Civil Works in the US Army Corps of Engineers

Resilience Roundtable: Designing and Building 22nd Century Infrastructure, an Owners Perspective

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The Army Corps of Engineers: 241 Years of Service to the Nation
US Army Corps of Engineers
+3,000 Infrastructure Systems

- Agency Statistics:
  - +33,000 team members in +100 countries
  - #1 Hydropower Producer in USA
  - #1 in Outdoor Recreation
  - +$30B in Annual Flood Damages Prevented
  - Navigation Benefits

710
709 Dams
+2,500 Levees
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CONTEXT FOR RESILIENCE
Principles of Resilience

USACE Resilience Definition:
"resilience means the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions."

Presidential Executive Order 13653, Preparing the U.S. for Impacts of Climate Change (NOV 2013)
Waves of Innovation and the Pace of Change!!

- Resilience
- Sustainability
- Risk informed decision making
- Big data
- Engineering judgment
- Climate change
- Systems approach
- Life Cycle costs
- Triple Bottom Line
Resiliency in the Context of History

The designers and builders of dams and levees from our “hey day”, are no longer around. What do we do about this?
What is the Life of Infrastructure?

Opportunities to Incorporate Resiliency into Decision Making

25-50
Planned and Formulated based on economic horizons

100
Designed based on type of facility

20-50
Upgraded and Modified to Extend Useful Life

+500
Actual Life Span ?? (in years)
Risk, Resiliency, and Decisions Over Time

(How we deal with it’s temporal nature)

- Initial Infrastructure Buys Down Risk
- Safety Programs
  - Identify Risks:
    - Aging Structures
    - New Science
    - Population Growth
- Interim Risk Reduction Measures
- Normal Risk Patterns
- Remedial Fixes

Tolerable Risk Guideline
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STRATEGIES FOR RESILIENCE
Strategy 1: Understand how Resiliency fits into the Enterprise Risk Framework

Risk Assessment
- Risk Identification
- Risk Estimation
- Characterization of Uncertainty

Risk Management
- Risk Evaluation
- Risk Management Options Assessment
- Prioritization of Recommendations
- Risk Management Option Selection
- Resiliency Decisions
- Monitoring and Review

Risk Communication
Stakeholder Engagement
Communication of:
- Nature of Risk
- Uncertainties in Risk Assessments
- Risk Management Options

PLANNING SMART
BUILDING STRONG®
Strategy 2: Care about Standards

Lessons from the 2010 Earthquakes

- **Chile**
  - 8.8 magnitude earthquake
  - +200 Loss of life
- **Haiti**
  - 7.7 magnitude earthquake
  - +200,000 loss of life

- Standards are Prudent means to address unlikely events
- One size does not fit all
- We will never know everything we need to know

Anticipating and Preparing for Resiliency
Strategy 3a: One Size Doesn’t Fit All... We Can’t Just Rely on Standards and Need Informed Critical Thinking!

USACE Dam and Levee Portfolio
Strategy 3b: Evolve Standards

- USACE is taking action:
  - Policy and guidance to **require risk-informed design** for the appropriate level of resilience
  - Plan and design for **future climate-impacted** water levels out 100 years
  - Account for uncertainty

- Future Opportunities / Challenges
  - Policy changes to **decision metrics** to allow for uncertain future conditions
  - International exchanges could help to develop **new economic analysis** techniques and best practices

New Orleans Floodwalls
Risk-Informed Design
Strategy 4: Improve Community Resilience

Making Shared Responsibility and Community Resiliency Work by Understanding Evacuation Effectiveness

- Evacuation Planning: 19% Unacceptable, 37% Minimal, 44% Acceptable
- Community Awareness: 6% Unacceptable, 35% Minimal, 59% Acceptable
- Flood Warning Effectiveness: 16% Unacceptable, 46% Minimal, 38% Acceptable

A GUIDE TO PUBLIC ALERTS AND WARNINGS FOR DAM AND LEVEE EMERGENCIES
Strategy 5: Building The Risk & Resilient-Minded Engineer

- Systems, Risk Trained
- Integrator of and Expert in Multiple Disciplines
- Critical Thinker
- Decision Oriented
- Makes Case with Evidence

I’m kind of a big deal...
Discussion

BUILDING STRONG