

**National Construction Safety Team Advisory Committee**  
National Institute of Standards and Technology

December 9, 2019

The Honorable Tammy Baldwin, Ranking Member  
Subcommittee on Science, Oceans, Fisheries, and Weather  
Senate Committee on Commerce, Science, & Transportation  
709 Hart Senate Office Building  
Washington, DC 20510

Dear Senator Baldwin:

I am pleased to submit the 2019 Annual Report of the National Construction Safety Team (NCST) Advisory Committee (Committee) of the National Institute of Standards and Technology (NIST). The Committee serves as NIST's advisor on implementation of the NCST Act (P.L. 107-231; the 'Act'), and the opinions and recommendations expressed in this letter reflect our views as an independent, private sector body. This year the committee met in person at NIST in Gaithersburg, MD, on September 6 and by teleconference on December 2, 2019. The in-person meeting was used to brief the Committee on activities performed under the Act and closely related activities performed by NIST under other authorities.

The Act directs that the Committee annually report our findings and recommendations to Congress in two areas:

15. Evaluation of NCST activities
16. Assessment of the implementation of recommendations of NCST and the Committee.

The Act was stimulated by the World Trade Center attack in 2001, and NIST distinguished itself with its thorough study of the performance of the affected structures and the thoughtful recommendations for improvements in building standards and codes that came as a result. NIST has a long history of investigating disasters of various types, going back at least as far as the 1971 earthquake in the San Fernando valley. The Act does facilitate NIST's ability to conduct such investigations and enhances cooperation with other Federal agencies. The most recent implementation of a full investigation under the Act is an ongoing investigation of the effects of Hurricane Maria on the island of Puerto Rico.

*Hurricane Maria*

The Maria investigation is complex and challenging due to the intensity of the hurricane and the geographic scale of the area that was affected. Nearly the entire commonwealth of Puerto Rico was exposed, impacting over 3.3 million people. The damage to engineered buildings was widespread, leading to loss of functionality that adversely affected response and recovery. Critical infrastructure failure and extensive flooding led to loss of communication for extended periods of time, further complicating emergency response. The challenges related to recovery severely hampered the education, healthcare, and business sectors.

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NIST is to be complimented on assembling a diverse team of highly qualified researchers in a range of critical areas, including hazard characterization (wind and flooding), performance of buildings and critical infrastructure, risk communication, business and supply chain logistics, and health and medicine. Furthermore, they have successfully involved professionals, including social scientists and engineers, from the affected area. We believe inclusion of local professionals was particularly important for this study. The breadth of the team resulted in a requirement for a considerable level of communication and project management support, which NIST has done very well.

We applaud the actions of linking the disparate parts of this study together. In particular the combined efforts of social science and engineering are likely to offer new insights that could not be accomplished without collaboration of the two disciplines.

We also recognize the necessity of a purposeful and deliberate process in coordinating and subcontracting the aspects of the investigation. This process has a positive effect on consistency and strategy for collaboration among different entities on an investigation of this scope.

The Advisory Committee was particularly impressed with the thoughtful and comprehensive approach NCST is taking to secure and manage disaster-related data. They have examined existing disaster data repositories and partnered with experts in data-driven science. This approach will serve the mission of the NCST Act while providing a database for collaboration with government agencies and experts in related fields. NCST is building a secure database to which others can contribute as well as mine for purposes that advance science and public safety.

### *Other Studies and Investigations*

Over the past year, NCST has rated 14 events and sent people to four events, none of which rose to the level justifying a formal implementation of the act, although research studies of selected aspects of the four events are continuing under other authorities at NIST. The ratings and the consequent studies indicate to us that NCST is actively considering significant events that could have an effect on building safety in the United States.

NCST conducted an investigation of the devastation caused by the 2011 Joplin tornado. Among the recommendations they developed following that study was that a deeper understanding of tornado phenomena and their effects on buildings was needed, with the concept that information could and should be developed to improve standards for building design and construction.

NCST has made significant strides toward a better understanding of potential tornado wind speeds and have developed tornado hazard maps for the US. They are working with a committee of the American Society of Civil Engineers that is charged with developing design loads for buildings and other structures, with the long-term goal of changing building codes and practices to better protect the public. The current focus is on standards for engineered structures; however, these standards are not intended for typical wood-frame house construction, which represents the majority of occupied structures in the US. Such structures are designed using less rigorous

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standards. Achieving tornado resistance in wood-frame residential construction would require extensive revisions to traditional practice and therefore may be difficult to adopt into building codes.

While it is probably not realistic nor in the public's best interest to require that common commercial buildings and single-family homes be designed for the most severe tornadoes, some individuals and/or jurisdictions may want to improve their tornado protection voluntarily and such protective measures should be described incrementally so that voluntary improvements can be incorporated with cost-benefit considerations. The Advisory Committee encourages NCST to continue to explore alternative strategies, especially the improvement of tornado shelter standards and public tornado sheltering strategies.

We are enthusiastic about the very important outcomes that have resulted from research on emergency risk communication following the Joplin tornado. The practical guidance, including messaging templates for emergency managers to communicate under imminent threat, paves the way for developing standards for risk communication, which draw from the empirical research record. Ongoing efforts to make these findings available to risk communicators is likely to aid in effective messaging for populations at risk.

We note that NIST has engaged in exploring the possibility of obtaining and analyzing social media data for future research endeavors. We understand the complexity of data collection, storage, management, and analysis that accompanies this process, and we recommend continued perseverance and ongoing efforts in this area.

*Administration of the Act*

NIST is well suited to host NCST activities, which are of critical importance to our country. It is fortunate that an extremely strong team with the requisite capabilities could be mobilized at NIST for the Hurricane Maria study, one with unprecedented geographical and societal extent. It is crucial that NIST capitalize on current efforts by institutionalizing the procedures and capabilities deployed for the Hurricane Maria study in order to ensure efficient and effective NCST responses in the future.

Given the importance of documenting and collecting time-sensitive data with NCST activities, we recommend that NIST investigate whether other federal agencies, such as the NTSB, have developed protocols for quick response activities. This could be crucial for potential future disasters such as an earthquake in a heavily populated area.

In the past, we have recommended that contingency budgeting be planned for investigating unpredictable future events. While we believe that is important, we understand the difficulty of accomplishing that, and we compliment NIST on their management of funds and staffing to handle the Maria investigation. All should be mindful that some future event might demand more resources.

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In summary, the Committee finds the NCST program to be highly valuable and relevant to the safety of our population. We commend the current administration at NIST for their diligence in evaluating events for worthwhile study and the commitment to finding the funding to carry out the studies when justified. Related to that, we also want to restate our recommendation to Congress that the Act be revised. The Act focuses exclusively on safety from building failures. NIST has studied failures of construction that cannot be characterized purely as buildings, and should do so again in the future. The failures of the power grid and communication systems in Puerto Rico caused by Hurricane Maria are good examples. Studies of such events are crucial to building performance, but also to improving tools to enhance community resilience, which is a current focus of research at NIST. A past example of an important NIST (then NBS) investigation of a construction failure that was not a building was the 1978 collapse of a cooling tower for the Pleasants Power Station at Willow Island, West Virginia. While investigations of failures of nonbuilding structures have been and could be carried out under the authorities granted NIST in its organic act, in the National Windstorm Impact Reduction Program, and in the National Earthquake Hazard Reduction Program, we recommend that formal consideration be given to amending the NCST act to emphasize the important role NIST should play in such investigations. The specific changes that we recommend are appended to this letter.

Sincerely yours,

A handwritten signature in black ink that reads "James Robert Harris". The signature is written in a cursive style with a large, sweeping initial "J".

James Robert Harris, P.E., Ph.D., NAE, Hon. Memb. ACI  
Chair, National Construction Safety Advisory Committee

Attachment

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Appendix

Proposed amendments to the NCST Act:

Sec. 2, paragraph (a):

“...after events causing the failure of a building or ~~buildings~~ structure that has resulted in substantial loss of life or that posed significant potential for substantial loss of life. Where the failure of the structure is the proper subject for investigation by another Federal agency, the Director shall defer to the authority of that agency. To the maximum extent practicable...”

And Sec. 2, paragraph (b)

“(1) PURPOSE.—The purpose of investigation by Teams is to improve the safety and structural integrity of ~~buildings~~ the built environment in the United States.

And replace the term “buildings” with “the built environment” in Sec. 2 paragraph (b)(2)(D)

And replace the term “building standards, codes, and practices” with “engineering standards, practices, and building codes” at the following locations:

Sec. 8 paragraph (3)

Sec. 9, paragraph (2)

Sec. 14

And replace the term “building failure” with “failure” at the following locations:

Sec. 2, paragraph (b)(2)(a)

Sec. 4, paragraph (c)(1)

Sec. 2, paragraph (c)(1)(G)

Sec. 4, paragraph (c)(2)

Sec. 2, paragraph (c)(1)(J)

Sec. 4, paragraph (d)(3)

Sec. 4, paragraph (a)

Sec. 4, paragraph (d)(4)

Sec. 4, paragraph (a)(1) [*2 locations*]

Sec. 7, paragraph (c)

Sec. 4, paragraph (a)(3)

Sec. 8, paragraph (1)

Sec. 4, paragraph (b)(a)

Sec. 8, paragraph (4)

Sec. 4, paragraph (b)(2)

And replace the term “building components” with “components” at the following locations:

Sec. 4, paragraph (a)(1)

Sec. 4, paragraph (a)(3)

Sec. 4, paragraph (b)(1)

And broaden Sec. 4, paragraph (d) on Interagency Priorities to include other agencies that have legislative mandates for the investigation of the failure of selected types of failures, such as the Army COE for dams and levees, the NRC nuclear power generation, the DOE for nuclear weapons facilities, and the DOT for vehicular bridges. [*Such mandates are assumed, not verified, by this advisory committee*]

Lastly, unrelated to the preceding, consider updating Sec. 2 paragraph (c)(1)(J) by adding a reference to the National Windstorm Impact Reduction Program.