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Enhancing Community Resilience: a U.S. Perspective

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Community Resilience and Critical Infrastructure Resilience are Societal Imperatives

The term *resilience* refers to the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.*

* *President Policy Directive 21 - Critical Infrastructure Security and Resilience February 12, 2013*

Resilience Components and Timelines

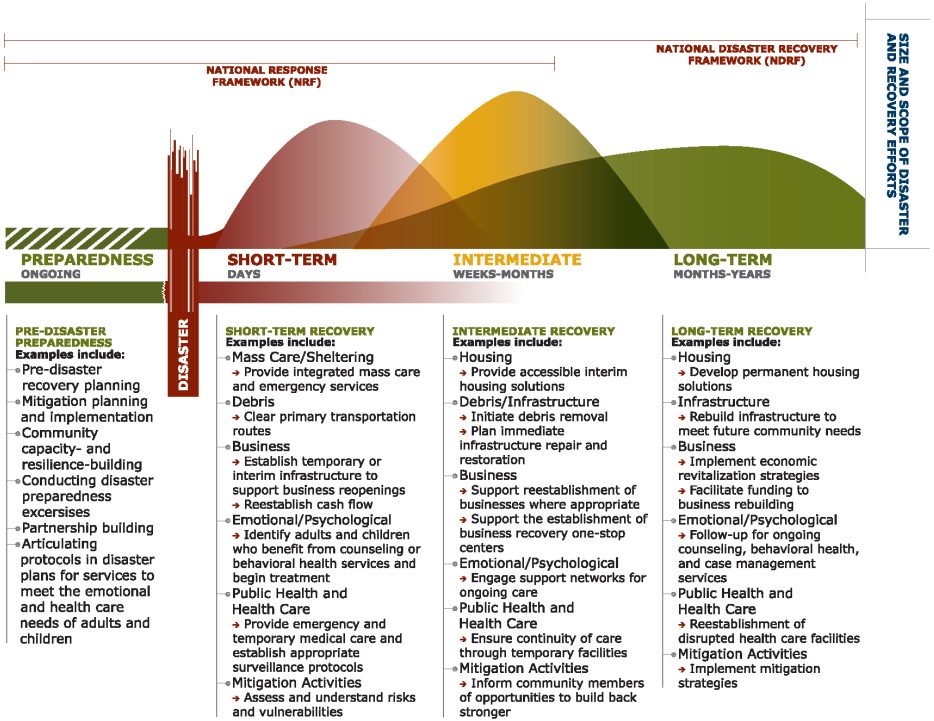
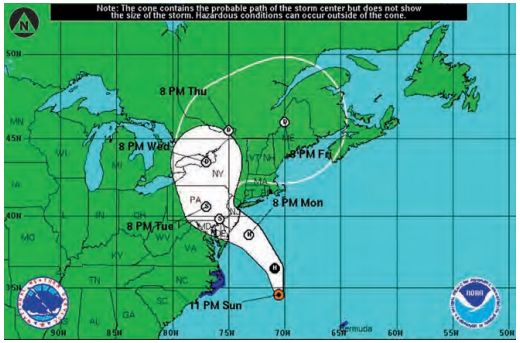


Figure 3. Resiliance

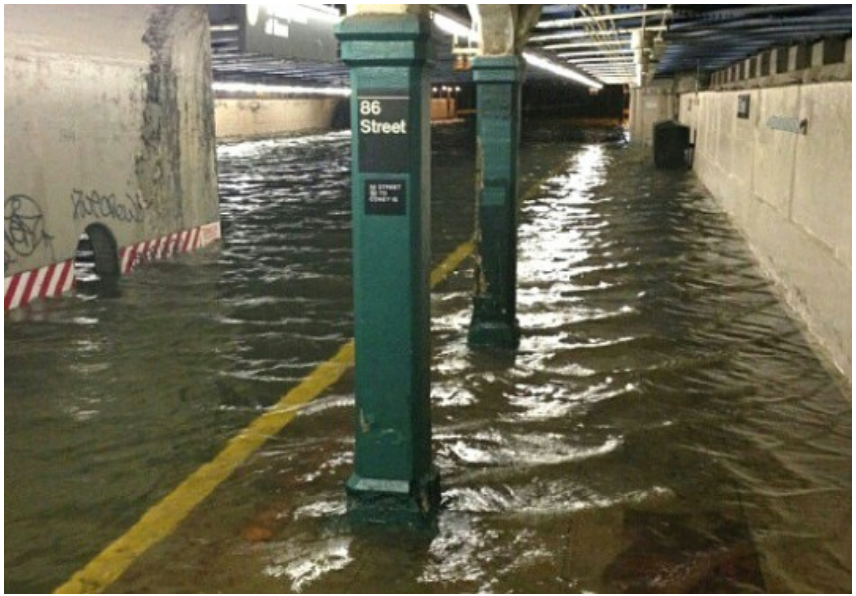
Why Community Resilience?

- All communities face potential disruption from natural, technological, and human-caused hazards.
- Disasters take a high toll in lives, livelihoods, and quality of life that can be reduced by better managing disaster risks.
- Planning and implementing *prioritized* measures can strengthen resilience and improve a community's ability to continue or restore vital services in a more timely way – and to build back *better*.
- The built environment exists to serve a social function (e.g., a hospital provides healthcare services). Therefore, social and economic needs and functions should drive the goals for performance of buildings and physical infrastructure.
- New tools and guidance are needed to measure resilience and plan and implement measures to enhance resilience.



Community Resilience - a Tale of Two Cities

Case Study I: Public Sector Resilience – Hurricane Sandy



New York City Metropolitan Transit Authority

New York
Metropolitan Transportation Authority

1. Moved Trains to high ground and shelter

2. Provided incentive for workforce to stay on the job

Case Study II: Public Sector Resilience – Hurricane Sandy

Hoboken, NJ – Train and Ferry Terminal

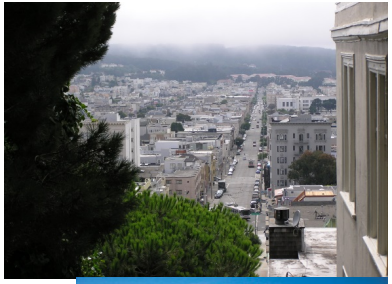
New Jersey Transit

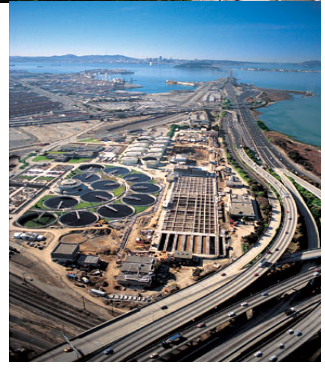
345 Trains damaged by flooding at the Meadowlands Maintenance Complex & Hoboken Yard totaling $120 million

Strategies

- Planning/Assessment/Risk Characterization
- Building Regulations
- Community Guidance
- Economic Incentives

Planning and Assessment





Buildings

Individual structures, including equipment and contents that house people and support social institutions

Building Clusters

A set of buildings that serve a common function such as housing, healthcare, retail, etc.

Physical and Social Systems

Physical networks and structures that support social institutions, including transportation, energy, communications, water and waste water systems.

Dependencies

Internal and External, Time, Space, Source

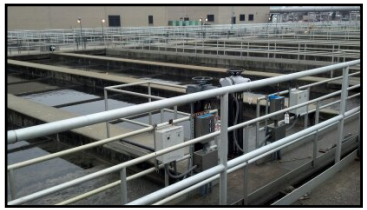
Event Characterization

- ***Routine –*** *Hazard level is below the expected (design) level and occurs more frequently. Resilient buildings and infrastructure systems should remain fully functional and not experience any significant damage that would disrupt social or economic functions in the community.*
- ***Expected –*** *Design hazard level, where the design level is often based on codes. The design hazard level may be greater than the minimum required by codes, or may be based on other criteria. Buildings and infrastructure systems should remain functional at a level sufficient to support the response and recovery of the community as defined by the performance levels. This level is based on the design criteria normally used for buildings.*
- ***Extreme –*** *Hazard level is above the expected (design) level. Some hazards refer to the maximum considered event, which is based on the historic record. Extreme events may also include long-term changes in hazards anticipated due to climate change. However, this hazard level might not be the largest possible hazard level that can be envisioned, but rather one that the community believes is credible. Critical facilities and infrastructure systems should remain at least minimally functional at this level. Other buildings and infrastructure systems should perform at a level that protects the occupants though they may need to be rescued. In addition, emergency response plans should be developed for scenarios based on this hazard level.*

Link Social Dimensions and Built Environment

Some rely more on the built- environment

Emergency Rooms



Industrial Plants

Some functions change

Schools → Shelters

Identify how services are supported

- Services provided to meet needs
- Dependency on other services and systems
- Dependency on built environment
- Consequences of loss

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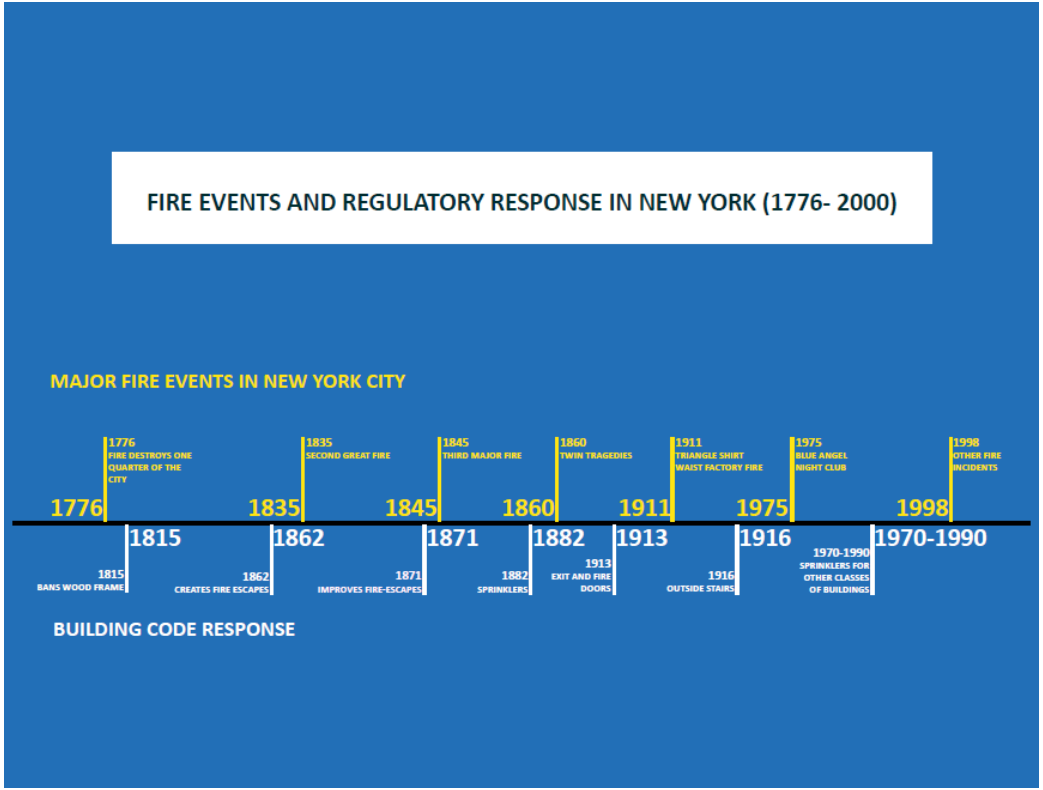
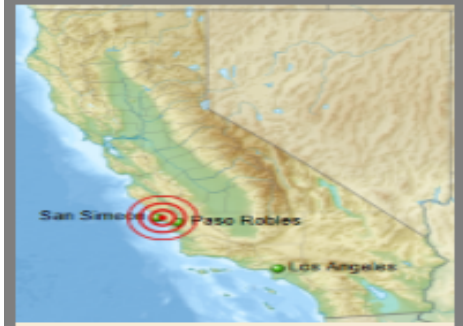
The Role of Regulation



The Role of Regulation

A Tale of Two Cities: The Paso Robles and Bam earthquakes of December 2003



- Paso Robles, Calif.
- Population: 30,000
- December 23, 2003
- 6.5 Richter
- 2 died
- 46 buildings damaged

- Buildings were code compliant

- Designed and built by qualified professionals

- Bam, Iran
- Population: 40,000
- December 23, 2003
- 6.5 Richter
- Over 30,000 died
- 85 percent of the city destroyed

- Buildings were not code compliant

- Informal buildings

NFPA

U.S. Resilience Regulatory Resources

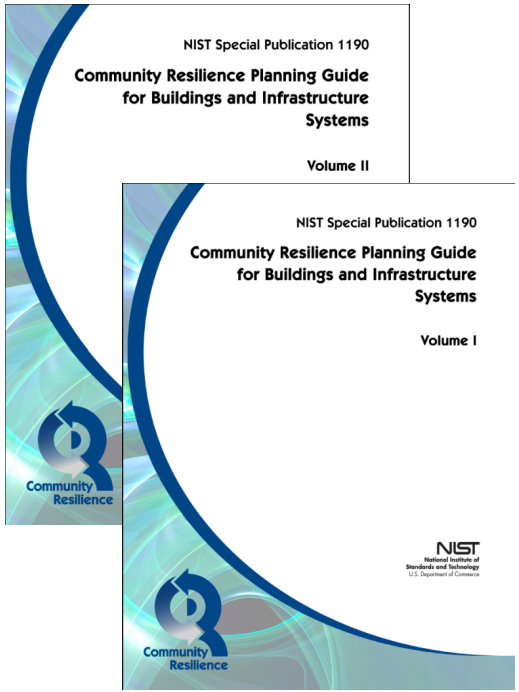
- NFPA 1600
  "Standard on Disaster/Emergency Management & Business Continuity Programs"
- FPRF, 2015

  "Guidance on Incorporating Resiliency Concepts into Codes and Standards"

NIST Community Resilience Planning Guide

- The built environment exists to serve a social function (e.g., a hospital provides healthcare). Therefore, social and economic needs and functions should drive the goals for performance of buildings and physical infrastructure.

- *Practical, flexible* methodology to better set priorities and allocate resources to reduce risks and to build back *better*.



Planning Steps for Community Resilience

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Example Summary Resilience Matrix

Infrastructure	Recovery Time								
	Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-24	Mos 24+
Critical Facilities									
Buildings	90%							X	
Transportation		90%	X						
Energy		90%	X						
Water			90%		X				
Wastewater				90%				X	
Communication		90%		X					
Emergency Housing									
Buildings									
Transportation									
Energy									
Water					X				
Waste Water									
Communication				90%	X				
Housing/Neighborhoods									
Buildings						90%			X
Transportation			90%	X					
Energy			90%	X					
Water				90%				X	
Waste Water					90%			X	
Communication				90%			X		
Community Recovery									
Buildings								90%	X
Transportation				90%	X				
Energy			90%	X					
Water				90%				X	
Waste Water							90%	X	
Communication				90%			X		

Desired Performance

Anticipated Performance

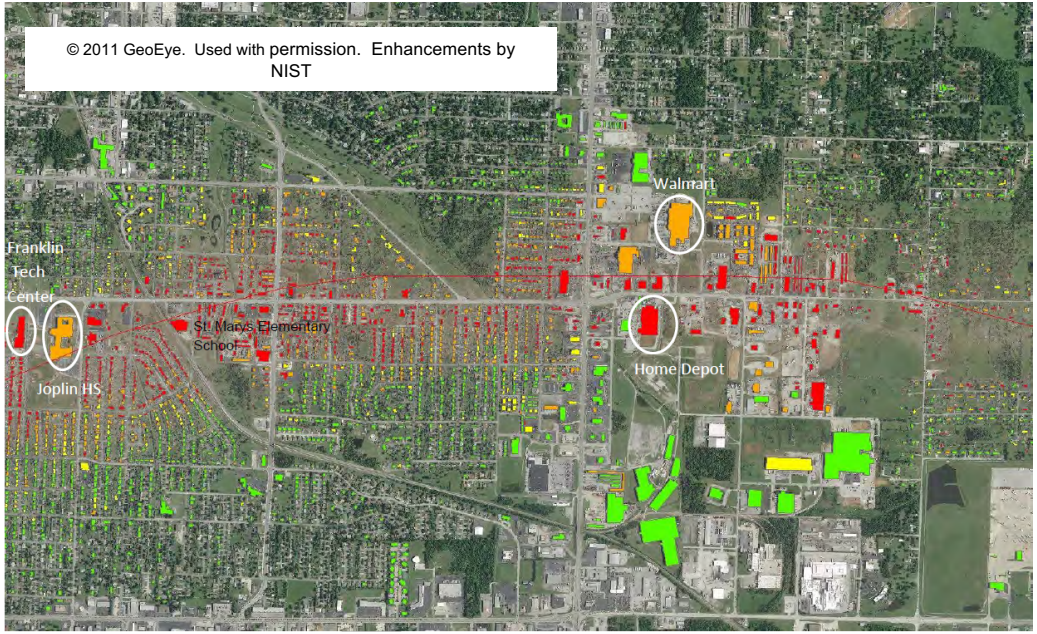
Challenges

Changing design considerations from life safety-driven to functionality-driven

- Determining how to define and measure the functionality of buildings and infrastructure systems – including structural and nonstructural components

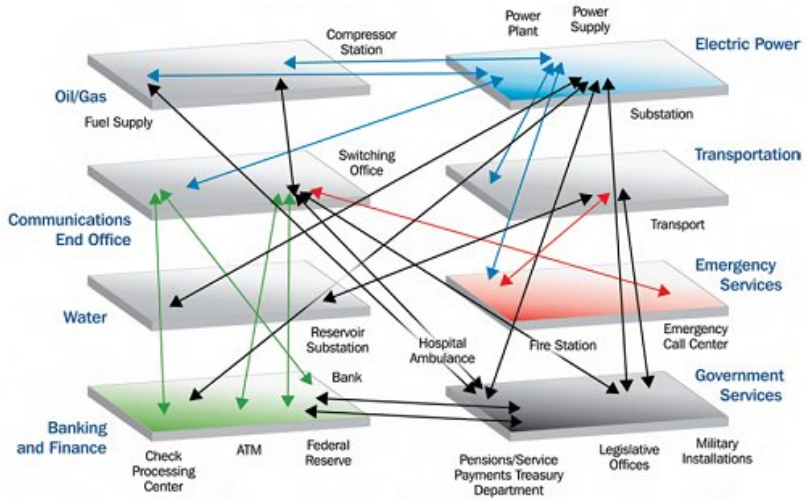
Challenges (cont'd)

Stochastic nature of hazards and typical decision maker's understanding of risk



Challenges (cont'd)

Fully capturing interdependencies amongst systems and prioritize for competing objectives



Examples of Interdependency Challenges

- Refineries and pipelines need electricity to operate.
- Vehicles for repairing electrical distribution lines need a reliable supply of gasoline or diesel fuels.
- Transportation conveyances are required to move fuel to commercial and residential users
- Transportation conveyances require fuel to operate
- Gas stations require electricity to operate pumps and telecommunications to support credit/debit card purchases

Challenges (cont'd)

Communication between the many disciplines – physical systems and their services, social services, economics – methods, vocabulary, input and output data

- Social scientists working at individual/neighborhood level working with economists at the regional/aggregate levels;
- time and frequency of data (annual versus monthly)

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The Resiliency Imperative

The abiding strategy of our parents' generation was 'containment' of communism in order to be free.

The abiding abiding strategy of our parents' generation was 'containment' of communism in order to be free. The abiding strategy of our generation has to be 'resilience.' We will only be free to live the lives we want if we make our cities, country and planet more *resilient*."

- Thomas L. Friedman, *The New York Times*, May 24, 2014

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Questions?

Thank You