Resilience Strategies for the Built Environment

Briefing for ACEHR
April 20, 2012

FY 2013 Budget Request

Dr. S. Shyam Sunder
Director, Engineering Laboratory
National Institute of Standards and Technology
U.S. Department of Commerce

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

The Problem

- Natural and technological disasters in the United States are responsible for an estimate $57B (and growing) in average annual costs in terms of lives lost, disruption of commerce and financial networks, properties destroyed, and the cost of mobilizing emergency response personnel and equipment.
- Major catastrophes such as Hurricane Katrina (2005) and future earthquakes like the ones that struck Tohoku and Kobe, Japan in 2011 and 1995, respectively, can cause mega-losses ($80B-$300B) in a single event.
- Preventing hazards (e.g., earthquakes, hurricanes, and community-scale fires) from becoming disasters depends upon the disaster resilience of our buildings and infrastructure.
- Disaster resilience, the ability to withstand the impacts of natural or man-made hazards and recover quickly to pre-disaster societal functions, is at once a local and a national issue.
- Regional and national disaster resilience are impacted by pre-event mitigation, immediate response, and long-term recovery.

Why Now? Why NIST?

- A broad national consensus is emerging on the value of focusing on community resilience among a diverse critical mass of thought leaders from the public and private sectors.
- Federal agencies (notably DHS) and the private sector are coming to NIST for leadership in defining the resilience concept, including the multiple independent components, complex interactions, and interdependent factors that must be considered.
- NIST is the right organization to lead such a major multi-pronged national effort. It has the credibility, the knowledge base, the required experience, and broad stakeholder relationships essential to achieving success.

Relevant NIST Core Mission Functions[1]

- Fire prevention and control (primary research agency)
- National earthquake hazards reduction (lead federal agency for NEHRP)
- National windstorm impact reduction (NWIRP)
- National construction safety teams (NCST)
- Building materials and structures
- Engineering and manufacturing materials, products, processes, equipment, technical data, and standards
- Green manufacturing and construction
- Smart grid devices and systems

[1]Authorized by NIST Organic Act or by other statutes

Program Goal

Provide critical science-based metrics, tools, standards, and other innovations essential to achieve national infrastructure resilience

through an integrated multi-year, public-private partnership program strategy

to accelerate research, development, adoption, implementation, and enforcement.

Program Approach

- Provide federal leadership to convene highly diverse stakeholder interests across all hazards (planners, designers, contractors, state and local officials, SDOs, code organizations, industry organizations, professional organizations, and other agencies) to develop and adopt a national resilience framework and associated model resilience standards and policies.
- Form a private-sector led, government funded National Model Resilience Standards Panel (NMRSP), modeled after the Smart Grid Interoperability Panel, both to engage the larger community and to accelerate the development of standards.
- Address the extraordinary R&D gaps (in both magnitude and scope) to realize the full potential of national resilience. Solutions will require active partnership with the private sector (including the NMRSP) and academia as well as close coordination with other agencies.

Program Deliverables

NIST will provide the measurement science and convener role to enable development of:

- Facility-specific resilience standards, guidelines, and methods:
  - to achieve performance targets from a baseline of life safety to higher levels of performance—such as immediate occupancy or a fully operational system—more appropriate for buildings and lifelines essential to community resilience (e.g., utilities, transportation systems, communication systems, hospitals, schools, and emergency operations centers) for hazard levels typically used in safety-based design.
  - for low probability, high-consequence hazard levels (i.e., “black swan” events) more appropriate for resilience-based design than hazard level typically used in safety-based design.
  - that take into account: (1) the increased risks from multiple hazards that many communities face, (2) the preparedness of a community’s emergency response and evacuation systems, and (3) the interaction of technical, social, and economic factors that determine pre-disaster mitigation and post-disaster response.
- Application of such standards, guidelines, and methods for measuring and enhancing the resilience performance of:
  - lifeline systems—with an emphasis on critical physical infrastructure systems
  - existing buildings—particularly those essential to community resilience
  - communities that are severely threatened by fires at the wildland-urban interface
  - communities that are severely threatened by extreme weather events

Specific Program Outputs and Schedule

Outputs	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Establish National Model Resilience Standards Panel (NMRSP).								
Develop comprehensive **technical framework (version 1.0)** for achieving community resilience that considers the interdependence of the community's physical and human assets, operations, and policies/regulations.								
Identify types of model standards, codes, best practice guidelines, and policies needed to implement technical framework for community resilience.								
Compile existing model standards, codes, best practice guidelines, and policies for **critical buildings** essential to community resilience.								
Compile existing model standards, codes, best practice guidelines, and policies for **lifeline systems** essential to community resilience.								
Develop updated **technical framework (version 2.0)** for achieving community resilience that considers the interdependence of the community's physical and human assets, operations, and policies/regulations.								
Develop science-based model standards, codes, best practice guidelines, and policies for **communication lifeline systems** essential to community resilience.								
Develop science-based model standards, codes, best practice guidelines, and policies for **critical buildings** essential to community resilience.								
Develop science-based model standards, codes, best practice guidelines, and policies for **transportation lifeline** systems essential to community resilience.								
Develop science-based model standards, codes, best practice guidelines, and policies for **utility lifeline systems** essential to community resilience.								

Key Program Outcomes

- Establishment of a public-private partnership to develop model resilience standard provisions.
- Comprehensive technical framework for achieving community resilience.
- Model standards, codes, best practice guidelines, and policies for critical buildings and infrastructure lifelines essential to community resilience.

The transformation from facility-specific life safety to community resilience will be truly revolutionary and the potential national impact will be huge!