NIST Community Resilience Program

Gaithersburg, MD

April 9, 2015

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What is the Problem?

- Natural and man-made disasters result in significant costs due to direct and indirect losses.
- Superstorm Sandy caused over $65B in losses.
- Large single events can cause losses exceeding $100B.
- Current approach of response and rebuilding is impractical and inefficient for dealing with natural disasters.
- Planning does not account for interconnected nature of buildings and infrastructure, nor for the affect on social institutions.
- Changing nature of hazards is not always considered.
NIST Community Resilience Program

*Stakeholder Engagement component is called out in the President’s Climate Action Plan
What is Disaster Resilience?

• The term "resilience" means the ability to *prepare for* and *adapt to* changing conditions and *withstand* and *recover rapidly* from disruptions*

• In the context of community resilience, the emphasis is not solely on mitigating risk, but implementing measures to ensure that the community recovers to normal, or near normal *function*, in a reasonable timeframe.

*As defined in Presidential Policy Directive 21.*
What is a Community?

- A community can be defined as having the following attributes:
  - Clear geographical boundaries
  - A governance structure able to make decisions and either implement actions or influence the actions of others

- Examples of communities include, but are not limited to:
  - Cities, towns, counties
  - College campuses
  - Military bases

- Some systems (e.g., electric power) often extend beyond the boundaries of the community.
Community Needs Drive Functional Requirements for Buildings and Infrastructure

- The effects of hazards often result in damage to buildings and infrastructure.
- The consequences are felt in the social and economic systems and can have far-reaching effects.
Community Resilience for the Built Environment

• Natural hazards
• Manmade hazards
• Degradation
• Climate change

Goal: Limit disruption to a duration desired by the community for an expected (design level) event, and minimize detrimental effects.
Attributes of Resilience

• Functionality – Resilience should be based on the ability of social systems to resume function within a prescribed period of time following an expected event. Buildings and infrastructure must be functional to support these social systems.

• Dependencies – Resilience must consider the dependencies of buildings and infrastructure and the relationship of individuals and organizations with the built environment.
Attributes of Resilience (Cont.)

• Three levels of hazard
  – Routine
  – Expected (design level)
  – Extreme

• Time basis – Resilient performance will require a timescale for when buildings and infrastructure need to be returned to service to meet social needs.

• Three phases of recovery for resilience
  – Short Term (Days)
  – Intermediate (Weeks)
  – Long-Term (Months/Years)
NIST Community Resilience Program

NIST is:

- **Convening** the highly diverse stakeholder interests to:
  - Develop the first version of a comprehensive Disaster Resilience Framework for achieving community resilience that considers the interdependence of the community's physical and human assets, operations, and policies/regulations
  - Establish a Disaster Resilience Standards Panel to further develop the Disaster Resilience Framework (version 2.0) and,
  - Develop Model Resilience Guidelines for critical buildings and infrastructure systems essential to community resilience based on model standards, codes, and best practices
- The Disaster Resilience Framework Version 1.0, formation of the Disaster Resilience Standards Panel, and Model Resilience Guidelines are called out in the President’s Climate Action Plan
Disaster Resilience Framework

- The disaster Resilience Framework is targeted to local government as a logical convener
- Expands on previous disaster resilience work in the public and private sector
- Provides specific guidance on how to plan for resilience
- The Disaster Resilience Framework complements the National Mitigation Framework (PPD-8)
- The framework has benefitted from extensive public and private sector input
Disaster Resilience Framework

- Volume 1
  - Call to Action
  - Executive Summary
  - Chapter 1: Introduction
  - Chapter 2: Establishing the Resilience Team
  - Chapter 3: Characterizing the Community
  - Chapter 4: Disaster Resilience Plan
  - Chapter 5: Implementation
  - Chapter 6: Future Directions
  - Appendix: Worked Example

- Volume 2
  - Chapter 7: Characterize the Social Community
  - Chapter 8: Dependencies
  - Chapter 9: Buildings
  - Chapter 10: Transportation
  - Chapter 11: Energy
  - Chapter 12: Communications
  - Chapter 13: Water and Wastewater
  - Chapter 14: Metrics
Framework Development Process

July 2014 Workshop
Hoboken, NJ
• 25% Draft

October 2014 Workshop
Norman, OK
• 50% Draft

February 2015 Workshop
San Diego, CA
• 75% Draft

April 2015 Workshop
Houston, TX
• Release Draft for Public Comment
• Public comment period

Disaster Resilience Framework Version 1.0
September 2015
Next Steps – Stakeholder Engagement

- Disaster Resilience Standards Panel
  - Planning to develop charter and bylaws has been conducted in parallel with the Framework development
  - Federal Register Notice to request interested parties indicate their interest
  - First meeting planned for August 2015

- Identify Pilot Communities
  - Work with communities interested in using the framework to develop resilience plans
  - Gather feedback to support revisions to Framework

- Model Resilience Guidelines
  - Provide guidance based on existing codes, standards, and best practices
  - Support implementation of resilience plans by communities
Disaster Resilience Fellows

The Disaster Resilience Fellows Program will augment expertise currently existing on the NIST team in the following areas:

- State and local governance
- Urban planning
- Lifeline sectors (electric power, water/wastewater, transportation, communications)
- Insurance/Re-insurance
- Emergency planning and response
- Sociology of disasters
- Economic resilience
- Business continuity (new)
Community Resilience R&D Community Resilience Assessment

• Develop first-generation tools to assess resilience at the community scale.
• Identify the systems (physical and social), attributes, and interdependencies that must be considered.
• Conduct pilot studies using the first-generation tool to inform development of community resilience models, identify gaps, and inform the development of a second-generation methodology.
Community Resilience R&D Systems Modeling

- Develop systems-based methods and models for assessing community resilience to provide the science basis for community resilience assessment and decision-support methodologies.

- Include the interdependencies among buildings, infrastructure, and the social systems that they support.

- Develop a conceptual model to explain long-term disaster recovery decisions by the public.
Community Resilience R&D
Economic Analysis Tools

- Develop a first-generation economic analysis tools to facilitate cost-effective resource allocations that minimize the economic burden of disasters on communities.
- Develop draft standard practices and submit to ASTM.
- Economic Analysis tools, combined with the Resilience Assessment tools, will provide decision makers at the community/regional level a means to evaluate alternate investment decisions.
Disaster Resilience Center of Excellence

- Awarded to a 10-institution team led by Colorado State University.
- $4M/year program funded through a cooperative agreement.
- Objectives are to:
  - Develop an integrated, multi-scale, computational modeling environment to accelerate development of systems-level models to enable new standards and tools for enhancing Community Resilience.
  - Foster the development of data architectures and data management tools to enable disaster resilience planning for emergency and decision-making officials, code and standards professionals, engineering design experts, and researchers.
  - Conduct studies to validate resilience data architectures, data management tools, and models for a variety of hazard events including:
    - Tornado, hurricane, earthquake, flood, Wildland-Urban Interface (WUI)
    - Effects of climate change, and effects of aging infrastructure
Concluding Remarks

- Improving resilience does not have to be prohibitively expensive
- Measures to improve resilience can be implemented over many years
- The Disaster Resilience Framework will help communities with prioritizing buildings and infrastructure and with planning to improve resilience
- Model Resilience Guidelines will provide guidance in the form of standards, codes, and best practices, to implement resilience measures
- Resilience assessment tools and economics-based decision support tools will aid communities aid communities with identifying needs and prioritizing actions
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Questions?