Community Resilience Panel:
Data, Metrics, & Tools Standing Committee Meeting

MEETING DATE: Monday, April 04, 2016
TIME: 1:00 – 4:30 PM PDT
ISSUE DATE: June 7, 2016

ATTENDEES:

Attendee	Affiliation
Megan Clifford [Chair]	Argonne National Laboratory
Paolo Bocchini [Vice-Chair]	Lehigh University
Naiyu Wang [Secretary]	University of Oklahoma
James Arnott	Aspen Global Change Institute
Bruce Ellingwood	Colorado State University
Eleanore Hajian	DHS S&T Office of University Programs
Ting Lin	Marquette University
Aaron Marks	Dynamis, Inc.
Duane Verner	Argonne National Laboratory
Jay Raskin	Jay Raskin Architects
Jeff Rubin	Tualatin Valley Fire & Rescue
Jesse Keenan	Columbia University
Howard Harary	NIST
Denzel Fisher	ERTIC, LLC
Emily Wasley Seyller	Cadmus
Mat Heyman	Impresa Management Solutions
John Hooper	MKA
Allison Boyd	Multnomah County
Frank Lavelle	Applied Research Association
Rahul Mehra	Cargill Inc.

DISTRIBUTION: Attendees and Data, Metrics, & Tools Standing Committee
NOTES BY: Naiyu Wang, the University of Oklahoma

1. Welcome

Megan Clifford (Chair) called the meeting to order. Megan welcomed and thanked attendees for participating.

2. Presentation: FEMA P-58 by John Hooper

FEMA P-58 is the principal product under a combined 10-year work effort, completed in September 2012, to develop a methodology for seismic performance assessment of individual buildings that: 1) properly accounts for uncertainty in our ability to accurately predict response and 2) communicates

performance in ways that better relate to the decision-making needs of stakeholders. The final products describe the resulting methodology, as well as the process of developing the basic building information, response quantities, fragilities, and consequence data that were used as inputs to the methodology. To allow practical implementation of the methodology, work included the collection of fragility and consequence data for most common structural systems and building occupancies, and the development of an electronic Performance Assessment Calculation Tool (PACT) for performing the probabilistic computations and accumulation of losses.

Action Item: The committee will look at the document and decide whether to recommend it for inclusion in the RKB.

3. Meeting logistics

Megan reviewed the April 4th Meeting Agenda and proposed a motion (moved by Paolo, seconded by Naiyu), which the committee unanimously approved.

James proposed a motion to approve the March 18th Meeting Minutes (moved by Aaron, seconded by Ting), which the committee unanimously approved.

Working group assignments are:

Group A - Data	Joe O'Keefe, Mat Heyman, Eleanore Hajian, Ting Lin
Group B - Metrics	James Arnott, Aaron Marks, Jeff Rubin, Duane Verner
Group C - Tools	Bruce Ellingwood, Emily Wasley Seyller, Frank Lavelle
Floating members	Megan Clifford, Paolo Bocchini and Naiyu Wang

RKB: Eleanore Hajian, Aaron Marks, Jeff Rubin and James Arnott

Overview of working group objectives: Megan suggested the following questions be discussed in the working groups:

- What already exists? Pros and cons? Recommend for RKB?
- What does not exist? What actions do we recommend to close the gap?
- What are the planned activities for this working group?

Megan also suggested the working groups complete the slide template for report out.

Plan for Report Out: One person from each working group will report to the Panel after the committee meeting.

4. Presentation: Brief Overview of NIST COE by Bruce R. Ellingwood

Modeling the resilience of communities and cities to natural disasters depends on many disciplines, including engineering, social sciences, and information sciences. No one discipline has the ability to model community resilience comprehensively, and the science to measure resilience quantitatively to inform decision-making currently does not exist. In 2015, the National Institute of Standards and Technology (NIST) established the Center for Risk-Based Community Resilience Planning, comprised of ten universities, headquartered at Colorado State University in Fort Collins, Colorado. The Center's overarching goal is to establish the measurement science for community resilience through three major research thrusts:

- ***Thrust 1.*** Develop a multidisciplinary computational environment with fully integrated supporting databases, known as NIST-CORE. NIST-CORE will enable full understanding of the inter-relationships between physical and social infrastructure systems that determine community resilience and will facilitate resilience planning and risk communication among stakeholders.
- ***Thrust 2.*** Produce a standardized data ontology, robust data architectures, and effective data management tools to support the computational environment developed in Thrust 1.
- ***Thrust 3.*** Validate the resilience data architecture through a series of testbeds that stress the process of data collection, its integration into the computational modeling environment, and decision algorithms. (Website: http://resilience.colostate.edu/; Email: resilience@colostate.edu)

5. Reference Material Presentations

5.1 Climate Resilience Toolkit by James Arnott (https://toolkit.climate.gov/)

The Climate Resilience Toolkit was supported by the White House and led by NOAA. In addition, ten other federal agencies were involved in this effort. The Toolkit specifies five steps to resilience. These steps are similar, but not identical to the NIST six-step resilience planning:

- Problem identification
- Vulnerability assessment
- Option development
- Risk and cost evaluation
- Action taking

Resources on the website include:

- Real world case studies
- Risk and vulnerability assessment tools
- A climate navigator for mapping and visualization
- Narratives on national climate assessment on regional risk impact
- Links to all the resources available across different federal agencies and institutions
- A data search engine that can link to available raw data set

Comments: This website has a slight emphasis on coastal communities and sea level rise, a focus on vulnerability assessment, and more resources for the early stages of the resilience planning.

5.2 Review of Climate Change Adaptation Indicators & Metrics by James Arnott (Paper draft – Evaluation that counts: A review of climate change adaptation indicators & metrics using lessons from effective evaluation and science-practice interaction.)

The draft Climate Change Adaptation Indicators & Metrics document discusses a broad range of indicators and metrics (I&M) on sustainability, resilience, climate, natural hazards and environmental health. The document's appendix includes links to forty-three (43) sets of I&Ms specific to adaptation/resilience success. These I&Ms are categorized into four domains based on where/by what organization they were developed:

- In academia
- By program sponsors (e.g., Rockefeller foundation)

- By boundary organizations
- By on-the-ground implementers (e.g. city government)

The paper concludes that evaluation of adaptation progress and effectiveness – if it is to usefully inform the adaptation practices of cities or other adaptation implementers – would benefit from greater attention to the concepts offered in the related, but largely still separate, fields of evaluation and science-practice interactions.

Suggestions (James). The data structure of RKB should help navigate the users to the information they are looking for by asking questions (e.g., Who are you? In what context are you working? What hazard is your primary concern? What stage are you at with your resilience planning activity? What barriers are you facing? Etc.).

5.3 Review of UNAVCO by Ting Lin (http://www.unavco.org/data/data.html)

UNAVCO includes data from geodetic scientists (primarily academia & government) that covers multiple hazards. Data types include GPS/GNSS, imaging data from radars and lasers, strain and seismic borehole data, and meteorological data.

Comments: A "happy agency family model" such as UNAVCO (NSF, NASA, NOAA, USGS) could provide an effective data platform. Data connection is key: Connecting hazards to resilience requires bridging research gaps among science, engineering, and policy, potentially via organizations such as American Geophysical Union (AGU), American Society of Civil Engineers (ASCE), and Federal Emergency Management Agency (FEMA).

5.4 Review of US Resiliency Council by Ting Lin (http://www.usrc.org/)

The building resilience rating system from the US Resiliency Council (USRC) is analogous to the sustainability rating system from Leadership in Energy and Environmental Design (LEED). The resilience system is hazard-specific, currently focusing on earthquakes, and is based on building/system performance levels.

Comments: Communication via rating (number of stars) or traffic light indicators (e.g., USGS PAGER) can be effective. Performance-based earthquake engineering (PBEE), exemplified by FEMA P-58, translates engineering results IM-EDP-DM-DV in terms of PEER's 3Ds to help decision making by stakeholders. More accurate rating requires PBEE refinements, e.g., Risk-based (or time-based) vs. intensity-based assessments. The potential of industry/academic partnership for other hazards.

5.5 Review of Arup City Resilience Framework by Ting Lin (http://publications.arup.com/Publications/C/City_Resilience_Framework.aspx, The Rockefeller Foundation | Arup)

The ***City Resilience Index*** focuses on learning from literature, case studies & cities. The index is not hazard-specific. It includes twelve indicators in four categories (health & wellbeing, infrastructure & environment, economy & society, and leadership & strategy) and relevant qualities.

Comments: Understanding of qualities that matter for resilience can be transferrable to different communities in a variety of hazards. Previous work (e.g., REDi) and ongoing work (e.g., City Resilience Index) by Arup demonstrates the role of industry leaders in resilience.

Synthesis and Suggestions (Ting). Both hazard and system considerations are essential; both quantitative and qualitative measures are important. Adapting to a changing climate (e.g., sea-level rise) especially in coastal regions could be key.

Related committee efforts:

- Dick Wright's document, climate change adaptation (ASCE initiative)
- Jerry Brashear's document, importance of risk analysis
- John Hooper's presentation, PBEE via FEMA P-58
- James Arnott's climate change work
- Eleanore Hajian's US/DHS coastal resilience and recommended European/Zurich flood
- Jeff Rubin's recommended document, measures of community resilience.

This DMT committee has the potential to integrate the six disciplines – Buildings & Facilities, Communication, Energy, Social & Economic, Transportation, and Water & Wastewater – with a systems approach. It is important to understand general and discipline-specific needs in order to focus on data, metrics, and tools priorities. Perhaps this committee can devote time to data management to better serve the six disciplines.

- What can we learn from earthquake and climate change communities to advance hazards, risk & resilience?
- To minimize duplicate effort, coordination among various agencies (e.g., NIST, FEMA, HUD, NOAA, DHS, NSF) could be beneficial, since each has its own strength and it would be most efficient to leverage existing resources.

5.6 Committee on Measures of Community Resilience by Jeff Rubin

Summary of a workshop by Committee on Measures of Community Resilience from Resilient America Roundtable, Policy and Global Affairs Division, National Research Council of the National Academies. Looked at four broad areas – *vulnerable population* (minority status, health issues, mobility, and socioeconomic status); *critical and environmental* infrastructure (e.g. water and sewage, transportation, power, communications, and natural infrastructure); *social factors* (e.g., social capital, education, language, governance, financial structures, culture, and workforce); and *built infrastructure* (hospitals, local government, emergency response facilities, schools, homes and businesses, bridges, and roads). The workshop addresses three broad questions: 1) What is the value of resilience? 2) How do I know that my investments are going to increase my resilience? and 3) How can measures/indicators be scaled and adapted to different frames of reference (e.g., community-to-community; nongovernmental organizations-to-business; citizen-to-elected official)? The workshop suggests indicators and metrics for each of the four areas and specifies resilience goals.

Suggestions (Jeff). This is an on-going effort. Our committee should be better connected to this effort.

5.7 DHS Coastal Resilience COE by Eleanore Hajian (http://coastalhazardscenter.org/)

The mission of the DHS Coastal Resilience COE is to enhance the nation's ability to safeguard infrastructure and economies from coastal natural hazards such as floods and hurricanes. The COE will also consider the impact of future climate trends on coastal resilience. Research and education areas include coastal infrastructure resilience, building resilient communities, disaster dynamics, and education and workforce development.

- Disaster Recovery Tracking Tools
  - https://showcase.hsuniversityprograms.org/events/resilient-communities-presentations/#tabc3
  - https://showcase.hsuniversityprograms.org/events/resilient-communities-presentations/#tabc2
  - https://www.hsuniversityprograms.org/

6. Working Groups Convene

6.1 Working Group A – Data (notes taken by Ting Lin)

- Begin developing a project plan:
  - Start with a review of NIST Guide Steps 1-2 (e.g., p.26-36).
  - Recommend one-stop shop that serves as match-maker pointing to a list of informative documents/directories of experts and organizations (e.g., Community A did this with NOAA).
  - Identify gaps in the guide (e.g., USGS is responsible for X and can provide Y expertise).
  - List alternative helpful resources in which the stakeholder should be involved.
  - Provide examples/case studies of how others do this, potentially modified for local contexts.
  - Note: Output should be coordinated with RKB.

- Develop plan as to how standing committee will develop selected work products
  - The products identified above will be developed at the standing committee level.
  - The chair/leadership team will lead/chair the work group.
  - Panel members from other standing committees will be needed in the work group, e.g., Buildings & Facilities.

6.2 Working Group B – Metrics (notes taken by Jeff Rubin)

- DHS Risk Lexicon (2010): sufficient?
- What does a community need to sustain the social fabric after a disaster?
  - Different tiers (speed, service levels) up to communities.
  - Direct measures vs. indicators.
  - Indicators of vulnerability or success? Processes or outcomes?
  - What indicators are already being used?
  - What has been investigated, even if not used?
  - How do we validate indicators?
  - Once adopted, who monitors indicators to determine gaps/needs?

6.3 Working Group C – Tools (notes taken by Emily Wasley Seyller)

- **Begin developing a project plan**
  - Develop recommendations on ways to organize the Resilience Knowledge Base (RKB) that can support the 6-step process.
  - Identify sources of funding opportunities that can support the 6-step process (make it searchable by hazard, sector, user, etc.).
  - Request that a consensus and voluntary standard (developed by SDOs) guideline be developed for plan preparation, review, approval, implementation, and maintenance of plans (steps 5 + 6) and identify the appropriate organization to lead.
  - Develop plan as to how standing committee will develop work products selected
    - Prioritize/select metrics – select core set metrics that all communities should consider on resilience assessment and planning.
    - Identify tools to support steps 5 and 6.
    - Identify metrics/tools that can evaluate the success of implementation of resilience plan (or recovery).
    - Identify tools that can evaluate the cost and benefit of alternative risk mitigation strategies.

7. Report Out to Panel (see Report-Out Slides)

- Group A – Data, presented by Joe O'Keefe
- Group B – Metrics, presented by Jeff Rubin
- Group C – Tools, presented by Emily Wasley Seyller