proposal on wind tunnel testing was turned down on a technicality since the referenced ASCE standard is a few weeks away from being issued in final form. The proposal on structural integrity of stairwell and elevator enclosures was voted down but a representative of the ICC Code Technology Committee promised to work the issue and come back with an alternate proposal.

The NIBS Code Experts Committee is also working with the NFPA to support proposals for change to the NFPA 5000 building code and the NFPA fire codes that respond to the recommendations of the WTC investigation. Table 1 includes on updated information on the status of code change proposals and next steps that are being taken as a result of the Code Hearing results.

NIST technical experts are also working closely with several standards and industry organizations including the American Society of Civil Engineers, ASTM International, the National Council of Structural Engineering Associations, American Society of Mechanical Engineers and others to provide technical support as these bodies consider actions that respond to the WTC recommendations.

NIST has also undertaken nearly a dozen research projects under the Research and Development for the Safety of Threatened Buildings program that support research needs identified in the WTC recommendations. A detailed description of the Safety of Threatened Buildings Program and the component projects is available on the NIST Building and Fire Research Laboratory web site, <http://www2.bfrl.nist.gov/projects/goalslist.asp>.

Appendix 1
NIST's Recommendations Following the Federal
Building and Fire Investigation of the World Trade Center Disaster

Recommendation	Affected Standards and Codes	Status as of (February 6, 2006)
<p>Recommendation 1. NIST recommends that: (1) progressive collapse be prevented in buildings through the development and nationwide adoption of consensus standards and code provisions, along with the tools and guidelines needed for their use in practice; and (2) a standard methodology be developed—supported by analytical design tools and practical design.</p>	<p><i>Affected Standards:</i> ASCE-7, AISC Specifications, and ACI 318. These standards and other relevant committees should draw on expertise from ASCE/SFPE 29 for issues concerning progressive collapse under fire conditions. <i>Model Building Codes:</i> The consensus standards should be adopted in model building codes (i.e., the <i>International Building Code</i> and NFPA 5000) by mandatory reference to, or incorporation of, the latest edition of the standard. State and local jurisdictions should adopt and enforce the improved model building codes and national standards based on all 30 WTC recommendations. The codes and standards may vary from the WTC recommendations, but satisfy their intent.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC change proposal concerning <u>Disproportionate Collapse</u>. AHC/TRB plans to challenge at Final Action Hearing in May.</p> <p><u>NCSEA:</u> NCSEA has established a coalition of relevant industry groups committed to developing a proposal for a code provision on progressive collapse, to be submitted to ICC by the August 2007 deadline. This proposal would be considered for inclusion in the 2009 IBC. NIST and the NIBS/MMC both have non-voting representatives on the NCSEA committee.</p> <p><u>CTBUH:</u> The Council on Tall Buildings and Urban Habitat plans to form a committee to develop best practices guidance on progressive collapse. NIST staff will participate on this committee.</p>

		<p><u>ASCE:</u> ASCE has established a technical committee to develop guidelines for the mitigation of progressive collapse. ASCE plans to establish a standards committee on progressive collapse to develop a pre-standard. NIST staff participate on the technical committee.</p> <p><u>NIST:</u> Multi-year NIST project to support the development of performance criteria, prediction tools, and practical guidance for prevention of progressive collapse. NIST is working through AISC TC 3, Loads, Analysis, & Systems, to provide NIST report on Comparison of Existing Design Standards on Progressive Collapse for consideration.</p> <p><u>NFPA:</u> Recommends that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available, NFPA 5000 would consider referencing such a guidance document. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC).</p>
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Recommendation 2. NIST recommends that nationally accepted performance standards be developed for: (1) conducting wind tunnel testing of prototype structures based on sound technical methods that result in repeatable and reproducible results among testing laboratories; and (2) estimating wind loads and their effects on tall buildings for use in design, based on wind tunnel testing data and directional wind speed data.

Affected National Standard: ASCE-7. Model Building Codes: The standard should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.

NIBS: The ICC CTC submitted an **IBC change proposal** to reference the new ASCE standard -- see [Code Change Proposals](#) on:

- [Determination of Wind Loads and Wind Tunnel Testing](#)
- [Special Inspections of Spray-Applied Fire Resistive Materials](#)
- [Structural Frame Approach to Fire Resistance Ratings](#)

The ICC Committee disapproved this proposal because it would incorrectly reference the wind tunnel test standard as an exception to ASCE 7 wind load requirements. CTC, Institute for Building and Home Safety (IBHS), and NIBS/MMC have submitted a request for approval combining the two proposals and addressing comments received at the September 2005 code Hearings. This proposal will be considered at the Final Action hearings in May 2007.

IBHS: Submitted a proposal to bring forward recommendations currently in the ASCE 7-05 commentary to provide a limit on reductions of base overturning moments on wind-force resisting systems and

		<p>pressures for cladding systems. This proposal give these limitations the force of code provisions.</p> <p><u>ASCE</u>: A wind load testing standard that addresses the first part of the recommendation is being balloted by ASCE. (NIST staff have reviewed ASCE wind tunnel testing draft standard, and have provided the comments to the NIBS/MMC committee for their consideration.)</p> <p><u>NFPA</u>: Recommended that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available, NFPA 5000 would consider referencing such a guidance document. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC).</p> <p><u>NIST</u>: Plans to work with ASCE to upgrade the standard to include standardized methods of wind load estimation from wind tunnel testing. Multi-year NIST project to support the development of prediction methodologies for wind loads estimation in next-</p>
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		generation standards.
<p>Recommendation 3. NIST recommends that an appropriate criterion be developed and implemented to enhance the performance of tall buildings by limiting how much they sway under lateral load design conditions (e.g., winds and earthquakes).</p>	<p><i>Affected National Standards:</i> ASCE-7, AISC Specifications, and ACI 318. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> Not directly an <i>IBC</i> issue but rather an AISC, ACI, ASCE 7 issue. NIBS committee wrote to ASCE staff and ASCE 7 chair encouraging that the issue be addressed in the near-term and that the committee be involved in that process. The NIBS/MMC committee hopes to receive an update on ASCE/SEI plans, at or before the May 2 meeting.</p> <p><u>NIST:</u> Consulted with major design firms and reviewed designs of 36 buildings to tabulate range of drift ratios found in common practice. NIST is working with ASCE Committee on Design of Steel Building Structures to address Practices related to Design of Steel Buildings under Wind Loads.</p> <p><u>NFPA:</u> Recommended that expert groups such as ASCE, NCSEA or a combination of the two work towards development of a guideline document. Once available, NFPA 5000 would consider referencing such a guidance document. Current drift</p>

		<p>limit criteria for seismic design as well as serviceability issues should be considered when any changes are suggested by ASCE/NCSEA. NFPA will consider making this a formal recommendation to ASCE or NCSEA via the NFPA High Rise Building Safety Advisory Committee (HRBSAC).</p>
<p>Recommendation 4. NIST recommends evaluating, and where needed improving, the technical basis for determining appropriate construction classification and fire rating requirements (especially for tall buildings)—and making related code changes now as much as possible—by explicitly considering factors including:</p> <ul style="list-style-type: none"> • timely access by emergency responders and full evacuation of occupants, or the time required for burnout without partial collapse; • the extent to which redundancy in active fire protection (sprinkler and standpipe, fire alarm, and smoke management) systems should be credited for occupant life safety ; 	<p><i>Model Building Codes:</i> A comprehensive review of current construction classification and fire rating requirements and the establishment of a uniform set of revised thresholds with a firm technical basis that considers the factors identified above should be undertaken.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC change proposal - see <u>Survival of a Building Contents Fire Without Collapse</u>.</p> <p><i>This proposal change was disapproved by committee action at the ICC Code Hearings in September 2006. AHC-TRB is addressing the comments received from the committee and plans to resubmit the proposal for consideration at the May 2007 Final Action Hearing.</i></p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a categorization process for high rise buildings. HRBSAC is also working to determine what enhanced or</p>

<ul style="list-style-type: none"> • the need for redundancy in fire protection systems that are critical to structural integrity; • the ability of the structure and local floor systems to withstand a maximum credible fire scenario without collapse, recognizing that sprinklers could be compromised, not operational, or non-existent; • compartmentation requirements (e.g., 12,000 ft² (27)) to protect the structure, including fire rated doors and automatic enclosures, and limiting air supply (e.g., thermally resistant window assemblies) to retard fire spread in buildings with large, open floor plans; • the effect of spaces containing unusually large fuel concentrations for the expected occupancy of the building; and • the extent to which fire control systems, including suppression by automatic or manual means, should be credited as part of the prevention of fire spread. 		<p>redundant features may be necessary based on this resultant categorization process. NFPA committees will also be closely reviewing the WTC 7 report as it relates to Bullet Item 6.</p>
<p>Recommendation 5. NIST recommends</p>	<p><i>Affected National and International</i></p>	<p><u>NIBS</u>: The NIBS Building Code Experts</p>

<p>that the technical basis for the century-old standard for fire resistance testing of components, assemblies, and systems be improved through a national effort. Necessary guidance also should be developed for extrapolating the results of tested assemblies to prototypical building systems. A key step in fulfilling this recommendation is to establish a capability for studying and testing the components, assemblies, and systems under realistic fire and load conditions.</p>	<p><i>Standards:</i> ASTM E 119, NFPA 251, UL 263, and ISO 834. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p>will support efforts to change ASTM E119 and related Underwriters Laboratories (UL) and National Fire Protection Association (NFPA) standards. At or before its May 2 meeting, the NIBS/MMC committee hopes to receive an update on the standards development efforts of ASTM, NFPA, et al.</p> <p><u>NIST:</u> Developed and presented proposed changes to the standard for consideration by ASTM, NFPA, UL, and ISO.</p> <p><u>ASTM:</u> International Subcommittee E05.11 on Fire Resistance began addressing this recommendation concerning changes to ASTM standard E 119 in December 2005. Committee Chairman has requested all subcommittees review their work to consider adopting NIST recommendations into their standards where applicable.</p> <p><u>NFPA:</u> The Fire Protection Research Foundation (FPRF) of the NFPA is working along side the ASTM E 5 process to complete a literature review and to begin an evaluation process.</p>
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<p>Recommendation 6. NIST recommends the development of criteria, test methods, and standards: (1) for the in-service performance of sprayed fire-resistive materials (SFRM, also commonly referred to as fireproofing or insulation) used to protect structural components; and (2) to ensure that these materials, as-installed, conform to conditions in tests used to establish the fire resistance rating of components, assemblies, and systems.</p>	<p><i>Affected Standards:</i> AIA MasterSpec and AWCI Standard 12 for field inspection and conformance criteria; ASTM standards for SFRM performance criteria and test methods. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard. (See Recommendation 10 for more on this issue.)</p>	<p>NIBS: The ICC CTC submitted an IBC change proposal to improve the performance of sprayed fire-resistant materials - see Code Change Proposals on:</p> <ul style="list-style-type: none"> • Special Inspections of Spray-Applied Fire Resistive Materials <p><i>Approved as Modified - Although the technical support data was not provided in the proposal, this proposal is consistent with the NIST recommendations and should provide for more reliable protection to the steel in high-rise buildings. Using the greater bond strengths will increase the probability that the protection will stay in place and will be less likely to become dislodged. Placing the provisions in the high-rise provisions of Chapter 4 instead of within Chapter 7 is logical because the provisions are only applicable to high-rises and will be more visible within that section. The committee agreed with the different bond strength requirements based upon the building's height as taller buildings are more critical and that imposed loads on tall buildings such as vibration loads may affect the long-term performance. Based on testimony provided, the cost impact of this</i></p>
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		<p><i>requirement was considered as being relatively small. The higher density products which are currently available will generally meet these requirements.</i></p> <p>The ICC AHC-TRB submitted three IBC change proposals addressing various aspects of this recommendation - see</p> <ul style="list-style-type: none">• <u>Bond Strength Requirements for Spray-Applied Fire Resistive Materials in Tall Buildings;</u>• <u>In-Place Durability of Spray-Applied Fire Resistive Materials</u> and• <u>Special Inspections Required for Spray-Applied Fire Resistive Materials.</u> <p><u>NFPA</u>: Technical Committees are expected to review proposals that will mandate conformance with field inspection/ quality control issues from groups like AWCI and FCIA.</p> <p><u>ASTM</u>: International Committee E06 on Performance of Buildings is addressing this recommendation and other related SFRM recommendations.</p>
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<p>Recommendation 7. NIST recommends the adoption and use of the “structural frame” approach to fire resistance ratings.</p>	<p>This approach is currently required by the <i>International Building Code (IBC)</i>, one of the model codes, and was incorporated into the 2006 edition of NFPA 5000, Building Construction and Safety Code. This requirement ensures consistency in the fire protection provided to all of the structural elements that contribute to overall structural stability. State and local jurisdictions should adopt and enforce this requirement.</p>	<p><u>NIBS</u>: The ICC CTC submitted an IBC change proposal to address the structural frame approach to fire resistance ratings – see Code Change Proposals on:</p> <ul style="list-style-type: none"> • Structural Frame Approach to Fire Resistance Ratings <p><i>Approved as Submitted - This change deals with concerns that the structural frame needs to be better defined in order for the level of fire protection to be easier to determine. This revision helps reinforce and distinguish the differences between the primary and secondary structural elements.</i></p>

		<p><u>NFPA</u>: The structural frame approach is mandated in the 2006 edition of NFPA 5000.</p>
<p>Recommendation 8. NIST recommends that the fire resistance of structures be enhanced by requiring a performance objective that uncontrolled building fires result in burnout without partial or global (total) collapse.</p>	<p><i>Model Building Codes:</i> This recommendation should be included into the national model codes as an objective and adopted as an integral part of fire resistance design for structures. The issue of non-operational sprinklers could be addressed using the existing concept of Design Scenario 8 of NFPA 5000, where such compromise is assumed and the result is required to be acceptable to the Authority Having Jurisdiction.</p> <p><i>Affected Standards:</i> ASCE-7, AISC Specifications, ACI 318, and ASCE/SFPE 29.</p>	<p><u>NIBS</u>: <u>NIBS</u>: The ICC AHC-TRB submitted an IBC change proposal - see <u>Survival of a Building Contents Fire Without Collapse</u>. See notes in <i>Recommendation 4</i>.</p> <p><u>NFPA</u>: NFPA Technical Committees are likely to parse this recommendation to distinguish between local collapse and global collapse. Performance Based Design (PBD) options already contained in NFPA 101 and NFPA 5000 address the possibility of non-functioning/available systems or features. NFPA supports the adoption of more formal guidance to establish performance criteria and relevant guidelines or information.</p> <p><u>NIST</u>: Will develop code change proposal to enhance criteria for compartment area and ventilation as an interim measure for the March 2006 deadline for the IBC supplement. Multi-year NIST project to</p>

		<p>support the development of performance objectives, criteria, evaluation methods, prediction tools, and practical guidance for fire resistance design and retrofit of structures. NIST is working with AISC TC 8 Design for Fire Conditions to implement performance-based approach to steel design.</p>
<p>Recommendation 9. NIST recommends the development of: (1) performance-based standards and code provisions, as an alternative to current prescriptive design methods, to enable the design and retrofit of structures to resist real building fire conditions, including their ability to achieve the performance objective of burnout without structural or local floor collapse; and (2) the tools, guidelines, and test methods necessary to evaluate the fire performance of the structure as a whole system.</p>	<p><i>Affected National and International Standards:</i> ASCE-7, AISC Specifications, ACI 318, and ASCE/SFPE 29 for fire resistance design and retrofit of structures; NFPA, SFPE, ASCE, and ISO TC92 SC4 for building-specific multi-compartment, multi-floor design basis fire scenarios; and ASTM, NFPA, UL, and ISO for new test methods. <i>Model Building Codes:</i> The performance standards should be adopted as an alternate method in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> The NIBS Building Code Experts support the performance-based design concept and will bring together various interests to identify gaps with respect to evaluation tools and to develop a detailed action plan (with estimated costs) for filling those gaps. Three national standards (ASCE/SFPE 29, ACI 216, and AISC Specifications) have incorporated first-generation performance-based methods, as an alternative to current prescriptive methods, to enable the design and retrofit of structures to resist building fires. These methods are limited to standard (not real) fires.</p> <p><u>NFPA:</u> Technical Committees are likely to parse this recommendation to distinguish</p>

		<p>between local collapse and global collapse. PBD options already in NFPA 101 and NFPA 5000 address the possibility of non-functioning/available systems or features. NFPA supports the adoption of more formal guidance to establish performance criteria and relevant guidelines or information.</p> <p><u>ASTM</u>: Various committees in ASTM International have been addressing the issue of performance-based methods. These discussions will continue at the April, May and June Committee Weeks.</p> <p><u>NIST</u>: NIST is working with AISI, AISC, and other industry groups to support the development of performance-based standards for fire resistance design and retrofit of structures. Multi-year NIST project to support the development of performance objectives, criteria, evaluation methods, prediction tools, and practical guidance for fire resistance design and retrofit of structures.</p>
<p>Recommendation 10. NIST recommends</p>	<p><i>Affected Standards:</i> Technical barriers,</p>	<p><u>NIBS</u>: Not directly a code matter but NIBS</p>

<p>the development and evaluation of new fire-resistive coating materials, systems, and technologies with significantly enhanced performance and durability to provide protection following major events.</p>	<p>if any, to the introduction of new structural fire resistance materials, systems, and technologies should be identified and eliminated in the AIA MasterSpec, AWCI Standard 12 and ASTM standards for field inspection, conformance criteria, and test methods. <i>Model Building Codes:</i> Technical barriers, if any, to the introduction of new structural fire resistance materials, systems, and technologies should be eliminated from the model building codes.</p>	<p>Building Code Experts will develop a plan for looking at new materials and facilitating their testing and use.</p> <p><u>ASTM:</u> International Committee E06 on Performance of Buildings is addressing this recommendation.</p> <p><u>NIST:</u> NIST has formed an industry consortium to develop the test methods, measure performance, and determine in-service performance criteria for fire protective coating materials. NIST multi-year project to assess the performance of current spray-applied and intumescent fire protective materials and to support the development of new standards. NIST will write paper for ICC Journal on use of intumescent coatings for fire protection.</p>
<p>Recommendation 11. NIST recommends that the performance and suitability of advanced structural steel, reinforced and pre-stressed concrete, and other high-performance material systems be evaluated for use under conditions expected in building fires.</p>	<p><i>Affected Standards:</i> AISC Specifications and ACI 318. Technical barriers, if any, to the introduction of these advanced systems should be eliminated in ASTM E 119, NFPA 251, UL 263, ISO 834. <i>Model Building Codes:</i> Technical barriers, if any, to the introduction of</p>	<p><u>NIBS:</u> Not directly a code matter but NIBS Building Code Experts will develop a plan for looking at new materials and facilitating their testing and use.</p> <p><u>NIST:</u> Project to determine the in-service performance properties of high temperature</p>

	<p>these advanced systems should be eliminated from the model building codes.</p>	<p>steels and compile property database.</p> <p><u>NFPA</u>: Will forward the relevant information to the NFPA Fire Test Committee for further consideration.</p> <p><u>ASTM</u>: Has established a joint task group under subcommittees A01.13 (Mechanical and Chemical Testing and Processing Methods of Steel Products and Processes) and E28.10 (Mechanical Testing: Effect of Temperature and Stress Relaxation) to define fire resistant steels and develop a standard material test method for fire resistance of such steels.</p>
<p>Recommendation 12. NIST recommends that the performance and possibly the redundancy of active fire protection systems (sprinklers, standpipes/hoses, fire alarms, and smoke management systems) in buildings be enhanced to accommodate the greater risks associated with increasing building height and population, increased use of open spaces, high-risk building activities, fire department response limits, transient fuel loads, and higher threat</p>	<p><i>Affected Standards:</i> NFPA 13, NFPA 14, NFPA 20, NFPA 72, NFPA 90A, NFPA 92A, NFPA 92B, and NFPA 101.</p> <p><i>Model Building Codes:</i> The performance standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC change proposal related to redundancy – see Reliability of Fire Suppression Systems in Tall Buildings.</p> <p><i>This proposal was disapproved at the Code Hearings in September 2006.</i></p> <p>The ICC AHC-TRB also submitted an IBC change proposal related to special fire loads (fuel oil storage and piping) that, while not</p>

<p>profile.</p>		<p>directly related to this recommendation is associated with it – see Storage and Distribution of Fuels in Buildings.</p> <p><i>This proposal was disapproved at the Code hearings in September 2006.</i></p> <p><u>NFPA</u>: The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a categorization process for high rise buildings. HRBSAC is working to determine what enhanced or redundant features may be necessary based on this any new high rise building categories. Also related to this HRBSAC proposal is to develop the Leadership in Life Safety Design (LLSD) approach. This process will look at resource documents such as the CTBUH <i>Building Enhancement Guidelines</i> and apply a point scoring system for enhancements that go above minimum code mandated criteria.</p> <p><u>NIST</u>: Has formed a consortium with NEMA 3SB to develop active surveillance technologies to enhance the reliability of sprinkler systems. The methods would form the basis for code change proposals. NIST is collaborating with the fire alarm industry, through a consortium with</p>
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		<p>NEMA, to develop new technologies and features for fire alarm systems that provide active surveillance and automated testing of fire safety systems and components keyed to primary modes of failure in order to provide maximum operational reliability</p>
<p>Recommendation 13. NIST recommends that fire alarm and communications systems in buildings be developed to provide continuous, reliable, and accurate information on the status of life safety conditions at a level of detail sufficient to manage the evacuation process in building fire emergencies; all 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.</p>	<p><i>Affected Standards:</i> NFPA 1, NFPA 72, and NFPA 101. <i>Model Building and Fire Codes:</i> 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.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers.</p> <p><i>Both parts of proposal were disapproved at the September 2006 code Hearings. AHC-TRB is planning to address concerns expressed at Code hearing in a challenge to be presented at the May 2007 Final Action Hearing.</i></p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit</p>

		<p>marking audible notification appliances.</p> <p><u>NIST</u>: The Department of Homeland Security has asked NIST to develop specifications and protocols that will enable fire/emergency command stations in buildings to accept and interpret a larger quantity of more reliable information from the active fire protection (e.g., sprinklers, fire alarm, smoke management) systems for purposes of providing tactical decision aids to fireground commanders (#14) and for managing the evacuation process (#13).</p>
<p>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.</p>	<p><i>Affected Standards:</i> NFPA 1, NFPA 72, and NFPA 101. <i>Model Building and Fire Codes:</i> 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.</p>	<p><u>NIBS</u>: The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. See <i>revisions to Recommendation 13</i>.</p> <p><u>NFPA</u>: The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed.</p> <p><u>NIST</u>: The Department of Homeland</p>

		<p>Security has asked NIST to develop specifications and protocols that will enable fire/emergency command stations in buildings to accept and interpret a larger quantity of more reliable information from the active fire protection (e.g., sprinklers, fire alarm, smoke management) systems for purposes of providing tactical decision aids to fireground commanders (#14) and for managing the evacuation process (#13).</p>
<p>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; 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</p>	<p><i>Affected Standards:</i> NFPA 1, NFPA 72, and NFPA 101. <i>Model Building and Fire Codes:</i> 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.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. See <i>Recommendation 13</i>.</p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed. The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a process to have real time information from the emergency scene simulcast to a remote location.</p>

required.		
<p>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.</p>	<p><i>Affected Standard:</i> ICC/ANSI A117-1. <i>Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard. <i>Affected Organizations:</i> NFPA, NIBS, NCSBCS, BOMA, and CTBUH.</p>	<p><u>NIBS:</u> A NIBS/MMC committee expert has prepared a white paper for the committee on the a state-of-the-art summary of research knowledge regarding public information campaigns for large general populations. This paper also identifies three other areas in need of similar exploration to provide the basis for a concerted effort. (see paper)</p> <p><u>NFPA:</u> At present, NFPA Public Education materials do address building evacuation issues. However, efforts are underway to establish an occupant response protocol that works to address other than ‘traditional’ building emergencies. The NFPA Disability Access Review and Advisory Committee (DARAC) has recommended that a guidance document for persons with disabilities be developed to address emergency procedures for persons with disabilities. A draft is currently being assembled by NFPA staff. This guide will provide a list of systems, resources and options for employers and occupants to assist those with disabilities.</p>

<p>Recommendation 17. NIST recommends that tall buildings be designed to accommodate timely full building evacuation of occupants when required in building-specific or large-scale emergencies such as widespread power outages, major earthquakes, tornadoes, hurricanes without sufficient advanced warning, fires, explosions, and terrorist attack. Building size, population, function, and iconic status should be taken into account in designing the egress system. Stairwell capacity and stair discharge door width³⁸ should be adequate to accommodate counterflow due to emergency access by responders.</p>	<p><i>Affected Standards:</i> NFPA 101, ASME A 17. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p>NIBS: The ICC AHC-TRB submitted an IBC change proposal addressing an additional exit – see Adequacy of Stair Capacity for Full Evacuation.</p> <p><i>This proposal was disapproved at the September 2006 ICC Code hearing. AHC-TRB has addressed the comments received at the Code Hearings and has resubmitted for consideration at the Final Action Hearings in May 2007.</i></p> <p>NFPA: The 2006 editions of NFPA 101 and NFPA 5000 include requirements for 56 inch wide (minimum) stairs when an aggregate of 2000 occupants are expected to use a stair.</p> <p>NIST: Multi-year NIST project to produce new data, on occupant evacuation in stairwells, including the counterflow of emergency responders, as input to evacuation prediction models and code provisions. NIST has conducted evacuation modeling to support AHC-TRB's resubmittal of code change proposal.</p>
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<p>Recommendation 18. NIST recommends that egress systems be designed: (1) to maximize remoteness of egress components (i.e., stairs, elevators, exits) without negatively impacting the average travel distance; (2) to maintain their functional integrity and survivability under foreseeable building-specific or large-scale emergencies; and (3) with consistent layouts, standard signage, and guidance so that systems become intuitive and obvious to building occupants during evacuations.</p>	<p><i>Affected Standard:</i> NFPA 101. <i>Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p>NIBS: The ICC AHC-TRB submitted four IBC change proposals and one IFC change proposal related to this recommendation – see</p> <ul style="list-style-type: none"> • <u>Photoluminescent Markings in Exit Paths; Remoteness of Exit Stair Enclosures;</u> • <u>Structural Integrity Criteria for Stair Enclosures; Continuity of Exit Stairs from Highest Story Served to the Level of Exit Discharge;</u> and • <u>Elimination of Overhead Obstructions in Exit Paths.</u> <p>The five code change proposals submitted by AHC-TRB were disapproved at the ICC Code Hearings in September 2006. AHC-TRB will focus on the proposal for photoluminescent markings in exit paths and submit a challenge for consideration during the Final Action Hearings in May 2007. AHC-TRB will resume work on the proposal to eliminate overhead obstruction at a later time. AHC-TRB plans to resubmit the proposal on Structural</p>
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		<p>Integrity Criteria for Stair Enclosures for consideration at the Final Action Hearing in May 2007.</p> <p><u>NFPA</u>: Prior to expanding the concept of remoteness and hardened design of exits, a determination will have to be made as to what hazard scenario(s) should be contemplated beyond what is currently in the codes. The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit marking audible notification appliances.</p> <p><u>NIST</u>: Provided ACH-TRB with pressure-impulse data representative of a gas explosion to support resubmittal of the Structural Integrity Criteria for Stair Enclosures proposal.</p>
<p>Recommendation 19. NIST recommends that building owners, managers, and emergency responders develop a joint plan and take steps to ensure that accurate emergency information is communicated in a timely manner to enhance the situational awareness of building occupants and</p>	<p><i>Affected Standard:</i> NFPA 101 and/or a new standard. <i>Model Building and Fire Codes:</i> The standard should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard to the extent it is within the scope of</p>	<p><u>NIBS</u>: One of the NIBS/MMC building code experts has prepared a white paper for the committee on the a state-of-the-art summary of research knowledge regarding public information campaigns for large general populations. This paper also identifies three other areas in need of</p>

<p>emergency responders affected by an event. This should be accomplished through better coordination of information among different emergency responder groups, efficient sharing of that information among building occupants and emergency responders, more robust design of emergency public address systems, improved emergency responder communication systems, and use of the Emergency Broadcast System (now known as the Integrated Public Alert and Warning System) and Community Emergency Alert Networks.</p>	<p>building and fire codes.</p>	<p>similar exploration to provide the basis for a concerted effort. (see paper)</p> <p><u>NFPA</u>: The 2007 edition of NFPA 72 (available September 2006) has accepted proposals and comments to recognize exit marking audible notification appliances. In addition, the new version has also accepted proposals and comments to recognize criteria for mass notification systems that will formalize notification criteria for large building, campus and even urban areas. The NFPA 72 Committee will work to incorporate additional and appropriate technologies when they are further developed.</p>
<p>Recommendation 20. NIST recommends that the full range of current and next generation evacuation technologies should be evaluated for future use, including protected/hardened elevators, exterior escape devices, and stairwell descent devices, which may allow all occupants an equal opportunity for evacuation and facilitate emergency response access.</p>	<p><i>Affected Standards:</i> NFPA 101, ASME A 17, ASTM E 06, ANSI A117.1. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NFPA</u>: The 2006 editions of NFPA 101 and NFPA 5000 include requirements for the installation of stair descent devices for use by mobility impaired occupants in certain circumstances. These editions of the codes also considered use of the exterior escape devices but the recognition was not included at the end of the process. NFPA staff actively participated in the ASTM E-06 process for these devices and</p>

		<p>it is expected that new proposals for the 2009 editions of NFPA 101 and NFPA 5000 will be considered later this year.</p> <p><u>ASTM:</u> International Committee E06 on Performance of Buildings will address this recommendation and other evacuation related issues before and during their upcoming April 23-26, 2006 meetings.</p>
<p>Recommendation 21. NIST recommends the installation of fire-protected and structurally hardened elevators to improve emergency response activities in tall buildings by providing timely emergency access to responders and allowing evacuation of mobility-impaired building occupants.</p>	<p><i>Affected Standards:</i> ASME A 17, ANSI 117.1, NFPA 70, NFPA 101, NFPA 1221, NFPA 1500, NFPA 1561, NFPA 1620, and NFPA 1710. <i>Model Building and Fire Codes:</i> The standards should be adopted in model building and fire codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> Two code change proposals were submitted to ICC for the March 24, 2006 deadline to address those recommendations: Fire Service Elevator Requirements (IBC Sections 403.10 and 3007) and Fire Service Elevator Requirements (IBC Sections 403.9 and 2702) and Illustration of Exit Stair Separation and Fire-Fighting Shafts. Current codes reference ASME A17, which requires that signs be posted by all elevators stating that elevators should not be used in an emergency. Elevators continue to operate unless a smoke detector is triggered in either the lobby or in the machinery room, in which case they are</p>

		<p>automatically recalled to the lobby or until manually recalled by fire service personnel. A survey of fire service use of elevators has been completed. (see survey results)</p> <p><i>The proposal for Fire Service Elevator Requirements was disapproved at the September 2006 Code Hearings, although in general, the committee was in favor of the proposal. CTC has submitted a modification to the proposal for consideration at the May 2007 Final Action Hearings.</i></p> <p><u>ASME</u>: A 17.1 task group, in partnership with the U.S. elevator industry and NIST, are working to develop specifications and operational protocols for protected elevators for fire service access and occupant egress. This work is being widely followed adoption in model building codes.</p> <p><u>GSA</u>: Has agreed to install a prototype system in a federal building as a demonstration project.</p> <p><u>NFPA</u>: Staff is very active with this project and has contributed to much of its</p>
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		<p>work product. Pending completion of the required updates to ASME A17.1, major NFPA codes (NFPA 101, NFPA 5000) will evaluate the new edition of ASME A17.1 and related criteria. NFPA staff has developed preliminary draft code language based on ASME task group progress to this point.</p>
<p>Recommendation 22. NIST recommends the installation, inspection, and testing of emergency communications systems, radio communications, and associated operating protocols to ensure that the systems and protocols: (1) are effective for large-scale emergencies in buildings with challenging radio frequency propagation environments; and (2) can be used to identify, locate, and track emergency responders within indoor building environments and in the field.</p>	<p><i>Affected Standards:</i> FCC, SAFECOM, NFPA Standards on Electronic Safety Equipment, NFPA 70, NFPA 297, and NFPA 1221. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. <i>See status for Recommendation 13.</i> A position paper is being planned on the intelligence aspects of information delivery for very large scale events.</p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering that broader use of supplemental antennas and/or repeaters for tall building environments to improve the communication ability of the radio equipment be integrated into building design. Such supplemental equipment may</p>

		become a mandate via NFPA 72, NFPA 101, NFPA 5000 or some combination there-of.
<p>Recommendation 23. NIST recommends the establishment and implementation of detailed procedures and methods for gathering, processing, and delivering critical information through integration of relevant voice, video, graphical, and written data to enhance the situational awareness of all emergency responders. An information intelligence sector should be established to coordinate the effort for each incident.</p>	<p><i>Affected Standards:</i> National Incident Management System (NIMS), NRP, SAFECOM, FCC, NFPA Standards on Electronic Safety Equipment, NFPA 1500, NFPA 1561, NFPA 1620, NFPA 1710, and NFPA 1221. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 – see Emergency Command Centers. <i>See status for Recommendation 13.</i></p> <p><u>NFPA:</u> The NFPA 72 Committee will work to incorporate appropriate technologies when they are further developed.</p>
<p>Recommendation 24. NIST recommends the establishment and implementation of codes and protocols for ensuring effective and uninterrupted operation of the command and control system for large-scale building emergencies.</p>	<p><i>Affected Standards:</i> NIMS, NRP, SAFECOM, FCC, NFPA Standards on Electronic Safety Equipment, NFPA 1221, NFPA 1500, NFPA 1561, NFPA 1620, and NFPA 1710. <i>Model Building Codes:</i> The standards should be adopted in model building codes by mandatory reference to, or incorporation of, the latest edition of the standard.</p>	<p><u>NIBS:</u> The ICC AHC-TRB submitted an IBC code change proposal related to this recommendation as well as Recommendations 13, 14, 15, 24 –see Emergency Command Centers. <i>See status for Recommendation 13.</i> A position paper is planned on the intelligence aspects of information delivery for very large scale events.</p>

		<p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering that expansion of the available frequencies that could be used by emergency responders be explored to reduce overuse of limited spectrum by emergency responders</p>
<p>Recommendation 25. Nongovernmental and quasi-governmental entities that own or lease buildings and are not subject to building and fire safety code requirements of any governmental jurisdiction are nevertheless concerned about the safety of the building occupants and the responding emergency personnel. NIST recommends that such entities be encouraged to provide a level of safety that equals or exceeds the level of safety that would be provided by strict compliance with the code requirements of an appropriate governmental jurisdiction. To gain broad public confidence in the safety of such buildings, NIST further recommends that asdesigned and as-built safety be certified by a qualified third party, independent of</p>		<p><u>NIBS:</u> Jurisdictional standards of practice issue. The potential for writing to the relevant groups developing model legislation for special authorities will be explored.</p> <p><u>NIST:</u> Has shared with the NIBS Building Code Experts the statute (U.S. Code Title 40, Section 3312) containing the policy of the federal government with regard to code compliance.</p>

<p>the building owner(s). The process should not use self-approval for code enforcement in areas including interpretation of code provisions, design approval, product acceptance, certification of the final construction, and post-occupancy inspections over the life of the buildings.</p>		
<p>Recommendation 26. NIST recommends that state and local jurisdictions adopt and aggressively enforce available provisions in building codes to ensure that egress and sprinkler requirements are met by existing buildings. Further, occupancy requirements should be modified where needed (such as when there are assembly use spaces within an office building) to meet the requirements in model building codes.</p>	<p>Provisions related to egress and sprinkler requirements in existing buildings are available in such codes as the <i>International Existing Building Code (IEBC)</i>, International Fire Code, NFPA 1, NFPA 101, and ASME A 17.3.</p>	<p><u>NIBS:</u> The NIBS/MMC committee concluded that this is a long-range issue but that there needs to be a plan for addressing it incrementally. ACH-TRB plans to consider at retrofit fire issues.</p> <p><u>NFPA:</u> NFPA 101 has always contained building safety requirements that are retroactive for myriad existing building types. It requires improvements to the level of safety provided to the occupants by ignoring grandfathering concepts that are the hallmarks of other model codes.. An expansion of the NFPA 101 scope to cover other than fire type hazards or development of a separate document will be considered by NFPA.</p> <p><u>NIST:</u> To prepare article for ICC/NFPA</p>

		Journals on the need for regulation of existing buildings.
<p>Recommendation 27. NIST recommends that building codes incorporate a provision that requires building owners to retain documents, including supporting calculations and test data, related to building design, construction, maintenance and modifications over the entire life of the building. Means should be developed for offsite storage and maintenance of the documents. In addition, NIST recommends that relevant building information be made available in suitably designed hard copy or electronic format for use by emergency responders. Such information should be easily accessible by responders during emergencies.</p>	<p><i>Model Building Codes:</i> Model building codes should incorporate this recommendation. State and local jurisdictions should adopt and enforce these requirements.</p>	<p><u>NIBS:</u> The NIBS/MMC committee concluded that problems exist because of ownership changes, the proprietary nature of some documents, determining what medium to use to save documentation, unreimbursable expense of maintaining information. It also was noted that only threat assessment documents need to be out of the public domain. The AHC-TRB submitted a code change proposal that includes some provisions for giving responders needed information by requiring that it be available in the command centers.</p> <p><u>NFPA:</u> The NFPA High Rise Building Safety Advisory Committee (HRBSAC) is considering a recommendation that building inventory plans be provided to or readily available to the first responders.</p>
<p>Recommendation 28. NIST recommends that the role of the “Design Professional in</p>	<p><i>Affected Standards:</i> AIA Practice Guidelines. <i>Model Building Codes:</i> The</p>	<p><u>NIBS:</u> Selected NIBS Building Code Experts have been assigned to review the</p>

<p>Responsible Charge” be clarified to ensure that: (1) all appropriate design professionals (including, e.g., the fire protection engineer) are part of the design team providing the standard of care when designing buildings employing innovative or unusual fire safety systems, and (2) all appropriate design professionals (including, e.g., the structural engineer and the fire protection engineer) are part of the design team providing the standard of care when designing the structure to resist fires, in buildings that employ innovative or unusual structural and fire safety systems.</p>	<p>IBC, which already defines the “Design Professional in Responsible Charge,” be clarified to address this recommendation. The NFPA 5000 should incorporate the “Design Professional in Responsible Charge” concept and address this recommendation.</p>	<p>issue with AIA and NIST. The committee plans to examine whether working with the National Council of Architectural Registration Boards and the National Council of Examiners for Engineering and Surveying would be helpful in implementing this recommendation.</p> <p><u>NFPA</u>: NFPA 5000 utilizes the term Registered Design Professional -RDP. Pending any clarifications that come out of the AIA-NIST effort, NFPA committees would be amenable to revisiting the use and description of this entity.</p>
<p>Recommendation 29. NIST recommends that continuing education curricula be developed and programs be implemented for (1) training fire protection engineers and architects in structural engineering principles and design, and (2) training structural engineers, architects, fire protection engineers, and code enforcement officials in modern fire protection principles and technologies, including fire-resistance design of structures, and (3) training building</p>	<p><i>Affected Organizations:</i> AIA, SFPE, ASCE, ASME, AISC, ACI, and state licensing boards. <i>Model Building Codes:</i> Detailed criteria and requirements should be incorporated into the model building codes under the topic “Design Professional in Responsible Charge.”</p>	<p><u>NIST</u>: NIST staff are actively working with National Fire Academy and Emergency Management Institute to develop curricula and teach courses.</p>

<p>regulatory and fire service personnel to upgrade their understanding and skills to conduct the review, inspection, and approval tasks for which they are responsible.</p>		
<p>Recommendation 30. NIST recommends that academic, professional short-course, and webbased training materials in the use of computational fire dynamics and thermostructural analysis tools be developed and delivered to strengthen the base of available technical capabilities and human resources.</p>	<p><i>Affected Organizations:</i> AIA, SFPE, ASCE, ASME, AISC, and ACI, ICC, NFPA.</p>	<p><u>NIST:</u> NIST staff are actively working with National Fire Academy and Emergency Management Institute to develop curricula and teach courses.</p>

Appendix 2
Summary of actions needed and/or taken regarding the recommendations from the NCST investigation of The Station nightclub fire
Updated 2/6/2007

NIST Recommendation	Responsible Parties	Comments
1. Adopt and enforce model codes	<ul style="list-style-type: none"> • state and local jurisdictions • ICC and NFPA 	<ul style="list-style-type: none"> • Continuous education and training effort required to raise awareness of the benefits and importance of embracing recommendation. • NFPA TIA #742R required owner to maintain records of egress inspection (NFPA 101:12.7.1 and 101:13.7.1); adopted in 2006 edition. • RI adopted NFPA 1 and NFPA 101, and strengthened fire marshal's enforcement power.
2. Strengthen requirement for sprinklers	<ul style="list-style-type: none"> • state and local jurisdictions • NFPA and ICC 	<ul style="list-style-type: none"> • NFPA TIA #739R required existing nightclub facilities and festival seating venues with occupant loads greater than 100 to be sprinklered (NFPA 101:13.3.5.1); adopted in 2006 edition. • NFPA TIA #743R required all new nightclub facilities and festival seating venues to be sprinklered (NFPA 101:12.3.5.1); adopted in 2006 edition. • Continuous effort required to raise awareness of the benefits and importance of embracing recommendation. • RI strengthened regulation requiring sprinklers based upon occupant load of 150 rather than 100, some exemptions. • Change to Section 903.2.1.2 of the 2006 IFC (F58-03/04 [Approved as Modified]) to tighten threshold for sprinklers in Group A-2 assembly occupancies, such as nightclubs, restaurants and banquet halls. ICC membership voted to require such occupancies to be sprinklered where the occupant load exceeds 100 (rather than 300).

NIST Recommendation	Responsible Parties	Comments
3. Strengthen restrictions on foam plastic finish materials	<ul style="list-style-type: none"> • state and local jurisdictions • NFPA, ICC, ASTM, UL • NAFTL • building materials industry • NIST 	<ul style="list-style-type: none"> • ICC FS108-03/04 dealt with one small aspect of foam plastic finish materials; additional revisions needed to be developed using established procedures. • NIST will work with standards committees (UL 94, ASTM E84, NFPA 255, and NFPA 286) to develop ways to address recommendation. This will be a long term effort due to the research needed to support changes to building and fire codes and standards. • State and local jurisdictions can have immediate impact by adopting and <u>enforcing</u> existing model codes.
4. Strengthen restrictions on use of pyrotechnics	<ul style="list-style-type: none"> • state and local jurisdictions • NFPA, ICC 	<ul style="list-style-type: none"> • NIST needs to work with NFPA 1126 to develop technical support for recommendation. This activity has not yet started. • RI strengthened restrictions to prohibit use of pyrotechnics in places of assembly such as nightclubs and to strictly regulate their use in large venues that can accommodate them safely. • State and local jurisdictions can have immediate impact by adopting and <u>enforcing</u> existing model codes.

NIST Recommendation	Responsible Parties	Comments
5. Increase factor of safety on egress	<ul style="list-style-type: none"> • state and local jurisdictions • NFPA, ICC • NIST 	<ul style="list-style-type: none"> • NFPA TIA #737R and NFPA TIA #740 restricted festival seating in new and existing facilities if occupant load is greater than 250 unless life-safety evaluation is conducted (NFPA 101:12.2.5.4.1 and 101:13.2.5.4.1); adopted in 2006 edition. • NFPA TIA# 738 required trained crowd managers for existing and new assembly occupancies (NFPA 101:12.7.5 and 101:13.7.5); adopted in 2006 edition. • NIST will work with NFPA 101, NFPA 5000, and IBC; substantial research effort required, which NIST is pursuing. • State and local jurisdictions can have immediate impact by adopting and <u>enforcing</u> existing model codes.
6. Conduct portable fire extinguisher study	<ul style="list-style-type: none"> • fire protection equipment manufacturers • NFPA 	<ul style="list-style-type: none"> • Workshop held at NIST with equipment manufacturers, building owners, fire service, NFPA, ICC, and testing organizations to develop outline of study, and identify participants, to feed technical information into NFPA 10 committee. • RI now requires two 20 pound extinguishers in stage areas.
7. Adopt and practice communication, response, command structures, and staffing guidelines already established	<ul style="list-style-type: none"> • state and local jurisdictions • NFPA, ICC 	<ul style="list-style-type: none"> • Continuous education and training effort required to raise awareness of the benefits and importance of embracing recommendation and practicing established guidelines for communication, response, command structures, and staffing. • No research nor code changes are required.
8. Conduct research to understand human behavior	<ul style="list-style-type: none"> • NSF, NIST, DHS, CDC, NIH, DOD, 	<ul style="list-style-type: none"> • NIST has established research program.

NIST Recommendation	Responsible Parties	Comments
better in emergency situations	GSA <ul style="list-style-type: none"> • universities 	<ul style="list-style-type: none"> • Energized multi-agency effort is needed. • Initial planning of international workshop to deal with building design for safe egress and access.
9. Conduct research to understand fire spread and suppression better	<ul style="list-style-type: none"> • NSF, NIST, DOD, DHS • building materials industry 	<ul style="list-style-type: none"> • Research is ongoing at NIST and elsewhere.
10. Conduct research to refine computer-aided decision tools	<ul style="list-style-type: none"> • NSF, NIST, DOD, DHS, GSA, EPA • universities 	<ul style="list-style-type: none"> • Research is ongoing at NIST and elsewhere.

Acronym

ASTM
 CDC
 DHS
 DOD
 EPA
 FPRF
 GSA
 ICC
 IFC

Organization

American Society for Testing Materials
 Centers for Disease Control
 Department of Homeland Security
 Department of Defense
 Environmental Protection Agency
 Fire Protection Research Foundation
 General Services Administration
 International Code Council
 International Fire Code

Type

non-governmental model standards organization
 federal government
 federal government
 federal government
 federal government
 non-profit research
 federal government
 non-governmental model code organization
 non-governmental model code organization

NAFTL	North American Fire Testing Laboratory organization	industry group
NFPA	National Fire Protection Association	non-governmental model standards/codes organization
NIH	National Institutes of Health	federal government
NIST	National Institute of Standards and Technology	federal government
NSF	National Science Foundation	federal government
UL	Underwriters Laboratories	non-governmental model standards organization