USACE - INNOVATION SUMMIT

DAM & LEVEE SAFETY
COMMUNITY OF PRACTICE

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“The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation.”
AGENDA

- Overview of the Dam & Levee CoP
- Existing Gaps
- Vision – DS/LS COP
Overview of the Dam & Levee CoP – National Perspective - Dams

National Inventory of Dams (NID)

National Dam Safety Portfolio

<table>
<thead>
<tr>
<th>Inventory</th>
<th>High Hazard Potential</th>
<th>Significant Hazard Potential</th>
<th>Low Hazard Potential</th>
<th>Undetermined</th>
<th>Total</th>
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<tbody>
<tr>
<td>United States - All Dams</td>
<td>15,498</td>
<td>11,882</td>
<td>60,705</td>
<td>2,495</td>
<td>90,580</td>
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<tr>
<td>Category %</td>
<td>17.10%</td>
<td>13.10%</td>
<td>67.00%</td>
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<td>100%</td>
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</table>

Hazard Potential Classifications:

A primary purpose of any classification system is to select appropriate design criteria. Design criteria becomes more conservative as the potential for loss of life and/or property damage increases.

- **High Hazard Potential** - Failure will probably cause loss of human life.
- **Significant Hazard Potential** - Failure results in no probable loss of human life but has economic loss, environmental damage or disruption of lifeline facilities.
- **Low Hazard Potential** - Failure results in no probable loss of human life, low economic and/or environmental losses.
Overview of the Dam & Levee CoP – National Perspective - Dams

**Dams were generally designed utilizing a Standards Criteria Approach:**

- Using Federal Standards or
- Using State Standards

**National Inventory of Dams (NID)**

- Federal Guidelines Implemented in 1979

- High Hazard Potential Creep:
  - Construction of New Dams
  - Changes in Downstream Development or Urbanization
  - Impacts due to Community Growth - Urban Sprawl

**United States Population**

- 1980 ~ 226,500,000
- 2018 ~ 327,200,000
Overview of the Dam & Levee CoP – National Perspective - Dams

Examples:
Urban Growth at 2 Locations

1957

Whittier Narrows Dam, California
USACE, Los Angeles District
Los Angeles, California

~ 2015

Cherry Creek Dam, Colorado
USACE, Omaha District
Denver, Colorado

1973

Today
Overview of the Dam & Levee CoP – USACE Perspective - Dams

Corps of Engineers Dams

Portfolio Comparisons

<table>
<thead>
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<td>United States - Federal Dams</td>
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<td>7.10%</td>
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Hazard Potential Classifications:

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Overview of the Dam & Levee CoP – National Perspective - Levees

- **15,000 MILES**
  - **Unknown**
    - Levees in the Nation
    - 6,800 Levees/15,000 miles
  - **Non-USACE Levees Identified in the NLD**
    - 1,530 Levees/8,200 miles
  - **Federal Levees Locally Operated & Maintained**
    - 190 Levees/4,200 miles
  - **Federal Levees USACE Operated & Maintained**
    - 500 Levees/1,750 miles

- **1,750 MILES**
  - **Non-Federal Levees Active in USACE Rehabilitation Program**

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US Army Corps of Engineers.
Overview of the Dam & Levee CoP – USACE Perspective - Levees

Majority of levees within USACE levee portfolio have a levee sponsor

- Levee sponsors operate and maintain 70% of USACE portfolio
- ~1,200 levee sponsors operate and maintain levees within the portfolio
Overview of the Dam & Levee CoP – USACE Perspective – Levees
Overview of the Dam & Levee CoP – USACE Perspective

Number of Structures Constructed

- Levee Construction
- Dam Construction

Pre-1930s Limited Construction Era

1930s-1980 Major Dam & Levee Construction Era

- Federal Guidelines Implemented in 1979

1980- Present Current

Overview of the Dam & Levee CoP – USACE Perspective

Federal Guidelines Implemented in 1979

US Army Corps of Engineers.
Overview of the Dam & Levee CoP – USACE Perspective

Statistical Information:

USACE Dams:
• 715 Dams
• 80% Earthen & 20% Concrete Gravity on Improved Foundations
• Population at Risk (PAR) of +12.8M
• Property at Risk = +$1T
• Total length ~ 267 miles
• Average Age ~ 60 Years
• Pass extreme flows in controlled manner

Source: RMC 2018

USACE Portfolio of Levees:
• 2,220 levee systems
• 97% Earthen, 3% Floodwalls on unimproved foundations
• Population at Risk (PAR) of +11M
• Property at Risk = +$1.3T
• Total length ~ 14,150 miles
• Average Age ~ 50 Years
• Pass extreme flows in uncontrolled manner

Source: USACE Portfolio Report 2018
Management Approach:

**Previous Approach:**
- Locally Led and Prioritized
- Locally Decided
- Balance Safety with Other Benefits
- First Come, First Served

**Revised Approach:**
- Nationally Led & Prioritized
- Jointly Decided
- **Life Safety Paramount**
- Risk Informed
Overview of the Dam & Levee CoP – USACE Perspective

Dams Risk

Levee Risk
Overview of the Dam & Levee CoP – USACE Perspective

USACE Dam and Levee Portfolio

- Annual Probability of Failure vs. Life Loss
- DSAC 1 Dams, DSAC 2 Dams, DSAC 3 Dams, DSAC 4 Dams, DSAC 5 Dams
- LSAC 1 Levees, LSAC 2 Levees, LSAC 3 Levees, LSAC 4 Levees

US Army Corps of Engineers
Overview of the Dam & Levee CoP – USACE Dam Perspective

DAM SAFETY INVESTMENT PLAN

- Includes all DSAC I, II, and III Dams
- $19.6 Billion Investment to Remediate 285 Dams
- Estimated Time to Complete Investment: 37 years @ ~$500M / year
Overview of the Dam & Levee CoP – USACE Levee Perspective

RISK FACTORS CONTRIBUTING TO BREACH PRIOR TO OVERTOPPING

- Floodwall Underseepage and Piping: 1%
- Floodwall Instability: 3%
- Embankment Instability: 8%
- Closure System Malfunction or Improper Operation: 9%
- Embankment Erosion: 15%
- Embankment and Foundation Seepage and Piping: 17%
- Overtopping with Breach: 40%

*Risk drivers associated with 1,670 levee systems with completed risk assessments.

Number of Levee Systems with Each Levee Performance Risk Driver
Overview of the Dam & Levee CoP – USACE Levee Perspective

COST OF MITIGATING RISK DRIVERS FOR HIGHEST RISK LEVEES

- $21B is Estimated need to address risk factors associated with highest risk levees
- Evacuation effectiveness is relatively inexpensive & directly relates to life safety

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Overview of the Dam & Levee CoP – USACE Levee Perspective

Structural Improvements

- Breach Prior to Overtopping
- Overtopping with Breach
- Evacuation Effectiveness

COST BREAKDOWN:

- $300 M
- $8 B
- $13 B

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US Army Corps of Engineers.
- Overview of the Dam & Levee CoP
- *Existing Gaps*
- Vision DS/LS COP
EXISTING GAPS [WHAT CAN INDUSTRY/ACADEMIA SUPPORT]

- Risk Communication – related to Social Science of Risk
  - How we Understand Risk
  - How we Behave
  - How we Perceive Risks

- Coastal Risk – How we Access of Build Infrastructure along the Coast

- Overtopping Erosion

- Risk Informed Design
- Overview of the Dam & Levee CoP
- Existing Gaps
- Vision – DS/LS COP
VISION – DS/DS COP

ACHIEVE OUR VISION

WORLD CLASS management of portfolio of dams and levees through risk-informed decision making

LEAD CHANGE through national/international partnerships and national/international technical assistance

SUCCESSION PLANNING to retain our workforce through challenging, rich and rewarding work by affording exceptional opportunities
  • Endowed Chairs
  • Mentoring Program
  • Early Career Network

DELIVER THE PROGRAM

Utilize the enterprise to identify the RIGHT people to make the RIGHT decisions on the RIGHT projects
  ON TIME and ON BUDGET

STRENGTHEN THE FOUNDATION

• Policy and Guidance to apply program consistently across entire enterprise
• Provide training to all dam and levee resources to ensure consistency, competency, retention, and recruitment

Dam and Levee Safety Mission

Demonstrate our WORLD CLASS program by:
  • Building strong partnerships with our communities and sponsors
  • Risk-informed Decision Making
  • Culture of continuous improvement

UTILIZE Our Enterprise Resources

• Risk Management Center (RMC) - Denver
• Levee Safety Center (LSC) - MVD
• Dam Safety Mandatory Modification Center of Expertise (DSMMCX) - LRH
• Mapping, Modeling, and Consequences Center (MMC) - MVD
• Division Dam Safety Production Centers (DSPC’s)
QUESTIONS

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