

# SEAOC and EERI

## Efforts on Functional Recovery



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ICC/CALBO Seismic Roundtable  
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# Outline

- Introduction to SEAOC & EERI
- Collaborative Efforts on Functional Recovery
- Functional Recovery: A Conceptual Framework



# Structural Engineers Association of California

- 3,500+ members
  - Engineers (Structural, Civil, Geotechnical), Academia & Researchers, Building Officials, and Other Industry Members
  - committed to improving the safety and resilience of the built environment through state-of-the-art structural engineering practice, code & standards advisory work, and public policy advocacy
- SEAOC Board of Directors Position Statement:
  - SEAOC supports evolution of building codes to explicitly provide “better than life safety” performance in terms of recovery time in addition to safety



# Earthquake Engineering Research Institute

- Multidisciplinary, nonprofit, technical society
  - Engineers, geoscientists, architects, planners, emergency managers, gov't officials, risk analysts, and social scientists
- Relevant Mission/Vision
  - to **reduce earthquake risk** by advancing the science and practice of earthquake engineering; improving understanding of the impact of earthquakes on the physical, social, economic, political, and cultural environment; and advocating comprehensive and realistic measures for reducing the harmful effects of earthquakes
- EERI White Papers & Policy Statements:
  - Functional Recovery: A Conceptual Framework
  - Creating Earthquake Resilient Communities
  - Improve Reliability of Lifeline Infrastructure Systems



# Efforts on Functional Recovery

- Current code provides/maintains life safety
  - Higher performance provided for Risk Category IV / Essential Service Buildings (Hospitals, Fire Stations, etc.)
  - Prescriptive and performance-based design approaches
- “Next Generation” Performance-Based Design (FEMA P-58)
  - Provides tools to quantify performance in terms of safety, repair cost, and repair time



# Efforts on Functional Recovery

- Interest from elected officials and public aligns with organizational missions/positions
  - Interest is not just about “life safety” but also “livelihood”
- Not just an engineering issue... spans multiple disciplines and perspectives
- SEAOC-EERI MOU to collaborate on FR efforts
- CA AB 393 and NEHRP Reauthorization
  - Programs are complementary
  - NEHRP report on options due June 2020
  - CA AB 393 Working Group could build from Federal work



# Efforts on Functional Recovery

- Functional Recovery Definition & Concepts
  - Working definition from AB 393
  - Consensus definition being developed
  - Not “immediate occupancy” nor “community resilience”
  - Acceptable recovery time will vary by occupancy
  - Some occupancies / systems may not need much change from current code
  - Might not be one-size-fits-all



# Efforts on Functional Recovery

- Functional Recovery: A Conceptual Framework –  
*A white paper of the Earthquake Engineering  
Research Institute*



# **Functional Recovery is a means to Community Resilience**

**David Bonowitz, S.E.**

ICC/CALBO Seismic Roundtable  
Sacramento  
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# Recent progress

- EERI White Paper on Functional Recovery
  - Conceptual Framework
  - Policy Position Statement (in development)
- PUC White Paper on Resilience-based Design
  - Anticipating the future *NEHRP Provisions*
  - Code and Standard model



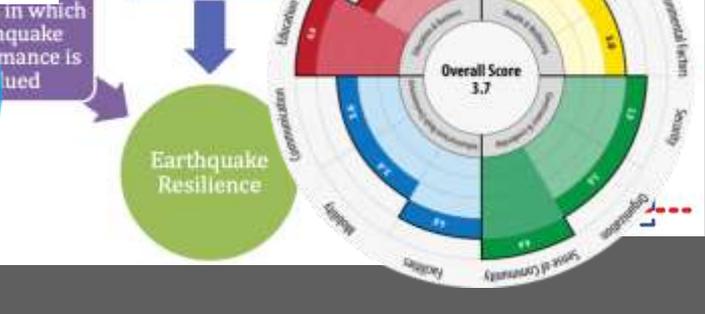
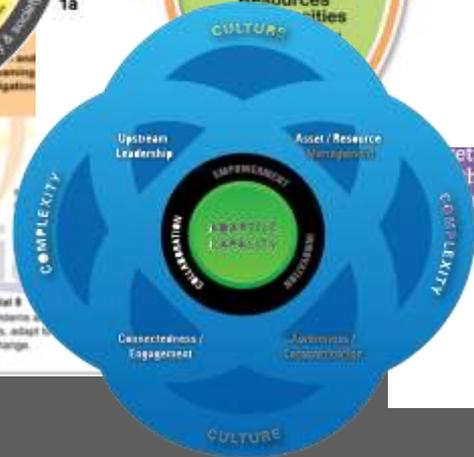
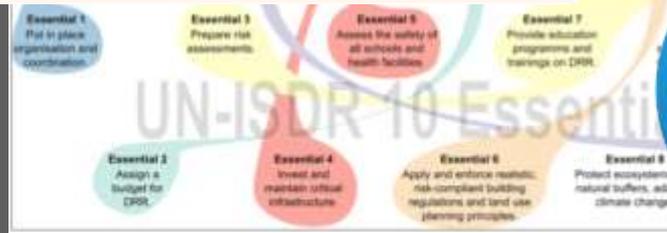
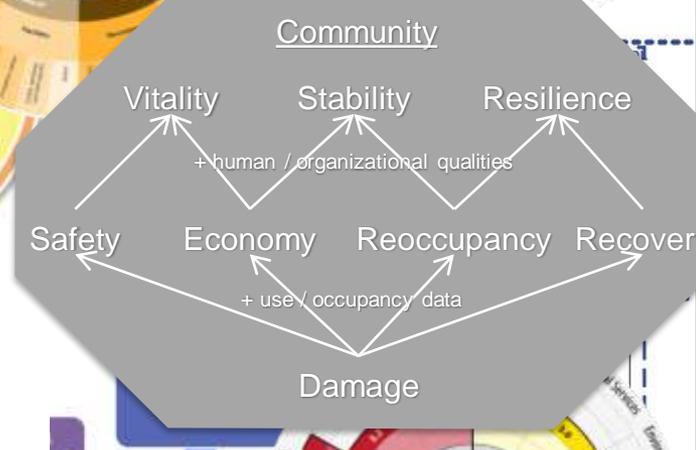
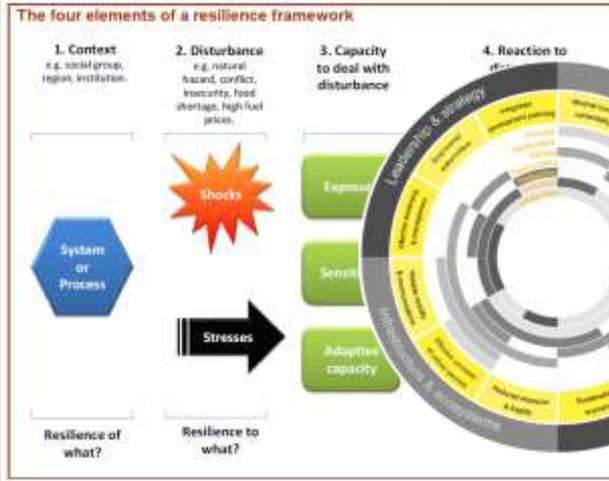
# EERI Conceptual Framework

- Starting point
- State of practice
- Concept development issue areas

# EERI Conceptual Framework

- Starting point
  - NEHRP Reauthorization
    - New purpose: Community Resilience

# Resilience models



# Resilience Definitions

- UNISDR (2009)
- FEMA NDRF (2011)
- NRC (2011)
- Nat'l Acad. (2012)
- White House (2013)
- 100RC (2013)
- US GAO (2014)
- AIA (2016)
- NEHRP (2018)

## Resilience:

- Mitigates shock of natural hazard
- Primarily about recovery of functions
- Measured as recovery time
- An attribute of human organizations

# EERI Conceptual Framework

- Starting point
  - NEHRP Reauthorization
    - New purpose: Community Resilience
    - NIST research “to improve community resilience through building codes and standards”

# Resilience field

Technical

About the physical building

- Structure
- Nonstructure
- Contents

Facility

About one building

- Traditional engineering context
- Traditional code context

Community

About the group

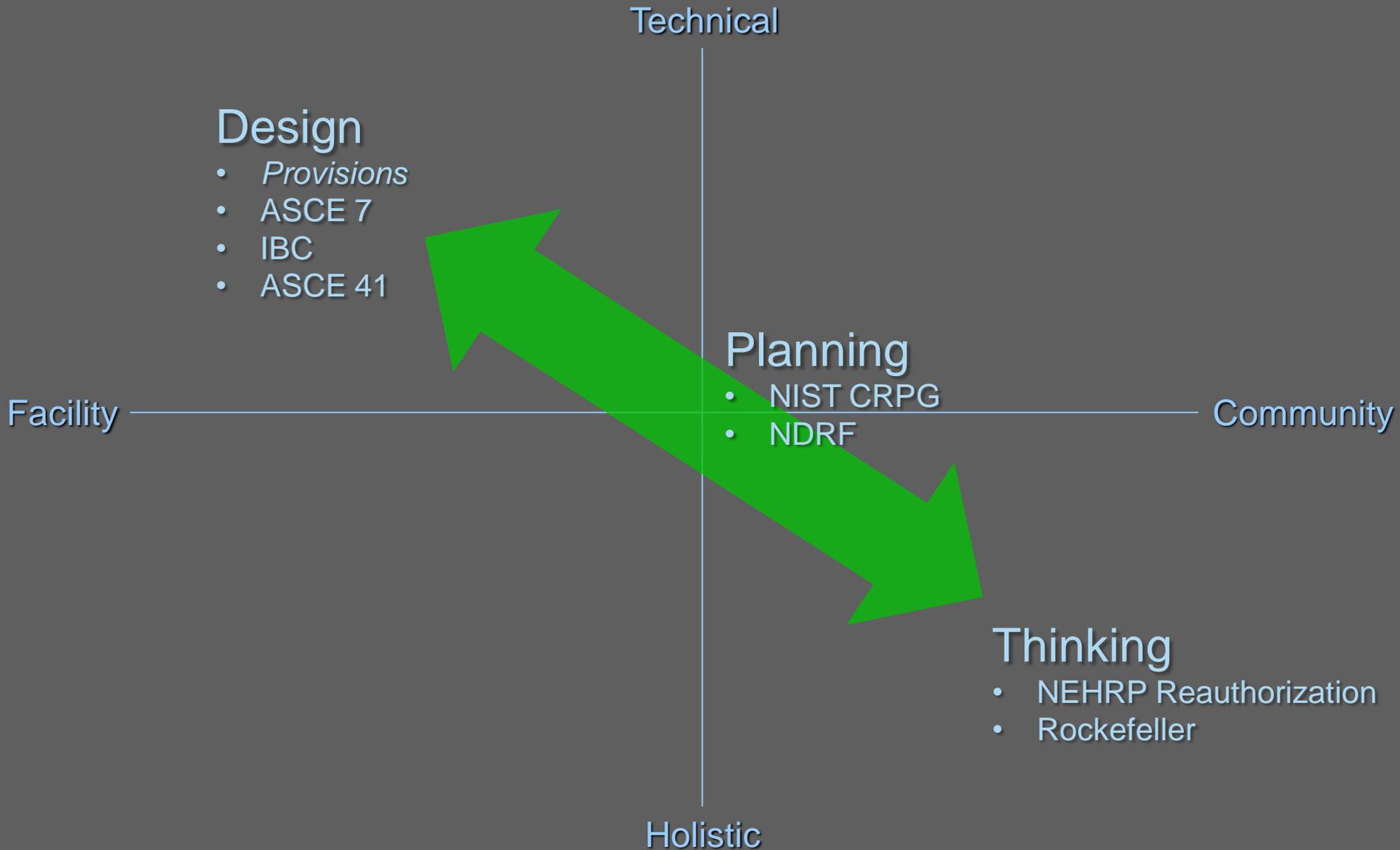
- Traditional planning context
- “Public” policy

Holistic

About more than a building

- Contents → Use, Occupancy
- Function
- Purpose

# Resilience field



# EERI Conceptual Framework

## ■ Starting point

### ■ NEHRP Reauthorization

- New purpose: Community Resilience
- NIST research “to improve community resilience through building codes and standards”
- NIST & FEMA to study “options” for buildings and lifeline infrastructure “in terms of post-earthquake reoccupancy and functional recovery”

### ■ AB 393: Functional Recovery Standard

- Definition written by EERI and SEAOC in 2018
- Adapted by ICC/CALBO for today’s roundtable

# Functional Recovery

- ICC/CALBO roundtable:

A post-earthquake state in which “structural and nonstructural capacity are maintained or can be restored to support the basic intended functions of the building’s pre-earthquake use and occupancy ...”

- What about contents?
- What about utilities, site effects, adjacent risks?
- What are “basic intended functions”?
- Do they vary by or *within* an occupancy group?
- Etc.

# EERI Conceptual Framework

- Starting point
- State of practice
  - Buildings
    - New and existing, all occupancies and uses
  - Lifeline infrastructure systems
    - Water and wastewater, Energy, Communication, Transportation
- Key point: Interdependent system of systems
  - But each likely to continue its own development
  - Our progress needs to accept that, work within it

# EERI Conceptual Framework

- Starting point
  - State of practice
  - Concept development issue areas
    - Definitional
    - Technical → *Building Design Standard*
    - Policy → *Building Code*
    - Implementation
- Key point: Each area will progress independently
    - We need to embrace this reality
    - Do not let gaps in one area slow the work in others