National Construction Safety Team (NCST)
Advisory Committee (Committee) Meeting
National Institute of Standards and Technology (NIST)
Gaithersburg, Maryland
November 7, 2011

Meeting Summary

Committee Member Attendees:

Jeremy Isenberg, Chair	AECOM
Ronny Coleman	Fireforceone
Paul Croce	FM Global (retired)
Susan Cutter*	University of South Carolina
Carlos Fernandez-Pello	University of California, Berkeley
Jeffrey Garrett	CTL Group
Anne S. Kiremidjian	Stanford University
R. Shankar Nair	Teng and Associates, Inc.
James Quiter	Arup
Sarah Rice	The Preview Group, Inc.

*not in attendance

NIST Speakers and Presenters:

Patrick Gallagher	Director, NIST
Shyam Sunder	Director, Engineering Laboratory (EL) and Designated Federal Official
Eric Letvin	Director, Disaster and Failure Studies Program
Marc Levitan	Lead, National Windstorm Impact Reduction Program (NWIRP) R&D
Erica Kuligowski	EL
Frank Lombardo	EL
Long Phan	EL

DoC, NIST, and Contractor Support:

Damien Bertot	NIST
Stephen Cauffman	NIST
Sherri Diaz	NIST
Tina Faecke	NIST
Simon Frechette	NIST
Frank Gayle	NIST
William Grosshandler	NIST
Anthony Hamins	NIST

Michelle Harman	NIST
Jack Hayes	NIST
Melissa Lieberman	DoC
Nancy McCabe	NIST
Steve McCabe	NIST
Michael Newman	NIST
Fahim Sadek	NIST
Rose Van Camp	NIST
Nathan Walker	NIST
Francoise Arsenault	BRI Consulting

Summary of Discussions

I. Welcome and Opening Remarks

Eric Letvin, Director of the Disaster and Failure Studies Program, welcomed everyone. He then introduced Jeremy Isenberg, Chair of the Committee, who welcomed the members. After introductions (bios are available at www.nist.gov/el/disasterstudies/ncst/ncstac_members.cfm), the Chair reviewed the charge to the Committee, as set forth in the Committee charter (www.nist.gov/el/disasterstudies/ncst/ncst_charter.cfm).

Shyam Sunder, Director of the Engineering Laboratory at NIST, thanked the members for their service. He discussed the work of the previous Committee, which was convened in 2002 to advise NIST and the NCST on the development of the World Trade Center (WTC) report. Since the completion of the WTC reports, the Committee has been dormant. This Committee has a new charge, and its members represent a cross-section of the disciplines that are the subject of NIST reports.

Sunder drew attention to the National Construction Safety Team (NCST) Act (Public Law 107-231) (Act), specifically Section 2(b), which describes the purpose of the investigations and the duties of the teams.

In response to a request from the Chair, Sunder provided his thoughts on the most important questions to be answered by the Committee:

1. Does NIST have the correct decision criteria in place for launching NCST studies?
2. Is the study of the Joplin, Missouri tornado proceeding as it should?
3. Is the NIST approach for implementing and executing NCST studies appropriate?
4. How can NIST improve its processes for the archiving and dissemination of data?

Patrick Gallagher, Director of NIST, also welcomed the members and discussed the decision to reconvene the Committee and the best approach to implementing the Act. Once NIST decides to launch a study based upon the established criteria, the next phase is carrying out the study. NIST seeks to obtain information utilizing a minimally disruptive process. The input of the Committee will be sought for this phase of the process, in developing recommendations, and in producing final reports. Acting on lessons learned from the study is a critical part of NIST's

responsibilities, and study recommendations are frequently put into practice via codes and standards.

Gallagher remarked that federal advisory committees serve as a powerful and unique mechanism for obtaining non-federal input into federal programs. The focus of this Committee is very different from the previous Committee. The new charge to this Committee is helping NIST to determine how to design and run the program with respect to NCST studies. He emphasized the importance of the Committee's recommendations, all of which he will take very seriously.

II. Disaster and Failure Studies Program Overview

Sunder provided an overview of the Disaster and Failure Studies Program (Program) (www.nist.gov/el/disasterstudies/ncst/upload/SunderD-FSNCSTAC110711.pdf). He discussed the core mission and functions of the Program, the statutory authority for the Program, five typical study objectives, the types of disaster and failure studies, and the role of NIST in the studies. The budget for the Program in Fiscal Year (FY) 2011 was $650,000. For FY 2012, a NIST budget initiative of $1.8 million was requested, including funds for expanding the disaster and failure data repository.

Sunder discussed the NIST role in studies led by other agencies, such as the Federal Emergency Management Agency (FEMA)-funded Building Performance Assessment Team (BPAT) studies, and studies of the earthquakes in Haiti and Chile led by the American Society of Civil Engineers (ASCE) and the Earthquake Engineering Research Institute (EERI). Under the legislation for the National Earthquake Hazards Reduction Program (NEHRP), post-earthquake investigations fall under the purview of the U.S. Geological Survey (USGS). The pending NEHRP reauthorization would transfer the lead role in post-earthquake investigations to NIST. Sunder clarified that the safety of occupants in buildings is a focus of NCST studies. Gallagher added that the NCST legislation is very specific on the building focus. The Program, however, must be viewed in context. It is fair for the Committee to articulate touch points that impact the NCST. It also is within the charge of the Committee to advise NIST to focus on buildings and infrastructure.

A member asked how the process distinguishes between fire codes and building codes. Sunder explained that NIST considers where changes are to be implemented. If changes are required in the fire code area, that is the direction NIST pursues. All codes relevant to building and fire safety can be the focus of recommendations. Sunder elaborated on the NIST role in codes and standards. In the WTC Investigation, a decision was made early on to focus on model code changes. Building code experts were convened through a NIST contract to the National Institute of Building Sciences (NIBS) to determine how to accomplish this. Through collaboration, NIST was able to participate in the International Code Council (ICC) code change process in 2007, 2009, and 2012. The entire NIST team was thrilled at the end of the process. The model code changes that were finally adopted were significant. In the standards area, the results have been more mixed. Changes also have been incorporated by the National Fire Protection Association (NFPA). In other areas, standards changes have been less significant. These will take longer.

Sunder also discussed how NIST determines whether an event warrants NIST study. These decisions are made at NIST, which monitors events 24/7. For example, NIST staff monitored the

Oklahoma earthquake this past weekend via the USGS Prompt Assessment of Global Earthquakes for Response (PAGER) notifications and other tools. Another example is the recent earthquake in Turkey. Letvin was able to provide Sunder a preliminary evaluation using established criteria on whether or not to deploy for those events within about two hours after they occurred.

III. Disaster and Failure Events Data Repository

Letvin presented on the data repository for disaster and failure events (http://www.nist.gov/el/disasterstudies/ncst/upload/NCSTAVmtgDataRepositoryLETVIN110411.pdf). He discussed the three phases of the NIST repository development. Phase 1 (the WTC) was released this August (www.nist.gov/el/disasterstudies/repository_home.cfm). The repository, which was developed in less than one year, contains more than 94,000 videos and photos and is user friendly. Since its release in August, there have been more than 300,000 page views. The platform for the repository is Gallery, an open source application.

The Phase 2 repository (Chile earthquake pilot) will offer new features from the Phase 1 repository and may employ a different platform. The Chile earthquake was selected for Phase 2 because it served a dual purpose as a repository and as support to NEHRP work with the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES). Milestones for the Phase 2 repository include a draft by March 2012; the final repository by June 2012; and a system assessment in August 2012. Work on Phase 3 has not yet begun. Letvin also described the new NIST Disaster Failure Studies website (www.nist.gov/el/disasterstudies/index.cfm), which includes reports and Committee information.

A member remarked on the many existing databases, including those maintained by the insurance industry. An important feature of the NIST repository is access by the public. Letvin stated that the goal is to keep as much data as possible in the public domain. In terms of promoting the repository, Letvin presents at conferences and workshops, writes papers and articles, and networks with stakeholders. NIST also has many media contacts for outreach. Links to other relevant databases, such as the Consortium of Organizations for Strong Motion Observation Systems (COSMOS) database, will be included in the repository.

The Committee discussed the process for admitting information to the repository. Sunder stated that NIST will determine minimum criteria for inclusion into the repository. A member commented that it may be advisable to establish firm and discrete criteria or standards for accepting and rejecting data to the repository. Letvin stated that this is being considered; it is a separate issue, however, from quality. Sunder added that any standards established must be very even-handed. It was noted that when another group's report on an event is posted to the repository, there will be disclaimers included stating that the report is not endorsed by NIST.

The Committee members, to a person, remarked that the repository is a tremendous effort on the part of NIST, and is meeting a need discussed for years in the earthquake community. Sunder stated that the input of the Committee will be very valuable in determining if and how to scale up the repository.

IV. NCST Study on the Joplin Tornado

A. Presentation by Marc Levitan

Levitan provided an overview of the NCST study of the May 22, 2011 Joplin tornado (www.nist.gov/el/disasterstudies/ncst/upload/NCSTACJoplin110411.pdf). The NCST reconnaissance team was composed of himself, three other members from NIST, and one member from the National Oceanic and Atmospheric Administration (NOAA). The team members are authoring the reconnaissance report.

A member asked about the anticipated impact of the study related to "producing the technical basis for cost-effective changes in national codes, standards, and practices." Levitan stated that the study team will consider this impact in a broad and historical context. Sunder added that based on R&D, NIST pursues the most effective ways of improving safety and, ultimately, cost-effectiveness decisions are made by building and fire code officials and others who vote to adopt any changes. The Committee also inquired if the Joplin investigation will be sufficiently detailed to generate information on what works and what does not work and trends for the future. Levitan stated that NIST will look at different building technologies. However, the investigation is somewhat limited in scope. In terms of quantifying resilience, tools should be developed down the road to accomplish this.

B. Presentation by Frank Lombardo

Lombardo presented on tornado hazard characteristics associated with the Joplin event (*see link for IV. A. above*). A preliminary finding is that the tornado rating procedure (Enhanced Fujita (EF) intensity scale) lacks adequate indicators for distinguishing intense tornadoes.

The Committee asked about the size of the discrepancy between the actual event and the forecast from NOAA (at 3:00 p.m., NOAA gave a 10 percent probability of a strong tornado (EF2 or greater) within 25 miles of Joplin). Lombardo stressed that the environmental conditions fit the climatology for strong tornadoes, however the formation of tornadoes and specifically strong tornadoes from those environments is relatively poorly understood. The Committee also discussed the disparity between the numbers provided by Jasper County and the U.S. Army Corps of Engineers on damaged and destroyed structures. Lombardo stated that the use of the same vocabulary is important to reconciling disparities and achieving consensus. This could be part of the study's recommendations.

C. Presentation by Erica Kuligowski

Kuligowski briefed the Committee on emergency communications and public response associated with the tornado (*see link for IV. A. above*). A NIST survey of communities shows a significant disparity in how warnings are disseminated in different communities. In addition, many communities do not have sirens. Studies also show that a warning lead time of more than 15 minutes is not necessarily more effective in terms of saving lives.

Kuligowski stated that an important part of the Joplin study is determining what factors influenced the behavior and fate of individuals, and what they did in response. The plan is to expand study results to other disasters. A member mentioned that the NFPA is addressing mass notification and may benefit from this study.

D. Presentation by Long Phan

Phan presented on the performance of buildings, designated safe areas, and lifelines (*see link for IV. A. above*).

A member asked about power lines in Joplin (many were overhead) and if the study will consider telephone/wireless communications. Sunder stated that the team will focus on performance of lifelines as related to functionality of buildings and facilities.
The Committee discussed reasons for the very high number of casualties caused by the Joplin tornado. Levitan stated that this information is still being gathered. He noted that one of the primary reasons NIST chose to deploy to Joplin is the high number of casualties. NIST will attempt to correlate the fatalities with where people were located and their actions when the tornado struck. This also will be tied back to performance of residential, commercial, and critical buildings and viewed holistically.

Phan commented that the effects of the Joplin tornado on robust, engineered structures made this tornado somewhat unique. NIST plans to carry out comparative studies with other tornado effects on similar structures. In the Joplin study, data is also being collected on buildings that were not damaged.

V. Recent Non-NCST Studies

Sunder presented on recent non-NCST studies, including the Sofa Super Store fire in Charleston, South Carolina; the Amarillo, Texas Wildland-Urban Interface Fires; the collapse of the Dallas Cowboys Indoor Practice Facility; earthquake damage assessments in Chile, New Zealand, and Japan; and the study of the Mineral, Virginia earthquake (www.nist.gov/el/disasterstudies/ncst/upload/SunderNonNCSTStudies110711.pdf).

The Committee discussed the criteria used to launch NCST studies. Sunder clarified that the criteria apply to all NIST studies. The question of which statute to use is study-specific. The Committee also asked about the tie-in with the National Institute for Occupational Safety and Health (NIOSH) in terms of investigating "line of duty" deaths. Sunder stated that NIST considers structural fires to be within its jurisdiction and the primary basis for its studies. The expertise that NIST brought to the Charleston fire was focused on the dynamics of the behavior of the fire, not the deaths of the firefighters. In the Amarillo fire, the purpose was to collect field data and refine fire spread models. This was more of a science-driven R&D study.

The Dallas Cowboys indoor practice facility study was considered an extended preliminary reconnaissance. NIST spent about 6 months on this study, with the majority of work completed in 3 months. This was not a major study; rudimentary modeling was done. A member asked about the stage collapse at the Indiana State Fair this summer. Letvin reported that he completed the decision criteria for this event and it did not meet the score for a study.

In terms of funding, all studies, with the exception of the WTC Investigation, are supported with federal (NIST) R&D funds. In the case of the WTC Investigation, there was a special appropriation from Congress to NIST via FEMA. NIST also works on a reimbursable basis at

times for other agencies.

VI. Committee Discussion

Isenberg opened the discussion by expressing his appreciation for all of the effort that went into the very comprehensive and well done Committee briefings. He thanked everyone at NIST for providing the Committee with such an informative first session. He asked the members to briefly discuss what they have learned with respect to the Committee charge.

Ronny Coleman: The briefings were very informative. Understanding the limits of the studies and the criteria used for decision-making are important outreach issues.

Paul Croce: It is impressive that this work is being done at the national level. Too much time, however, may be spent on determining if the study is a NIST-based study, a NEHRP-funded study, or a study funded by other agencies. Time is of the essence. Trained staff should arrive quickly at events. NIST also should consider adding criteria for unusual events, such as the stage collapse at the Indiana State Fair, and should clearly define what will be included in the data repository.

Carlos Fernando-Pello: The briefings were informative and interesting. The information in the fire reports is of great value. There are questions about separating the interior of buildings from the infrastructure.

Jeffrey Garrett: The purpose of the studies is to produce code changes. The NIST team is to be complimented on the scope of the work and their accomplishments.

Anne Kiremidjian: The work to date is impressive, particularly the repository project. It is noteworthy that the studies are undertaken to support the development of codes. This includes a tremendous amount of science in support of technical credibility.

R. Shankar Nair: The numerical approach of the decision criteria appears sound. With regard to the criterion for NIST involvement, this should be considered at the outset. If there is no requirement for NIST involvement, there should be no need to proceed further.

James R. Quiter: Meeting only once a year will be a challenge if we are to provide meaningful input, particularly as the committee gets started. A cohesive program of all NIST investigations and advisory committees is needed. To facilitate this, the Chairs of the NIST Advisory Committees should speak to each other. With regard to building codes, there is almost no discussion of risk at code hearings. A role for NIST may be greater involvement in risk discussions. In addition, the NFPA is cutting back on investigations, which will leave a large void. The human factors element is very important. In terms of funding, sufficient staff is needed to send out on investigations.

Sarah Rice: The NIST study teams appear to be very qualified. From the engineering perspective, it is encouraging that we are moving into a world where code changes are based on science, data, and statistics.

The Chair opened the Committee discussion of the NCST program. A summary of the discussion by topic area follows.

Decision Criteria: The Chair stated that the decision-making algorithm adopted by NIST for launching studies appears sound. His hope is that NIST will provide the latitude for the criteria to mature. Refinements, if appropriate, should be based on a backward look as NIST moves forward.

Kiremidjian asked about the current decision-making approach in terms of bias built into the scoring system. For example, is there a bias toward natural hazards? The Committee discussed the E2 nightclub disaster in Chicago; the source of the disaster was a fight between patrons. This type of cause is not found in the criteria. Sunder pointed out that if there are only four out of eight possible factors, the factors are divided by four. Nonetheless, the cause could affect the decision to investigate. He added that NIST has been satisfied with its decision making. Externally, there have been some issues. This is the first time the decision-making criteria are being reviewed and discussed in a public forum. He revisited the comment that NIST involvement should pre-empt all of the criteria. NIST should determine if it is the appropriate agency. However, he does not believe that this is a pre-emptive factor in terms of the decision to launch a study.

Data Collection and Codes and Standards: The Chair asked the members about the interface between data collection and codes and standards processes. NIST has staff involved in this process, which is to be commended, assuming adequate and proper human resources are assigned to the task. In large part, the successful interface depends on the interpersonal dynamics between staff and the code writing bodies. The Committee may want to consider if NIST has the necessary influence it deserves in this area.

The Committee discussed National Fire Incident Reporting System (NFIRS) data. A member stated that NFIRS is not designed to capture data on an incident. NFIRS allows for the study of structures across the United States but not one structure in particular. Coleman remarked that very few fire departments voluntarily participate in NFIRS. Most in the community do not believe it is a reliable source for developing policy. He also remarked on the effects of codes in saving lives. In the 1970s, there were about 10,000 deaths a year from fires. Today, there are about 3,500 a year.

Data Repository: The Chair stated that funds must be committed at the outset so that the repository is supported 3 years from now. The technologies of the future also must be given great weight. Kiremidjian agreed that funding must be in place to guarantee the long-term viability of the repository. Sunder noted previous estimates of $2 million to operate and maintain the repository. Rice asked about NIST plans to include past studies in the repository. This will be done on a selective basis in Phase 3.

Coordination and Interaction with other Programs: Kiremidjian asked about coordination with other programs, such as study teams funded under the National Science Foundation (NSF) RAPIDS grants. Sunder stated that NIST makes every effort to coordinate

with NSF and other agencies, although this is not always an easy task. In response to a question on turf battles on disaster investigations, he stated that in the world of disaster investigations, people know each other and there are good relationships. There have not been any difficulties in NIST studies. There was excellent cooperation on the WTC Investigation. NIST also tries to build relationships with local authorities, when possible. This was done very well with New York City during the WTC Investigation.

Risk: Coleman stated that risk should be included as part of the equation. The need is to consider low probability but high consequence events. Nair commented that tornadoes, which are very high probability when considered cumulatively, would be an appropriate topic for future studies, with a focus on better communication and warning systems and evacuation procedures. Garrett remarked that the question goes back to the discussion of high risk versus the low probability of killing 162 people again. Croce stated that he would rather have NIST acknowledge that tornadoes are low probability events, and he does not see the need to focus on risk in NCST investigations. Kiremidjian commented that risk comes into play because the event will occur in a given area and will cause probable losses. She mentioned Performance-Based Engineering, which the Committee may want to consider

Topics for Future Studies: The Chair asked the members for their thoughts on tornado hazard preparedness and response as a priority topic given the 500 people who have died from tornadoes in the United States this year. Nair agreed that tornadoes are a logical outcome of the Joplin study, with a focus on warning systems and interior safety and creating shelters that could save lives. Quiter also agreed that it is logical to pursue recommendations from the Joplin study, but advised that the Committee not be restricted by what is currently being studied. Kiremidjian agreed.

Committee Reports and Recommendations: The Chair asked about the annual report from the Committee. Sunder stated that the statute requires the Committee to prepare an annual report. The Advisory Committee on Earthquake Hazards Reduction alternates detailed annual reports with shorter, summary annual reports. Garrett recommended that the first Committee report be brief, essentially a summary of today's discussion.

After further discussion, the Committee agreed to the following responses to the charges posed at the start of the meeting (the responses may be incorporated in the first annual report of the Committee):

> *1. Does NIST have the correct decision criteria in place for launching NCST studies?* The decision criteria and the subjects of the NCST studies appear to be appropriate. The Committee will further consider risk as an element of the decision criteria.
>
> *2. Is the study of the Joplin, Missouri tornado proceeding as it should?* The study to date is thoughtful and well done. The subject of NCST studies should not be restricted to tornadoes. Lessons learned from the Joplin tragedy can be applied across the spectrum of hazards.

3. Is the NIST approach for carrying out NCST studies appropriate? The NIST approach to carrying out the NCST studies seems appropriate. Consideration of the human factor is critical.

4. How can NIST improve its processes for archiving and dissemination of data? All of the Committee members are very impressed with the data repository project. The Committee endorses the expansion of the repository to a national database that would support a top tier level of knowledge of the built environment.

VII. Public Comments

There were no public comments.

VIII. Adjournment

The Chair thanked the members and adjourned the meeting.