

**National Construction Safety Team Advisory Committee (NCSTAC)**  
**Meeting Summary**  
**National Institute of Standards and Technology (NIST)**  
**Gaithersburg, Maryland**  
**(Public Meeting conducted via web conference)**  
**June 8-9, 2022**

**Advisory Committee Members:**

Ross Corotis, Chair	University of Colorado, Boulder
Jose Izquierdo-Encarnación, Vice Chair	PORTICUS
Reginald DesRoches	Rice University
William Holmes	Rutherford + Chekene
Gary Klein	Wiss, Janney, Elstner Associates
Kimberley Shoaf	Utah School of Medicine
Jeannette Sutton	University at Albany, State University of New York

**NIST Leadership:**

Laurie Locascio	Director, NIST
Joannie Chin	Director, Engineering Laboratory
Jason Averill	Chief, Materials & Structural Systems Division (MSSD)
Steve McCabe	Associate Division Chief, MSSD
Judith Mitrani-Reiser	Senior Research Scientist, MSSD Champlain Towers South NCST Lead Investigator, and Hurricane Maria NCST member

**NIST Staff (listed in alphabetical order):**

Glenn Bell	Structural Engineer and Champlain Towers South NCST Associate Lead Investigator
Tanya Brown-Giammanco	Director, Disaster and Failure Studies
Benjamin Davis	Designated Federal Officer, NCSTAC
Maria Dillard	Social Scientist and Hurricane Maria NCST Associate Lead Investigator
Peter Gale	Administrative Office Assistant, MSSD
David Goodwin	Research Chemist, Infrastructure Materials Group
Kenneth Harrison Group	Operations Research Analyst, Community Resilience
Jennifer Helgeson	Economist, Applied Economics Office
Emina Herovic	Social Scientist, MSSD
Ken Hover	Research Civil Engineer, Champlain Towers South
Jennifer Huergo	Director, Public Affairs Office and Family Liaison, Champlain Towers South
Kathrine “Jo” Johnson	Social Scientist, Earthquake Engineering Group
Scott Jones	Mechanical Engineer, Infrastructure Materials Group
Marc Levitan	Research Engineer, Structures Group

Joseph Main	Research Structural Engineer, Structures Group and Hurricane Maria NCST Lead Investigator
Jack Moehle	Research Civil Engineer, Champlain Towers South
Sissy Nikolaou	Research Civil Engineer, Earthquake Engineering Group
Long Phan	Group Leader, Structures Group
Fahim Sadek	Research Structural Engineer, Structures Group
Kamel Saidi	Acting Group Leader, Sensing & Perception Systems Group
Chris Segura	Research Structural Engineer, Earthquake Engineering Group
Jonathan Weigand	Research Structural Engineer, Structures Group
DongHun Yeo	Research Structural Engineer, Structures Group

**Non-NIST Staff (listed in alphabetical order):**

Emel Ganapati	Evidence Preservation co-lead, Champlain Towers South
James Harris	Building and Code History co-lead, Champlain Towers South
Georgette Hlepas	Remote Sensing and Data Visualization co-lead, Champlain Towers South

**Other Attendees:**

Aaron Davis	Vice President of Federal Relations, International Code Council
Jeffrey Harrington	Senior Attorney, Office of the General Counsel, DOC

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

Mr. Benjamin Davis, serving as the Designated Federal Officer (DFO), called the meeting to order and took roll call of the Committee members. All seven members of the Committee were in attendance. Mr. Davis then introduced the NIST Director, Dr. Laurie Locascio, who thanked the Committee for their engagement and serious participation and stated that the NCSTAC and its reports are very important to NIST. Dr. Locascio noted that the Committee would receive an update on Hurricane Maria's impacts on Puerto Rico and the Champlain Towers South partial collapse in Surfside, Florida. She also reminded the Committee of the impact their recommendations make as a result of the NCST investigations. These recommendations are instrumental in saving the lives of US citizens exposed to varying hazards. Dr. Locascio thanked the Committee members for their contributions and encouraged them to continue to provide advice.

## **II. FACA Ethics Briefing**

Mr. Jeffrey Harrington provided an ethics briefing detailing the rules, requirements, and obligations that apply to the NCST Advisory Committee members in order to remain in good standing.

## **III. Change in Committee Leadership**

Dr. Reggie DesRoches made the announcement that he has stepped down as the Chair of the Committee as he has been promoted to serve as the President of Rice University. Dr. Ross Corotis has taken his place as Chair. Dr. DesRoches noted that he will finish his term as a member of the Committee. Dr. Corotis then reviewed the following meeting goals as the Chair:

- Review NIST's response to the NCSTAC's 2021 Report to Congress,
- Review Disaster and Failure Studies Program Scoring of Events and Readiness of Teams,
- Review the status of the NCST investigation of Hurricane Maria's effects on Puerto Rico,
- Review the status of the NCST investigation of the partial collapse of Champlain Towers South in Surfside, Florida,
- Review progress on the implementation of NCST investigation recommendations for the World Trade Center and the Joplin tornado, and
- Develop the Committee's annual report to Congress

## **IV. NIST Response to the NCSTAC's 2021 Report to Congress**

Dr. Tanya Brown-Giammanco provided a presentation that included responses to each of the recommendations made to NIST in the NCSTAC's most recent letter to Congress. The presentation can be found here:

[NIST Response to the NCSTAC's 2021 Report to Congress](#)

### **Discussion:**

The Committee asked about the automated scoring of events and why its initial use would be on hurricanes instead of other hazards. NIST stated that this decision was made to support the National Windstorm Impact Reduction Program (NWIRP), which is also led by NIST and added that it made sense to coordinate this effort within NIST. NIST will standardize and continue to

expand the tool to be used with other hazards. The Committee noted that they were pleased by NIST's plan to propose updates to the 2023 ICC Building Code based on the new ASCE 7-22 load provisions which include tornado loads as well as into the 2023 edition of the ICC 500 Storm Shelter Standard in response to their recommendation in the 2021 Report to Congress.

#### **V. Disaster and Failure Studies (DFS) Program Updates**

Dr. Brown-Giammanco then presented an overview of the DFS Program and the progress made over the last year. The presentation can be found here:

[Disaster and Failure Studies Program Updates](#)

#### **Discussion:**

The Committee mentioned that the Center for Disease Control and Prevention's (CDC) Emergency Responder Health Monitor and Surveillance (ERHMS) training could be a good resource for NIST field training. The Committee also asked about who decides the funding that will be provided for an investigation and if there was anything the Committee could do to help. NIST outlined the process for deployment and investigation noting that when the NIST Director approves an investigation, funds for the investigation and their source are determined. In some instances, special congressional funding can be provided as in the case of the Champlain Towers investigation.

The Committee asked for more information about how individuals that work with the National Science Foundation (NSF) facilities are determined. NIST responded that it attempts to use the faculty and expertise provided by the RAPID and National Hazards Engineering Research Institute (NHERI) facilities that are already trained and familiar with needed equipment and analyses. NSF also funds rapid response grants, and is establishing a new Interagency Agreement (IAA) that would allow NIST to work with these experts for preliminary reconnaissance missions and investigations. The Committee also noted that the University of Colorado CONVERGE program under NHERI would be a good resource for researchers, and data when considering field deployment.

The Committee stated that they look forward to hearing more about the timeline associated with the Champlain Towers investigation. The Committee commended NIST for using the Enhanced Fujita (EF) Scale when assessing wind damage.

#### **VI. Summary of Hurricane Maria NCST Investigation Progress**

Prior to the presentations, the DFO asked if any members of the Committee had a conflict of interest and if so, to recuse themselves. No Committee members recused themselves. Dr. Joseph Main reviewed the Hurricane Maria NCST Investigation's goals and progress. His presentation can be found here:

[Summary of Hurricane Maria NCST Investigation Progress](#)

Dr. Main then introduced Dr. DongHun Yeo to provide the first presentation on the Hazards Characterization Project. The presentation can be found below:

### [Hazards Characterization Project](#)

Dr. Main then gave the next presentation on the Performance of Critical Buildings Project. The presentation can be found here:

### [Performance of Critical Buildings Project](#)

Dr. Main then introduced Dr. Katherine Johnson to give the presentation on the Emergency Communications Project. A link to the presentation can be found below:

### [Emergency Communications Project Update](#)

Finally, Dr. Main introduced Dr. Judith Mitrani-Reiser to give the presentation on the Morbidity and Mortality Project. A link to the presentation can be found below:

### [Morbidity and Mortality Project Update](#)

#### **Discussion:**

The Committee asked about how NIST could implement updates to standards since so many agencies and organizations are involved. NIST responded that the Hurricane Maria NCST is still in the process of developing its findings. Once the findings are established, NIST can determine which organization(s) would be best to work with and who would be best to take the lead in implementing new standards and practices, as NIST may not always be the lead implementing agency. NIST routinely works to update standards or to draft new ones. NIST noted that during the investigation the NCST has established many helpful relationships with organizations that would be helpful with the implementation of new standards. NIST stated that through the Community Resilience Program, which is also under the NIST Engineering Laboratory, NIST has provided tools to allow communities to be more proactive in making changes to their codes and practices. The Committee asked about translating the messages from Spanish to English and conducting analyses in English, and whether NIST had the capacity to analyze the messaging in Spanish and translate the analyses into English to make sure nothing is lost in translation. NIST acknowledged that this is an important question and that while there may be nuances in meaning, the primary focus is to identify the location and other key details which will not be lost in translation. NIST has communicated to the relevant contractors the importance of nuances in Puerto Rican Spanish to make sure as much connotation and context are captured.

The Committee also asked whether there has been an assessment of the effectiveness of the verbal autopsies, as this could help establish a link between injuries and deaths to building failure. The Committee inquired about whether there is a timeline established with the methodology. NIST responded that the next steps are to complete the verbal and social environmental surveys by the end of the calendar year 2022. The Committee asked why NIST is still conducting hospital interviews five years after Hurricane Maria and about how NIST is handling interviews when many people present during the event are no longer there. NIST responded that it has been able to locate many personnel that were on-site during the event although it has been challenging. The

Committee stated that most of the population in Puerto Rico was without power when Hurricane Maria hit due to Hurricane Irma and that this is an important factor to consider. The Committee stated that because of this, there was severely limited communication when Hurricane Maria occurred. The damage done and total absence of communication needs to be taken into consideration when assessing the status of communications after the event. NIST responded that this context has been captured during their interviews with residents of Puerto Rico.

The Committee estimated that 50% of homes built in Puerto Rico are informal construction and do not follow codes and standards. Newer houses built with relief funds are much more likely to be built to proper codes and standards. The Committee asked whether the household surveys gathered for the emergency communications project revealed that the majority of the Puerto Rico population relies on radio communications for emergency information, and whether NIST will have access to the broadcasts made in the days leading up to Hurricane Maria. NIST responded that the Hurricane Maria NCST has collected emergency messages that were transmitted, but not full transcripts. Even information about what stations were broadcasting and when they went off the air could be helpful. This is something that NIST can look into further, but information may not be readily available five years later.

#### **VII. Updates on the NWIRP Project Supporting the Hurricane Maria Program**

NIST then transitioned into the NWIRP presentations for the Hurricane Maria Program. Dr. Maria Dillard introduced the first presenter, Dr. Ken Harrison, who provided an update on the Infrastructure Systems Supporting Critical Buildings and Emergency Communications. The presentation can be found through the link below:

[Infrastructure Systems Supporting Critical Buildings and Emergency Communications](#)

Dr. Dillard then introduced Dr. Jennifer Helgeson, who presented an update on the Recovery of Business Supply Chain Project. The presentation can be found through the link below:

[Recovery of Business and Supply Chains Post-Hurricane Maria](#)

Dr. Dillard then presented an update on the recovery of Social Functions Project. The presentation can be found through the link below:

[Recovery of Social Functions Project](#)

#### **Discussion:**

The Committee noted that the presentations were focused on permanent recovery and asked whether there was any interest in temporary relief from the loss of power and the loss of communication. NIST responded that this is a part of the study's focus and NIST was looking at the cascading effect of how the breakdown of various systems affected each other. The Committee then asked how much NIST knew about the design of the communication towers. NIST responded that it has received information from the Federal Communications Commission (FCC) on the date of construction, but not specific design details. The information NIST has will allow for determination of the codes and standards that were applicable at the time of the tower's

construction. The Committee asked whether NIST has the information about the distribution of change in business revenue across large business chains and if NIST can contrast it against the change in revenue of small businesses and local chains. NIST responded that the NWIRP team has received data from the Small Business Association (SBA) and the Puerto Rico Manufacturing Extension Inc. (PRiMEX) to understand the distribution. NIST does not ignore large businesses but has focused on the recovery of small and medium sized businesses and their dependencies. The Committee noted that the transportation data is likely highly irregular because of much less use of public transportation due to COVID. NIST acknowledged that this was a factor, but that the focus of the survey was on the ability of schools and hospitals to transport people.

### **VIII. Progress of Implementation of Recommendations from Previous NCST Investigations**

Dr. Long Phan and Dr. Marc Levitan then gave a presentation on the Summary of Progress on Prior NCST Investigations. The presentation can be found through the link below:

[Summary of Progress on Prior NCST Investigations](#)

#### **Discussion:**

The Committee asked whether there had been a consideration for other facilities such as bridges, transportation facilities, power facilities, and other structures when making recommendations for updates to the (American Society for Civil Engineers) ASCE-7 standard related to tornado hazards. NIST responded that several other structures were considered, and additional provisions were made for them as well. NIST has also briefed the Federal Energy Regulatory Commission (FERC) and they are already using data provided by NIST for their analyses. The Committee asked whether NIST had plans for the adoption by the appropriate authorities. NIST informed the Committee that NIST is already reaching out to codes and standards bodies to support the adoption of the proposed updates. The Committee asked whether NIST has considered Risk Category II buildings to be covered by the tornado loads. NIST responded that Risk Category II buildings have no tornado hazard at their current reliability requirements. NIST has taken a different approach. Instead of proposing updates to the ASCE-7 to take this into consideration, NIST is conducting an economic study to help develop a design guide with the goal of adding new guidance to the International Building Codes (IBC), and the International Residential Codes (IRC). The Committee asked whether mitigating respiratory infection in shelters was being considered by NIST. NIST responded that it is, workshops were planned, but then had to be postponed because of the pandemic. NIST presented guidance in the International Codes Counsel's (ICC) ICC-500 standard that stated considerations for public health must be a part of the operations plan for public shelters.

### **IX. NCSTAC Preparation of Annual Report to Congress**

The Committee discussed the information presented on the first day of the meeting and then assigned sections of the report to Congress to individual members of the Committee. Once the Committee assigned roles and asked questions of NIST, the first day of the meeting was adjourned at 5 pm.

The next day Mr. Davis convened the meeting with a call to order and roll call. All of the

Committee members were present.

### **X. Champlain Towers Updates**

Before the presentation began the DFO asked if any Committee members had a conflict of interest, and if so, to recuse themselves. None of the Committee members recused themselves. Dr. Corotis made a note that although Committee member Gary Klein did not recuse himself, he does have an outside activity working with civil litigants that have court actions pending related to the Champlain Towers South collapse. Mr. Klein noted that he is free to disclose that his firm was engaged on behalf of the Homeowners Association (HOA) as a potential expert and the litigation has not fully settled. Therefore, he does not intend to offer any observations or findings from the investigation or make any comments based on his firm's learnings. He did note that he may participate and make general comments based on his experience with structural failures. Once the litigation is settled, he will be able to speak more freely.

Dr. Mitrani-Reiser and Ms. Jennifer Huergo gave an overview presentation on the Champlain Towers South Investigation. The presentation can be found through the link below:

[Champlain Towers South NCST Investigation Overview](#)

Dr. Mitrani-Reiser then introduced Mr. Glenn Bell as the Associate Lead Investigator for the Champlain Towers South NCST. Mr. Bell began a presentation on investigation updates that was continued by Dr. Mitrani-Reiser due to technical issues. The presentation can be found through the link below:

[Champlain Towers South NCST Investigation Update](#)

### **Discussion:**

The Committee asked whether the recommendations will impact all of the United States or just local codes and standards. NIST responded that there are many buildings similar to the one being investigated across the US, so a large portion of US building stock could be impacted. The Committee noted that specifically, flat slab buildings should be of interest for recommendations because of their lack of redundancy. The Committee asked whether there are tools available to quantify the collapse and understand it further using the video capturing the collapse. NIST responded that they have been working with digital forensic experts from the police, within NIST, and the FBI to use the video captured in order to conduct an in-depth analysis of the collapse. The Committee commended NIST on their outreach to family members and their efforts to keep them informed. The Committee asked whether the "family liaison" position is a new model or practice that can be followed by other agencies. NIST responded that each tragedy has its own unique community and needs to be addressed in terms of communication. For the Champlain Towers event, the required translation of information from English to Spanish may not be needed in every situation. The National Transportation Safety Board (NTSB) has been a great resource for determining the best way to inform the community. The Committee also commended NIST for its detailed timeline of the investigation.

Dr. Mitrani-Reiser introduced the first set of presenters for the Investigation of the Champlain



Towers South Collapse investigation, focused on preliminary collection and analysis of evidence. Dr. David Goodwin and Dr. Georgette Hlepas presented on the 3D Visualization of Evidence. The full presentation can be found through the link below:

[3D Visualization of Evidence](#)

Following their presentation, Dr. Emel Ganapati and Dr. Kamel Saidi gave a presentation on the Collection of Additional Evidence. The presentation can be found through the link below:

[Collection of Additional Evidence](#)

This presentation was followed by the Non-Destructive Testing of Evidence presentation given by Dr. Scott Jones and Dr. Sissy Nikolaou. The presentation can be found through the link below:

[Non-Destructive Testing of Evidence](#)

**Discussion:**

The Committee asked about how the destructive testing was done, whether individual pieces or several pieces were used, and about how the correlation was being determined. NIST responded that the correlation of materials has begun and contracts to support this effort are in the process of being awarded. An invasive testing plan has been created to test the compressive strengths of the materials used in the construction of Champlain Towers and to build a correlation between the materials. The testing done thus far has focused on determining if any of the materials used differed in any way, or if they were all consistent. The Committee asked whether it will be possible to annotate what information is in alignment with NIST's hypotheses when NIST releases the information they have collected. NIST responded that they are currently developing the scope to make sure everything released is factual and can be traced back to the data collected. The animations NIST releases will be based upon the most probable cause(s) of the building's failure. The Committee commended NIST for their use of different types of non-destructive testing in this investigation.

The Committee asked about the interviews and focus groups that will be conducted and commended the use of social science for this investigation. The Committee inquired about the status of the interview development process and about how NIST would determine the appropriate number of interviews. NIST responded that a social science needs assessment has already been conducted and they are now creating sample forms for Office of Management and Budget (OMB) approval. NIST is also establishing a larger social science team. Thus far, NIST has determined the needs of the social science teams and who should be contacted for focus groups and surveys. Once initial interviews are conducted, NIST can determine the appropriate saturation level needed. The Committee commended NIST's integration of all of the projects for the investigation. The Committee noted that in 1981 NIST conducted a study of a similar collapse in Cocoa Beach, Florida, and the way NIST is approaching and using technology for this investigation is very impressive in contrast. NIST noted that they agreed with the observation and were also glad to be collaborating with other agencies.

The Committee asked about how the material property testing data was progressing, and if anything unusual had been discovered. NIST responded that testing is ongoing, and no comment would be made on the data that has been discovered yet. The Committee commended NIST for its use of outside experts and resources in order to achieve the most accurate results possible.

Dr. Brown-Giammanco gave an overview of the progress on the planned schedule, and opened the next topic on invasive testing, and structural testing and analysis. Dr. Chris Segura and Dr. Ken Hover then gave a presentation on the Invasive Testing of Evidence. The presentation can be found through the link below:

### [Invasive Testing of Evidence](#)

This was followed by a presentation by Dr. Jonathan Weigand and Dr. Jack Moehle on the Structural Testing being done to support the Champlain Towers investigation. A link to the presentation is below:

### [Structural Testing](#)

A final presentation on the Computation Modeling Analysis was given by Dr. Jim Harris and Dr. Fahim Sadek. A link to the presentation is below:

### [Computational Modeling and Analysis](#)

#### **Discussion:**

Mr. Bell started the discussion period by thanking the Committee for their previous recommendations and highlighting how it has impacted the planning and execution of the Champlain Towers investigation. Dr. Mitrani-Reiser then thanked the project leaders for their dedication and contributions to the Champlain Towers investigation. She also encouraged input from the public through the submission of photos and videos via the [NIST Data Portal](#). The Committee commented on how impressive NIST's response to their comments and recommendations has been. The Committee asked whether the weight loads could have been impacted by the building's initial weight design for carpet that was replaced over time with tiles or tiles that were placed on top of tiles and that there is uncertainty about this detail. NIST responded that the uncertainty around this topic is high. NIST is in the process of interviewing people from search and rescue teams as well as former residents to incorporate a range of uncertainty for the weight loads. Real estate transaction records and photographs are also sources of information that are being reviewed for information. NIST commented that resources have been dedicated to this specific aspect of the investigation. The Committee asked about how uncertainty was being taken into account in the collapse model. NIST responded by acknowledging that there is a large amount of uncertainty in multiple aspects of the investigation. NIST is working with statisticians from other areas within NIST to quantify uncertainty issues. NIST is also conducting sensitivity analyses on materials to get a firm understanding of the materials' and building's response. The Committee noted that this is a very comprehensive approach to the investigation, but all the data will not be able to be determined, and some data will be missing. The Committee also noted that sensitivity analyses can be a helpful tool to limit uncertainty. The Committee asked about the difficulty in

replicating the corrosive environment present at the event. NIST responded that an expert in corrosion has been brought in to support this effort, and various methods of accelerated corrosion will be tested to replicate the conditions present in the pool deck area. This will be done to determine at what point corrosion impacts the integrity of the building system. NIST's expectation is that the result of these tests will reveal the structure has little sensitivity to corrosion levels.

The Committee commended the appointment of Dr. Jim Harris to the codes history aspect of the project due to his experience and involvement with codes and standards. The Committee asked if NIST has taken into consideration the varying uses of codes and standards that have changed over time and location. NIST responded that this has been taken into consideration, and some of the engineers that worked on the building have passed away. NIST has made contact with various associates and colleagues of the engineers that developed the building in an effort to determine what codes and standards were followed during the construction of the building.

### **XI. Closing Business**

Mr. Jason Averill, the Materials and Structural Systems Division Chief, gave the closing remarks. He thanked Dr. DesRoches for his time as Chair and the new Chair and Vice-Chair, Dr. Corotis and Mr. Izquierdo-Encarnacion respectively. He also thanked the Committee for their salient and timely input. Mr. Averill again asked for any useful or relevant information from the public to be provided to NIST via the [NIST Data Portal](#). Mr. Averill stated that once the investigations are completed NIST will strive to have the recommendations implemented to ensure the safety of buildings within the United States.

Following the closing remarks, Mr. Davis opened the public comment period. Mr. Aaron Davis from the International Code Council (ICC), spoke. He thanked NIST for their investigation described ICC efforts to convene a group of experts to create guidelines to prevent future catastrophic collapses. While developed specifically for Florida, the ICC will pursue similar national guidelines to be adopted by all of the US. Less than a year after the Champlain Towers South collapse, Florida passed [SB 4-D](#) which mandates milestone inspections of condominiums when buildings reach either twenty-five or thirty years of age, and includes requirements for inspections every ten years after, along with other new requirements. Mr. Davis stated that the ICC looks forward to the results of the investigation and appreciates NIST's efforts. The ICC benefits from NIST's expertise and looks forward to working with NIST in the future.

Following the public comment period, the Committee began their preparation for their annual report to Congress.

Following the Committee's discussion, Mr. Benjamin Davis adjourned the meeting at 4:24 pm ET.