engineering laboratory

NIST Special Publication 1190

Community Resilience Planning Guide for Buildings and Infrastructure Systems

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

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.
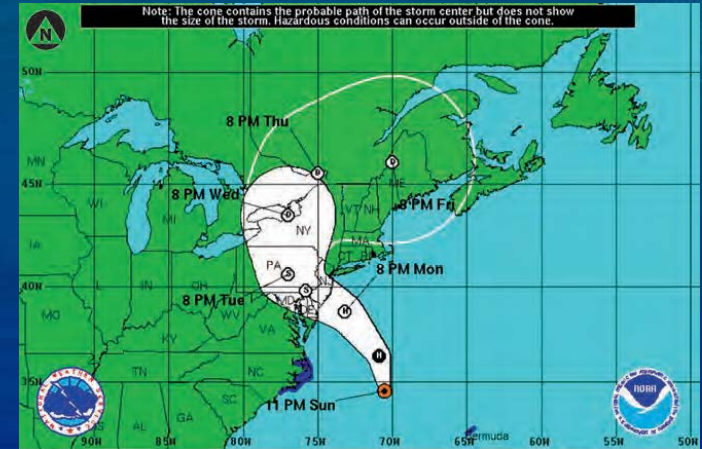
NIST Community Resilience Program

Stakeholder Engagement*

Community Resilience Planning Guide

Community Resilience Panel

Community Resilience Implementation Guideline

Research

Community Resilience Systems Model

Community Resilience Assessment Methodology

Economics-based Decision Support Tool

Center of Excellence

Integrated, multi-scale modeling

Database Architecture

Pilot Studies

Disaster Resilience Fellows

*Stakeholder Engagement component is called out in the President's Climate Action Plan

What is Resilience?

- *"the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies".* (Presidential Policy Directive (PPD) 8)

- *"the ability to prepare for and adapt to changing conditions and to withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents."* (PPD 21)

- Resilience addresses all activities <u>through recovery</u>:
  - Prevention, Protection, Mitigation, Response, and Recovery
  - Risk assessments address the potential consequences of hazard's impact on existing construction and identify vulnerabilities
 - Emergency management addresses immediate response, with a focus on life safety

Why Resilience Planning?

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- Planning and implementing *prioritized* measures can improve a community's ability to restore vital services in a timely way – and to build back *better*.

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

- The NIST Community Resilience Planning Guide provides a *practical, flexible* methodology to set priorities and allocate resources to reduce risks by improving their resilience.
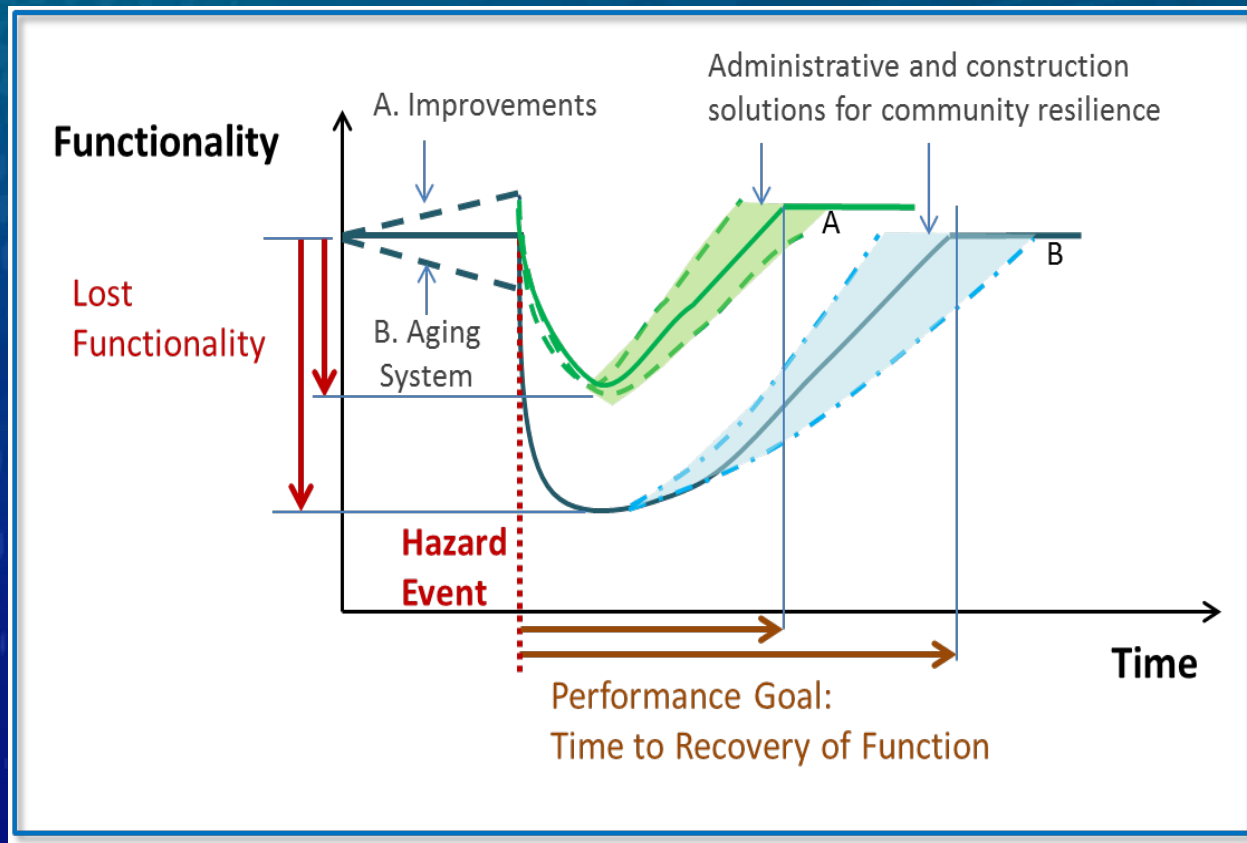

Downtown Cedar Rapids, Iowa, during the 2008 floods
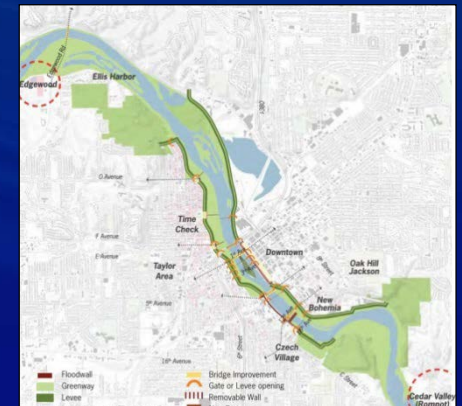
Recovery and Reinvestment Plan

Key Concept: Recovery of Function

Resilience can be expressed simply in terms of system functionality and the time to recover functionality following a disruptive hazard event.

Guide Development Process

Community Resilience Planning Guide Version 1.0 September 2015

February 2015 Workshop

San Diego, CA

- 75% Draft

April 2015 Workshop

Houston, TX

- Release Draft
- Public Comments until June 26

October 2014 Workshop

Norman, OK

- 50% Draft

July 2014 Workshop

Hoboken, NJ

- 25% Draft

April 2014 Workshop NIST

Guide Focus: Resilience Planning

- 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.

- The draft NIST Community Resilience Planning Guide provides a *practical, flexible* methodology to better set priorities and allocate resources to reduce risks by improving their resilience.

Guide Overview

- The Guide helps communities:
  - Organize effectively to address resilience risks, goals, and priorities.

  - Determine customized long-term resilience goals.

  - Develop short- and long-term plans for buildings and infrastructure systems to achieve resilience goals.

  - Prioritize improvements to the built environment based on their role in supporting social institutions and economic functions during recovery.

  - Address infrastructure dependencies and cascading effects of system failures.
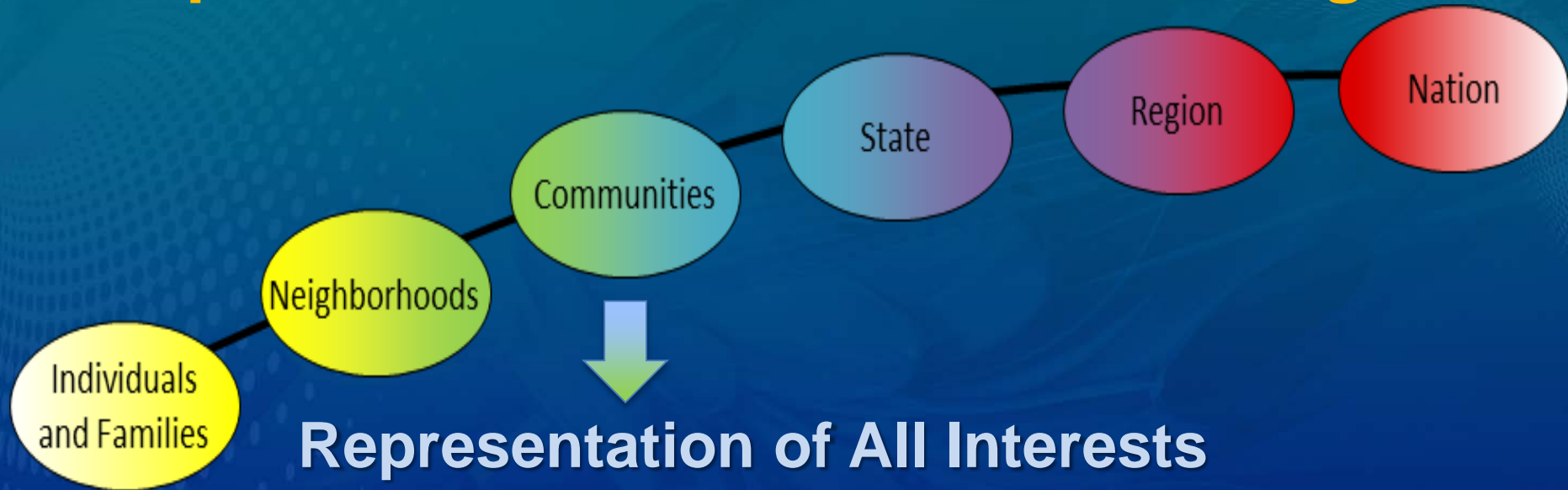
Planning Steps for Community Resilience

SIX-STEP GUIDE TO PLANNING FOR COMMUNITY RESILIENCE

1. FORM A COLLABORATIVE PLANNING TEAM
- Identify leader
- Identify team members
- Identify key stakeholders

2. UNDERSTAND THE SITUATION

Social Dimensions
- Characterize social functions & dependencies
- Identify support by built environment
- Identify key contacts

Built Environment
- Identify and characterize built environment
- Identify key contacts
- Identify existing community plans

Link Social Functions & Built Environment
- Define clusters

3. DETERMINE GOALS & OBJECTIVES
- Establish long-term community goals
- Establish performance goals
- Define community hazards
- Determine anticipated performance
- Summarize results

4. PLAN DEVELOPMENT
- Evaluate gaps
- Identify solutions
- Develop implementation strategy

5. PLAN PREPARATION, REVIEW, AND APPROVAL
- Document plan and strategy
- Obtain feedback and approval
- Finalize and approve plan

6. PLAN IMPLEMENTATION AND MAINTENANCE
- Execute approved solutions
- Evaluate and update
- Modify strategy as needed

Community Resilience

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Step 1. Form a Collaborative Planning Team

Individuals and Families → Neighborhoods → Communities → State → Region → Nation

↓

Representation of All Interests

Public

- Elected Officials
- Local Government
- Community Members

Private

- Business and Services
  - Banking, Health care
  - Utilities
  - Media
- Organizations
  - NGOs (VOAD, Relief)

Step 2. Understand the Situation

Characterize the Social Dimensions

- Community members
  - Present and future needs
  - Demographics and economic indicators
  - Social Capital/Social Vulnerabilities
- Social institutions
  - Social functions
  - Gaps in capacity
  - Dependencies on other institutions
- Community metrics

Characterize the Built Environment

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.
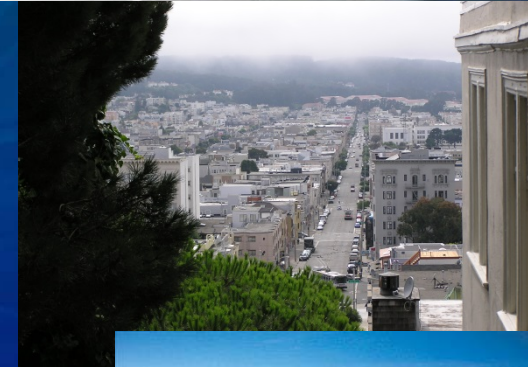
Infrastructure Systems

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

Dependencies

Internal and External, Time, Space, Source

Characterize

Location, number, construction, demands and use, etc.

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

Step 3. Determine Goals and Objectives

Establish Long Term Community Goals

- Long term goals to improve the community can guide the prioritization and implementation process.
  - Improve reliability of infrastructure systems
  - Enhance community functions
  - Reduce travel time impacts to residents and businesses
  - Revitalize an existing blighted area
- Community resilience is achieved over time
  - Resilience can be achieved with resources for current maintenance and capital improvements

Establish Desired Performance Goals for the Built Environment

- Performance goals are independent of hazard events.
  - Community functions are needed during recovery, such as acute health care, 911 call centers, emergency response
  - Consider role of a facility or system that impacts others outside the community.

- Define goals in terms of '*time needed to restore functionality*'.

- Use goals to help prioritize repair and reconstruction efforts.

- Goals may suggests criteria for new construction and retrofit of existing construction.

Recovery of the Built Environment

Organize around restoring functionality over time
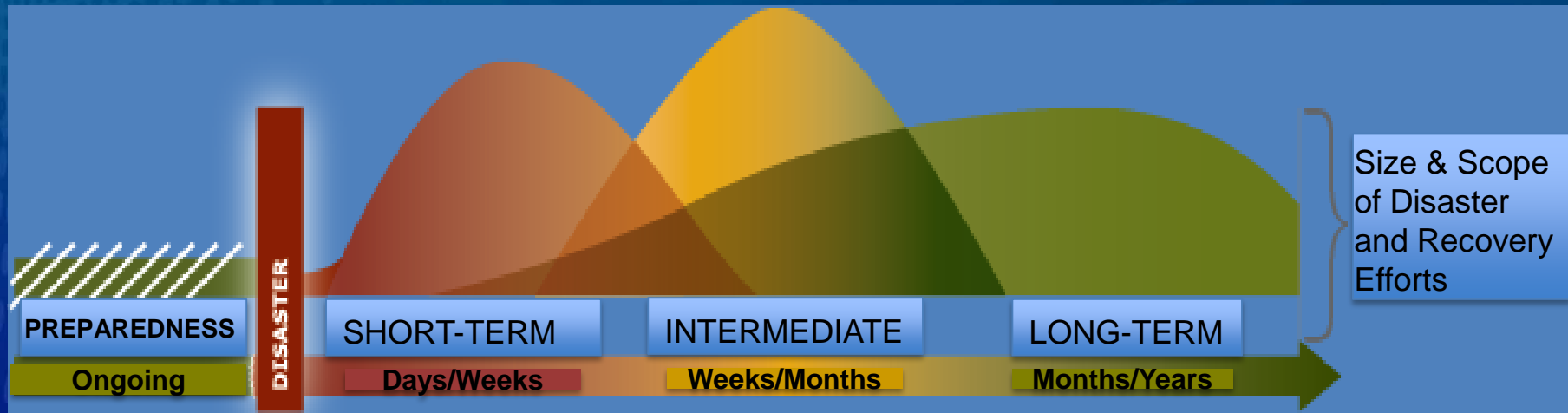
When is each system needed for recovery?

Determine and Characterize Hazards

- Identify prevalent hazards
  - Wind, Earthquake, Inundation
  - Fire, Snow, Rain
  - Human-caused or Technological

- Evaluate hazards for 3 levels
  - Routine   Level expected to occur frequently
    - *Should have minimal disruption*
  - Design   Level used to design buildings
    - *Anchor for community planning*
  - Extreme   Maximum considered possible
    - *Plan for critical services*

Anticipated Performance of Existing Built Environment

- Anticipated performance (restoration of function) during recovery depends

  - Damage level - Condition and capacity of structural and nonstructural systems

  - Recovery time - Materials, equipment, and labor needed for restoration

  - Dependencies on other systems that may be damaged

Hurricane Irene

Hurricane Katrina

Example Summary Resilience Matrix

Superstorm Sandy

Step 4. Plan Development
Evaluate Gaps and Identify Solutions

- Prioritize gaps
  - Long-term community goals
  - Social needs during recovery

- Identify alternative solutions
  - Multiple stages
  - Temporary and permanent
  - Administrative
  - Construction

- Flood plain management
  - Reduce threat: relocate, elevate

- Wind and seismic preparedness
  - Strengthen: retrofit, redundancy

- Recovery Plans
  - Mutual aid agreements
  - Improvement plans

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%								
Transportation		90%							
Energy		90%							
Water			90%						
Wastewater									
Communication		90%							

Prioritize Solutions and Develop Implementation Strategy

2013 Mandatory Soft Story Retrofit program for all older, wood-framed, multi-family buildings ensures the safety and resilience of San Francisco.

- Select solutions for prioritized performance gaps
    - Determine how alternative solutions can be combined to meet community goals.
    - Consider collaborative projects.

- Develop implementation strategies
    - Quantify benefits of impact on public safety and social needs.
    - Evaluate economic impacts on community - costs and savings.
    - Consider short- and long-term benefits versus costs.

North Texas 2050 plan integrates land use, natural resources, transportation, housing, water and wastewater infrastructure, parks and open spaces.

- Determine preferred implementation strategy

Step 5. Plan Preparation, Review, and Approval

Plan Approval

- Document proposed implementation strategy and supporting assessments and solutions.

- Share with all stakeholders and community members
  - Public Meetings, review and comment period

- Finalize and approve community plan.

APPROVED

Final Community Plan: Implementation Strategy

Step 6. Plan Implementation and Maintenance

Implementation

- Formally adopt community plan to guide local government and agencies

- Identify and obtain resources to implement solutions

- Track and *communicate progress* to stakeholders

Plan Maintenance

- Review strategy and solutions on a regular basis

- Modify or update as needed

Planning Guide Outline

Volume 1 - Methodology

Executive Summary

- Introduction
- Methodology and Planning Steps
- Future Directions
- Planning Example – Riverbend, USA
- Glossary and Acronyms

Volume 2 - Reference

Executive Summary

- Social Community
- Dependencies and Cascading Effects
- Buildings
- Transportation Systems
- Energy Systems
- Communications Systems
- Water & Wastewater Systems
- Community Resilience Metrics

Related Activities

- Community Resilience Panel
    - Focus on identifying gaps in practice and knowledge
    - Develop supporting guidance and best practices to help users of the Guide.
    - First meeting held November 2015, next meeting Spring 2016
- Community Use of the Guide
    - How to best work with communities interested in using the Guide
    - Gather feedback to support revisions to Guide

NIST Contact

Website:

http://www.nist.gov/el/resilience/

Guide:

http://www.nist.gov/el/resilience/guide.cfm

Or google "NIST Resilience Planning Guide"

General E-mail: resilience@nist.gov

Questions?