

**National Construction Safety Team Advisory Committee (NCSTAC)**

**National Institute of Standards and Technology (NIST)  
Gaithersburg, Maryland**

**June 30, 2020  
Meeting Summary**

**Advisory Committee Members:**

James Harris, Chair	J. R. Harris & Company
Reginald DesRoches, Vice Chair	Rice University
Ross Corotis	University of Colorado, Boulder
William Holmes	Rutherford + Chekene
Gary Klein	Wiss, Janney, Elstner Associates, Inc.
Kimberly Shoaf	Utah School of Medicine
Jeannette Sutton	University of Kentucky

**NIST Representatives**

Howard Harary	Director, Engineering Laboratory
Jason Averill	Chief, Materials & Structural Systems Division
Judith Mitrani-Reiser (listed in alphabetical order)	Associate Chief, Materials & Structural Systems Division
Benjamin Davis	Designated Federal Officer, NCSTAC
Maria Dillard	Acting Director, Disaster and Failure Studies
Kenneth Harrison	Operations Research Analyst, Community Resilience Group
Jennifer Helgeson	Research Economist, Applied Economics Office
Kathryn “Jo” Johnson	Research Social Scientist, Earthquake Engineering Group
Marc Levitan	Research Engineer, Structures Group
Joseph Main	Research Engineer, Structures Group
Long Phan	Group Leader, Structures Group
Scott Weaver	Director, National Windstorm Impact Reduction Program
DongHun Yeo	Research Engineer, Structures Group

## **I. Welcome and Opening Remarks**

Mr. Benjamin Davis, serving as the Designated Federal Officer, called the meeting to order and introduced the NIST Director, Dr. Walter Copan. Dr. Copan emphasized how much NIST values the input from an Advisory Committee with such a diversity of backgrounds. He elaborated that the recommendations from this Committee make a real difference in how NIST prioritizes and approaches NCST investigations. He then recognized Committee Chair Dr. James Harris for his two terms of service to the NCST Advisory Committee and thanked him for his extraordinary leadership.

## **II. Meeting Goals & Agenda**

Dr. Harris reviewed the goals of the meeting:

- Review NIST's response to the NCSTAC's 2019 Report to Congress;
- Review progress on the implementation of NIST Joplin tornado investigation's recommendations;
- Review the status of the NCST investigation of Hurricane Maria's effects on Puerto Rico, and
- Develop the Committee's annual report to Congress.

Dr. Harris turned the meeting over to Dr. Maria Dillard to review the agenda. Dr. Dillard also acknowledged Dr. Harris's leadership and time served on the Committee. She gave an overview of the meeting agenda, which can be found here: <https://www.nist.gov/topics/disaster-failure-studies/meeting-and-agenda-presentations>

Dr. Dillard then presented a brief background of the NCST ACT, and NIST's response to the NCST Advisory Committee's 2019 Report to Congress. The presentation can be found here: [https://www.nist.gov/system/files/documents/2020/07/21/01\\_DILLARD\\_NCSTAC\\_June2020\\_Response\\_to\\_Annual\\_Report\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/21/01_DILLARD_NCSTAC_June2020_Response_to_Annual_Report_FINAL.pdf)

## **III. Progress on Implementation of the Joplin Tornado Recommendations**

Dr. Long Phan and Dr. Marc Levitan provided a summary of progress on the implementation of the recommendations from the NCST Investigation of the Joplin, Missouri Tornado. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/21/02\\_Phan\\_Levitan\\_NCSTAC\\_June2020\\_Joplin\\_Recommendations\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/21/02_Phan_Levitan_NCSTAC_June2020_Joplin_Recommendations_FINAL.pdf)

## **Discussion**

The Committee discussed several points regarding the Joplin recommendations and tornado hazard characterization, as well as the recommendations from the 2019 Letter to Congress. The first question raised by the Committee was how the current COVID-19 pandemic might impact future recommendations about evacuating to storm shelters. NIST responded that a NIST engineer chairs the committee responsible for developing the forthcoming edition of the ICC 500 Standard for Design and Construction of Storm Shelters. The 2020 version will include a new appendix on shelter operations. NIST provided materials and draft provisions to the committee that would require consideration of public health and safety for infectious disease to be included in the shelter operations plan.

Another point raised by the Committee is related to the long process of implementing investigation recommendations. NIST is working to get the Joplin recommendations into ASCE-7 and later plans to tackle the Residential Building Code. In order to streamline the implementation of recommendations, the Committee Chair suggested developing a strategy for NIST to provide technical support during the debates held by codes and standards bodies to ensure that the recommendations are included in building codes. NIST agreed that it takes a long time to make significant changes in engineering standards for buildings due to the timing of the codes and standards update processes. NIST stated that progress is just beginning on some of the Joplin building standards recommendations, but there is reason to be confident that tornado loads will be incorporated into ASCE 7 (2022). The Joplin, MO tornado changed prevailing attitudes on the need for tornado resistant design, and the Committee applauded NIST for their commitment to implement recommendations to changes in codes and standards.

A Committee member communicated that there is a need for balance between the technical, economic, and design factors involved when working to get new provisions into the main building code. There has been resistance, however, to incorporating tornado design standards. Committee members raised that one of the challenges is that the tornado hazard map and load design work Dr. Levitan described does not have much effect on single family residential construction because the requirements are aimed at structures in Risk Categories III and IV. Risk Category III includes buildings that house a large number of people in one place, or house persons with limited mobility. This category includes theaters, prisons, and schools. Risk Category IV includes the essential buildings for community function and response, such as hospitals, fire stations, police stations, and emergency communications centers. Most residential and commercial buildings are included in Risk Category II. NIST responded that based on the current reliability targets in ASCE 7, the tornado speeds at the shorter return periods for Risk Category II buildings are low enough that tornado loads will not control the design over the current wind load requirements in the standard. NIST agreed that to date, the focus of the field has been on the use of shelters for reducing loss of life as opposed to tornado resistant residential housing. Further changes to residential building code requirements for tornado resistance will require perseverance.

NIST scientists responded to several Committee members' questions with additional explanation of the wind speed maps being developed. Wind speeds between tornadoes and straight-line winds cannot be directly compared to see which will control the design, due to differences in many other wind load coefficients. Slide number 17 from Dr. Levitan's presentation showed that for a 10,000 square foot building in Risk Category III, the tornado design speed might be about 80 miles per hour (mph). For the same building in Risk Category II, the tornado design speed is below 50 mph. NIST will be developing a tornado design guide in collaboration with FEMA that describes cost effective methods to improve tornado resistance for residential construction. NIST will work with the American Society of Civil Engineers (ASCE) to propose incorporation of tornado load provisions for the ASCE 7-22 standard into the 2024 International Building Code (IBC).

#### **IV. Hurricane Maria Program Updates**

Dr. Joe Main provided a summary of the progress of the Hurricane Maria NCST investigation. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/22/05\\_Main\\_NCSTAC\\_June2020\\_CriticalBuildings\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/22/05_Main_NCSTAC_June2020_CriticalBuildings_FINAL.pdf)

Dr. Donghun Yeo and Dr. Scott Weaver gave a joint presentation on the status of the project to characterize the Hurricane Maria hazards being conducted under the National Construction Safety Team Act. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/22/04\\_Yeo\\_Weaver\\_NCSTAC\\_June2020\\_HazardCharacterization\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/22/04_Yeo_Weaver_NCSTAC_June2020_HazardCharacterization_FINAL.pdf)

### **Discussion:**

Based on significant differences in the reported measurements of rainfall in Puerto Rico during Hurricane Maria, NIST is working with NOAA, NASA and other stakeholders to evaluate how instrumentation functions in extreme environments. There are several factors to consider including the potential for failure of the communication systems associated with the measurement instrumentation, inaccuracies in the measurements recorded by the instruments, and other modes of failure. During Hurricane Maria, the radar instrumentation was destroyed, so hardening of the instruments may be a recommendation arising from the NCST investigation. With respect to measurements of flooding, an interagency flood mapping working group is working across federal agencies to improve alignment of flood event measurement. Through NWIRP, NIST is working to engage with these efforts as well as with those of a mobile coordinated network that is supplementing existing meteorological measurement systems.

Dr. Joe Main gave a presentation on the status of the project focused on performance of critical buildings being conducted under the National Construction Safety Team Act. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/28/NCSTAC\\_June2020\\_CriticalBuildings.pdf](https://www.nist.gov/system/files/documents/2020/07/28/NCSTAC_June2020_CriticalBuildings.pdf)

### **Discussion**

The Committee raised a question on the interaction between the critical buildings project under NCST and functional recovery projects under NWIRP. NIST responded that the focus of the critical buildings project is on documenting the factors that contributed to the damage and initial loss of function of these structures. NIST has a separate project under NWIRP focused on recovery of healthcare and educational services from hospitals and schools, respectively. The NWIRP project will examine the impact of building damage and loss of function—including structural, non-structural, loss of power, and electrical or generator failure—had on the recovery of school and hospital services over time. These projects will be complementary. Dr. Dillard's slides on the recovery of social functions, presented later in the meeting, provided more information.

The Committee raised a point about how rainfall related to storms is impactful to structures and the exposed population. For example, hurricane fatalities due to rain and subsequent flooding outnumber those related to building damage and wind. Also, Committee members have observed that property damage and losses from hurricanes can be driven by damage caused by water, yet owners are sometimes insured for wind losses and not flood damage. NIST responded that the team has documentation of a small percentage of hospitals that experienced flooding during

Hurricane Maria. NIST is still collecting data, and it is too early to draw a conclusion, but generally, other factors caused the loss of function. NIST will be documenting these factors as part of this study.

Dr. Katherine Johnson gave a presentation on the status of the project focused on emergency communications and protective action before, during, and after Hurricane Maria being conducted under the National Construction Safety Team Act. The presentation can be found here: [https://www.nist.gov/system/files/documents/2020/07/22/06\\_Johnson\\_NCSTAC\\_June2020\\_EmergComms\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/22/06_Johnson_NCSTAC_June2020_EmergComms_FINAL.pdf)

### **Discussion**

There was a discussion about the alerts and warnings collected by NIST scientists and supporting team members. A Committee member asked what types of messages had been collected. NIST responded that there are several different message types and formats, such as press releases, news articles, and social media postings included in the dataset. NIST is cataloging those messages and considering whether these provide a representative sample to assess the effectiveness of those messages, or whether additional messages need to be collected. The focus has largely been on written messages, as they were the easiest to capture at the time. Radio messages in rural communities were not generally archived for subsequent analysis, as compared to social media messages, but may be quite valuable. NIST is considering whether a set of guidelines should be established around collecting this kind of data when an event occurs.

Dr. Judith Mitrani-Reiser gave a presentation on the status of the project focused on the characterization of morbidity and mortality being conducted under the National Construction Safety Team Act. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/24/07\\_Mitrani-Reiser\\_NCSTAC\\_June2020\\_Mortality\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/24/07_Mitrani-Reiser_NCSTAC_June2020_Mortality_FINAL.pdf)

### **V. Committee Discussion of the Hurricane Maria NCST Investigation Progress and Collaborations**

A Committee member raised a concern that verbal autopsies conducted in any mode other than face-to-face may be insufficient. The sensitivity of the topic makes doing the interviews by phone difficult because the interviewer is unable to read subtle, non-verbal signals that the respondent may provide. The use of a web conference platform with visual and audio was suggested as a way to address the issue. The challenges of data collection mode (e.g., phone, web) were discussed as part of pandemic related changes to methodology that are being anticipated.

The Committee asked about the data that will be used to characterize deaths. NIST responded that the project will involve linking death certificate information with available medical records and working to triangulate data. Too often, death records do not account for underlying mechanisms and therefore, only capture injury-related deaths. Earlier reports used a single source of data to compare event deaths with deaths in prior years. These other studies were using the “excess deaths” approach - establish a baseline for mortality on the island, establish the number of deaths during a time period after the storm, and the difference can produce an estimate of the death toll from the storm. The intent of the NIST investigation, however, is not to provide another count of deaths in Puerto Rico. Rather, the intent is to establish how many

deaths were attributable to storm hazards or building damages. NIST will examine the time period of six months following the storm to better understand the principal causes of mortality that occurred, as well as to analyze temporal and spatial clustering of deaths. NIST cannot do the work to understand the injury mechanisms from the existing data; the additional step of conducting verbal autopsies to understand the specific conditions leading to an illness or death is necessary. An optional task within the contract award that is pending is to convene a panel of experts for the cases that are not clear; this is known as a clinical panel. Ultimately, NIST may use statistical, survey, and clinical panel methods to make a final attribution for deaths following Hurricane Maria.

NIST is working to develop inclusion and exclusion criteria to help identify which data merits further investigation. NIST has retained a contractor to look at the first two weeks after the storm to more closely examine the causes in order to identify those deaths associated with building failures.

This investigation will link all the investigation projects, and elements of the disaster discussed in earlier presentations. Even though NIST is doing mortality studies across the island, there will be information about failures of hospitals, shelters, and how risk communications were perceived by households in the four study areas shared by the projects. Linking these projects involves intensive weekly discussions among all the project leaders to ensure that everyone is aware of the project activities and proposed methods. This allows for the integration of cross-project needs.

**VI. Public Comment Period:** Dr. Harris asked if there was any member of the public participating in the meeting. Ben Davis indicated that there was one person who registered and NIST provided the meeting information, including a web link. There was no response from anyone on the phone or on the internet.

## **VII. Recovery of Infrastructure, Business and Social Functions**

Dr. Kenneth Harrison gave a presentation on the status of the project focused on recovery of infrastructure systems supporting critical buildings and emergency communications being conducted under the National Windstorm Impact Reduction Act. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2019/09/19/08\\_harrison\\_sept2019\\_infrastructure\\_nctac\\_090519\\_final.pdf](https://www.nist.gov/system/files/documents/2019/09/19/08_harrison_sept2019_infrastructure_nctac_090519_final.pdf)

Dr. Jennifer Helgeson gave a presentation on the status of the project focused on recovery of businesses and the supply chain being conducted under the National Windstorm Impact Reduction Act. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2019/09/19/08\\_harrison\\_sept2019\\_infrastructure\\_nctac\\_090519\\_final.pdf](https://www.nist.gov/system/files/documents/2019/09/19/08_harrison_sept2019_infrastructure_nctac_090519_final.pdf)

Dr. Maria Dillard gave a presentation on the status of the project focused on recovery of social functions being conducted under the National Windstorm Impact Reduction Act. The presentation can be found here:

## **Discussion**

The Committee raised some concerns about the timeframe required to award contracts. They asked whether the data collection associated with the NCST investigation and NWIRP study could have been conducted before the pandemic if the contracts had been awarded in a more timely fashion. Dr. Dillard responded that it may have been possible to have been in the field with some data collection efforts prior to the pandemic, but noted that the contractors are able to shift from on the ground, in-person data collection to other modes such as phone and online. The Committee asked for information about how long it took NIST to prepare and advertise the contracts, and how long it took from the time that it was advertised to when it was awarded. NIST responded that this information for the contracts awarded under the Hurricane Maria Program will be compiled and provided to the Committee.

The Committee asked how NIST will measure the recovery of various aspects of the community. NIST responded that the survey and interview instruments developed by NIST will include many indicators of recovery including self-reported assessments of recovery by the respondents. There is also existing data on repair progress that can be used to characterize recovery. For example, the Puerto Rico Department of Transportation has data on what happened to the roads during Hurricane Maria and the status of road repairs at various time intervals. NIST is working to determine the level of infrastructure support of the critical buildings and clarified that recovery may be defined differently for different people. Another measure of recovery comes from the assessment of business planning, specifically, the decision making that went into post-event recovery. In those cases where recovery has not gone as well as anticipated, NIST scientists can inquire about what happened in order to better understand the challenges and delays. NIST also explained that many members of this team have been instrumental in the collaborative NIST- Center of Excellence Hurricane Matthew Field Study in Lumberton, North Carolina. The different components of recovery in a community, such as housing, business, infrastructure, and schools are all being assessed in terms of how they interrelate and affect recovery for other sectors. The interdependencies can be measured across different geographic locations. The Committee noted that insurance companies often hire engineers to study whether the damage was from wind or water. If the damage is from water, the insurance company is often not liable for repairs. This can result in insufficient financial resources to repair damage for those who had not purchased flood insurance. In the context of Puerto Rico, flood insurance was not highly subscribed. NIST responded that this issue of wind versus water damage is being explored; NIST has a process within the survey instruments to assess damage states, the sources of damage, and the capacity for repairs.

The Committee asked if there were any cell tower failures due to water. NIST scientists responded that NIST has not gotten any information on flood damage to cell towers. There are photographs from American Towers, but the images were hard to decipher. Often there was damage to a cable, but that was not visible in a photograph. NIST will also look at towers and communications infrastructure that did not fail to understand good performance further. There is some information available about wind driven rain entering equipment; NIST is working to obtain more information of this kind.

Dr. Maria Dillard updated the Committee on the Disaster and Failure Studies Program's efforts to enhance the readiness of teams. The presentation can be found here:

[https://www.nist.gov/system/files/documents/2020/07/22/11\\_Dillard\\_NCSTAC\\_June2020\\_DFS%20Readiness\\_FINAL.pdf](https://www.nist.gov/system/files/documents/2020/07/22/11_Dillard_NCSTAC_June2020_DFS%20Readiness_FINAL.pdf)



## **Discussion**

The Committee asked if NIST considered scoring the dam failure events in Edenville and Sanford, Michigan in May. The dam failures required the evacuation of three communities in Michigan.

NIST responded that data were collected on that event and scoring was considered. However, these events were not building failures and dam failures generally fall under other agency's primary authority. The substantial emergency response and evacuation were of interest to NIST. The Committee asked about whether NIST has a mechanism to ensure data is being systematically archived, similar to the NSF DesignSafe team's efforts to archive data and research tools. NIST response included that NIST and supporting contractors plan to utilize DesignSafe for some of the data collected. Additionally, with the support of researchers at Johns Hopkins University (JHU), NIST is working to develop NIST SciServer for storing disaster data and is ensuring that this platform is interoperable with DesignSafe and similar platforms. When NIST developed the statement of work for researchers at JHU, one of the tasks was to do a deep dive into DesignSafe and other agencies/organizations that house disaster data. Though there are challenges to a central national database because of limitations on what the federal government can share publicly, NIST's goal is to create an instance of SciServer that provides many tools for engaging with the data within NIST and outside NIST, in other disaster portals. At present, data housed at NIST that is publicly available can be integrated into the NIST SciServer platform. NIST is working to expand the approvals for SciServer.

## **VII. Meeting Closure**

Dr. Harary thanked the Committee for their comments and insightful questions, especially given the challenges of attending a virtual meeting. He also thanked the presenters. He looks forward to results in the Committee's report and to hearing other questions and recommendations. Finally, he thanked Dr. Harris for his leadership of the Committee during his six years on the Committee. Committee Chair Harris concluded the meeting at 4:15 pm.

**July 1, 2020  
Meeting Summary**

**Advisory Committee Members:**

James Harris, Chair

Reginald DesRoches, Vice Chair

Ross Corotis

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University of Kentucky

**NIST Representative**

Benjamin Davis

Designated Federal Officer, NCSTAC

**VIII. NCSTAC Preparation of Annual Report to Congress**

The Committee planned and discussed how the NCSTAC Annual Report to Congress should be written. The meeting was adjourned at 2:00 pm EDT.