National Institute of Standards and Technology
National Construction Safety Team Act
Annual Report
Fiscal Year (FY) 2016

Summary

This annual report to Congress for Fiscal Year (FY) 2016 is required by the National Construction Safety Team (NCST) Act (Public Law 107-231). The National Institute of Standards and Technology (NIST) did not undertake any new NCST investigations, nor did it continue any NCST investigations in FY 2016.

In FY 2016, NIST continued carrying out implementation of the recommendation to develop consensus standards and code provisions related to progressive collapse from the World Trade Center investigation final report (September, 2005).[1] NIST also continued carrying out the 16 recommendations in the Joplin tornado investigation final report (March, 2014).[2] Highlights of FY 2016 implementation activities include the approval of proposals developed by NIST providing requirements and guidance for selection of existing facilities for use as shelters and best available refuge areas for tornadoes and other hazards in the new National Fire Protection Association (NFPA) Standard for Mass Evacuation and Sheltering (NFPA 1616), a newly developed annex by NIST on community-wide public alerts and warnings in rapid-onset emergencies submitted as first-draft public input to NFPA 1600 Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations Programs, and publication of a new Commentary to the International Code Council's (ICC) Standard for the Design and Construction of Storm Shelters (ICC 500-2014), developed in collaboration with the Federal Emergency Management Agency (FEMA) and several other members of the standards committee.

Additionally, NIST held one face-to-face meeting of the NCST Advisory Committee (AC) during FY 2016. The meeting[3] was held at NIST on May 3, 2016. In this meeting, NIST briefed the AC on:

- progress of NIST implementation of the Joplin tornado investigation recommendations;
- availability for public access of the NIST Chile Earthquake Data Repository;
- status of the Center for Risk-Based Community Resilience Planning; and
- the Reauthorization of the National Windstorm Impact Reduction Program (NWIRP) by Congress.

A summary of the discussions at this meeting may also be found in the FY 2016 Annual Report of the NCST AC to Congress.[4]

Introduction

In October 2002, the NCST Act was signed into law by President George W. Bush and authorized the Director of NIST to establish and deploy Teams to investigate events leading to failure of a

[1] Report available at: http://www.nist.gov/customcf/get_pdf.cfm?pub_id=909017
[2] Report available at: http://www.nist.gov/customcf/get_pdf.cfm?pub_id=915628
[3] Meeting summary available at: http://www.nist.gov/sites/default/files/documents/2016/10/12/ncst_ac_may_3_2016_meeting_summary.pdf
[4] FY 2016 NCST AC Report to Congress available at: https://www.nist.gov/sites/default/files/documents/2016/10/06/2016_report_to_congress_with_signatures.pdf

building or buildings that result in substantial loss of life or that pose 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 (U.S.). A Team shall:

1. Establish the likely technical cause or causes of building failure;
2. Evaluate the technical aspects of evacuation and emergency response procedures;
3. Recommend as necessary, specific improvements to building standards, codes, and practices based on the findings made pursuant to (1) and (2); and,
4. 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 an annual report to the House Committee on Science, Space, and Technology and to the Senate Committee on Commerce, Science, and Transportation by February 15 of each year. This report is to include:

1. A summary of the investigations conducted by Teams during the prior fiscal year;
2. A summary of recommendations made by the Teams in reports issued under Section 8 of the NCST Act 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 NIST during the prior fiscal year in response to reports issued under Section 8 of the NCST Act.

This report summarizes NIST's activities under the NCST Act for FY 2016 as required by Section 10 of the Act.

1. Investigations Conducted Under the NCST Act during FY 2016

During FY 2016, NIST neither undertook nor continued any investigations under the NCST Act. NIST uses a screening tool to assess the need for NCST investigations of disasters and failures that includes the following key decision criteria: substantial loss of life or disabling injury; significant potential for loss of life; hazard intensity; consequences to resilience; major challenges in evacuation and/or emergency response; safety of first responders; new knowledge gains; and potential impact to existing standards, codes, and guidelines. Nine domestic and international events were scored in FY 2016, including one building collapse, one flood, one tornado, two fires, and four earthquakes. Eight of the nine events scored did not meet preliminary deployment criteria for one or more of the following reasons: no clear objectives for impacting standards, codes, and practices; unsafe conditions for NIST investigators; no primary authority or in-house expertise of hazard type; construction practice and codes for locality are not similar to those used in the U.S.; no new lessons would be gained; and minimal impact to building occupants. One international event scored above the necessary threshold required to consider a preliminary NCST deployment. However, the answers to six additional questions used as criteria about deployment resulted in the decision to not deploy; the main reasons for this decision were the unsafe site conditions due to a major land slide caused by the earthquake and the lack of clear objectives that would impact U.S. codes, standards, and practice.

2. Summary of Recommendations Made by Teams in Reports Issued Under Section 8 of the NCST Act during FY 2016

During FY 2016, NIST did not issue a report under Section 8 of the NCST Act.

3. Actions Taken to Improve Building Safety and Structural Integrity during FY 2016 in Response to Reports Issued Under Section 8 of the NCST Act

During FY 2016, NIST convened one face-to-face meeting of the NCST Advisory Committee (AC). The meeting was held at NIST on May 3, 2016. In this meeting, NIST briefed the AC on:

- progress of NIST implementation of the Joplin tornado investigation recommendations;
- availability for public access of the NIST Chile Earthquake Data Repository;
- status of the Center for Risk-Based Community Resilience Planning; and
- the Reauthorization of the NWIRP by Congress.

a. Actions Related to Report on the NIST World Trade Center Investigation:

In its *Final Report on the Collapse of the World Trade Center Towers*[1], NIST recommended that "progressive collapse be prevented in buildings through the development and nationwide adoption of consensus standards and code provisions." In FY 2012, based on a proposal from NIST, a new American Society of Civil Engineers (ASCE)/ Structural Engineering Institute (SEI) Standards Committee called the "Disproportionate Collapse Mitigation Standard" Committee was established. This voluntary standards committee is currently developing a standard, with substantial contributions from four NIST staff who are translating the results of NIST research into the standard. Additional information about changes to building codes and standards as a result of this investigation can be found at:
http://www.nist.gov/el/disasterstudies/wtc/wtc_recommendations.cfm.

b. Actions Related to Report on the NIST Joplin Tornado Investigation:

NIST has taken the following actions during FY 2016 to implement the recommendations to improve building safety and structural integrity and found in Chapter 9 of the Joplin tornado investigation final report[2]:

- Completed work, in collaboration with FEMA and several other standards committee members, on the new Commentary to the ICC 500-2014 Standard for the Design and Construction of Storm Shelters. The Commentary was published by ICC in February 2016. This effort supports NIST recommendation #8 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- Completed work on requirements and guidance for selection of shelters and best available refuge areas in existing buildings for tornadoes and other hazards, which has been approved for inclusion in the new National Fire Protection Association (NFPA) 1616 Standard for Mass Evacuation and Sheltering. This effort supports NIST recommendation #8 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).

- Worked with FEMA and the ICC's Building Code Action Committee (BCAC) to develop and submit a proposal for the 2018 International Building Code (IBC) requiring that facilities designated by the emergency management authority having jurisdiction as emergency shelters must be designed as Risk Category IV structures, which includes community storm shelters. This effort supports NIST recommendation #8 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- Developed and submitted a code change proposal with the BCAC for the 2018 IBC to prohibit use of aggregate as surfacing for roof coverings and as roof ballast in tornado-prone regions, and conducted and published an economic study[5] that documented the minimal cost impact of the proposed code change. This effort supports NIST recommendation #10 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- Continued work developing Tornado Hazard Maps for use in tornado-resistant design of buildings. This effort directly addresses NIST recommendation #3 and provides prerequisite technical underpinning for recommendations #5 and #6 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- Continued work with the ASCE SEI committee that is developing the new ASCE/SEI *Tornado Wind Speed Estimation Standard.* The standards committee, co-chaired by the National Oceanic and Atmospheric Administration (NOAA) and NIST staff, is developing standardized methods for estimating the wind speeds in tornadoes and other severe wind storms. This activity on standards development directly addresses both NIST recommendations #2 and #4, and supports NIST recommendations #1 and #3 (of Recommendations Group 1, *Tornado Hazard Characteristics and Associated Wind Field*, in the final report[2]).
- NIST staff continued to lead the *Tornado Working Group* within the ad-hoc ASCE committee on *Performance-Based Design for Wind Hazards*, addressing NIST recommendation #5 and supporting NIST recommendation #6 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- NIST staff continued working with FEMA on development of a new methodology and revised guidance for selection of best available tornado refuge areas in existing buildings. This effort supports NIST recommendation #9 (of Recommendations Group 2, *Performance of Buildings, Shelters, Designated Safe Areas, and Lifelines*, in the final report[2]).
- NIST staff conducted a workshop with emergency managers and National Weather Service representatives from 13 jurisdictions within U.S. tornado-prone areas to provide feedback on NIST-developed interim guidance on standardizing outdoor siren system policies, including siren tones, usage of the system, and system testing. This effort supports NIST recommendations #13, #14, and #15 (of Recommendations Group 3, *Pattern, Location, and Cause of Fatalities and Injuries, and Associated Performance of Emergency Communications Systems and Public Response*, in the final report[2]).
- NIST developed and submitted an annex on community-wide public alerts and warnings in rapid-onset emergencies as a first-draft for public input to NFPA 1600 Standard on Disaster/Emergency Management and Business Continuity/Continuity of Operations

[5] Technical Note available at: http://dx.doi.org/10.6028/NIST.TN.1930

Programs. This effort supports NIST recommendations #13, #14, and #15 (of Recommendations Group 3, *Pattern, Location, and Cause of Fatalities and Injuries, and Associated Performance of Emergency Communications Systems and Public Response*, in the final report[2]).

In addition to the above, NOAA's National Severe Storms Lab (NSSL) is making significant progress developing a new hazardous weather forecasting paradigm, called Forecasting a Continuum of Environmental Threats (FACETs). FACETs includes a grid-based, all-hazard watch/warning paradigm for communicating probabilistic threats. This effort supports NIST recommendation #16 (of Recommendations Group 3, *Pattern, Location, and Cause of Fatalities and Injuries, and Associated Performance of Emergency Communications Systems and Public Response*, in the final report[2]).

4. Other NIST Activities Related to the NCST Act

No other NIST activities related to the NCST Act took place during FY 2016.

5. Conclusion

The NCST Act authorizes NIST to establish and deploy teams to investigate building failures that result in a substantial loss of life or pose significant potential for loss of life. In FY 2016, NIST assessed nine events (fires, earthquakes, tornado, and flood) that may have required preliminary NCST investigations using a screening tool that considers: substantial loss of life or disabling injury; significant potential for loss of life; hazard intensity; consequences to resilience; major challenges in evacuation and/or emergency response; safety of first responders; new knowledge gains; and potential impact to existing standards, codes, and guidelines. Based on the results from this screening tool, NIST did not undertake or continue any investigations under the NCST Act. NIST did pursue actions related to improving building safety and structural integrity that were recommended by previous NCST investigations. NIST presented FY 2016 activities to the NCST Advisory Committee during an in-person meeting at the Gaithersburg campus.