



# Disaster and Failure Studies Program and Data Repository

UJNR

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# Presentation Outline

- Program Overview
- Disaster and Failure Events Data Repository



# Typical Study Objectives

- Establishing likely technical factor(s) responsible for damage, failure/successful performance of buildings/infrastructure in aftermath of disaster/failure event.
- Evaluating technical aspects of evacuation and emergency response procedures that contributed to extent of injuries and fatalities sustained during the event.
- Determining procedures and practices that were used in design, construction, operation and maintenance of buildings/infrastructure.
- Recommending, as necessary, specific improvements to standards, codes, and practices as well as any research and other appropriate actions based on study findings.

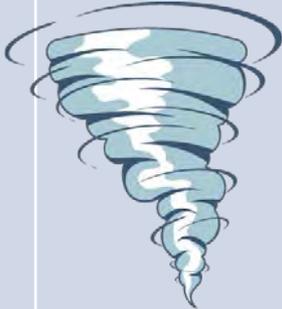
*NIST promotes, enables, and tracks adoption of recommendations through improved standards, codes, and practices as well as any research and other appropriate actions based on study findings.*



# NIST Disaster and Failure Studies



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Earthquakes	Hurricanes	Construction/ Building	Tornadoes	Fires
<p>San Fernando, CA (1971)</p> <p>Mexico City, Mexico (1985)</p> <p>Loma Prieta, CA (1989)</p> <p>Northridge, CA (1994)</p> <p>Kobe, Japan (1995)</p> <p>Kocaeli, Turkey (1999)</p> <p>Maule, Chile (2010)*</p> <p>Christchurch, NZ (2011)*</p>	<p>Camille, MS/LA (1969)</p> <p>Alicia, Galveston, TX (1983)</p> <p>Hugo, SC (1989)</p> <p>Andrew, FL (1992)</p> <p>Hurricanes Mitch and Georges, LAC (1998)</p> <p>Hurricanes Katrina and Rita (2005)</p> <p>Hurricane Sandy (2012)*</p>	<p>Skyline Plaza Apartments, Bailey's Crossroads, VA (1973)</p> <p>Willow Island Cooling Tower, WV (1978)</p> <p>Kansas City Hyatt Regency, Kansas City, MO (1981)</p> <p>Riley Road Interchange, East Chicago, IN (1982)</p> <p>Harbor Cay Condominium, Cocoa Beach, FL (1981)</p> <p>L'Ambiance Plaza, Hartford, CT (1987)</p> <p>Ashland Oil Tank Collapse, Floreffe, PA (1988)</p> <p>U.S. Embassy, Moscow, USSR (1987)</p> <p>Murrah Federal Building, Oklahoma City, OK (1995)</p> <p>World Trade Center Disaster, New York, NY (2001)</p> <p>Dallas Cowboys Indoor Practice Facility, May 2009</p>	<p>Jarrell, TX (1997)</p> <p>Spencer, SD (1998)</p> <p>Oklahoma City, OK (1999)</p> <p>Joplin, MO (2011)*</p> <p>© 2011 Shutterstock/Diagon. Used with permission</p>  	<p>DuPont Plaza Hotel, San Juan, PR (1986)</p> <p>First Interstate Bank Building, Los Angeles, CA (1988)</p> <p>Loma Prieta Earthquake, CA (1989)</p> <p>Hillhaven Nursing Home (1989)</p> <p>Pulaski Building, Washington, DC (1990)</p> <p>Happyland Social Club, Bronx, NY (1990)</p> <p>Oakland Hills, CA (1991)</p> <p>Hokkaido, Japan (1993)</p> <p>Watts St, New York City (1994)</p> <p>Northridge Earthquake, CA (1994)</p> <p>Kobe, Japan (1995)</p> <p>Vandalia St, New York City (1998)</p> <p>Cherry Road, Washington, DC (1999)</p> <p>Keokuk, IA (1999)</p> <p>Houston, TX (2000)</p> <p>Phoenix, AZ (2001)</p> <p>Cook County Administration Building Fire (2003)</p> <p>The Station Nightclub, RI (2003)</p> <p>Charleston, SC, Sofa Super Store Fire (2007)</p> <p>Witch Creek &amp; Guejito, CA, WUI Fire (2007)</p> <p>Amarillo, TX, WUI Fire (2011)</p>



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\* Ongoing

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# NIST's Role in Disaster and Failure Studies

- NIST may use any one or a combination of the study options below in conducting a study:
  - **NIST may lead post-event studies.**
  - **NIST may coordinate or participate in post-event studies.**
  - **NIST may sponsor or participate in private sector-led post-event studies.**
  - **NIST may provide technical assistance in the reconstruction process for international disaster and failure events** at the request of U.S. agencies, industry, private organizations, governments of other nations, or international organizations.



# International Disaster and Failure Events

- NIST may conduct reconnaissance of international disaster or failure events when lessons can be learned for the U.S.
- NIST involvement in international disaster and failure studies generally are undertaken:
  - in cooperation with other U.S. agencies, industry or private organizations, governments of other nations, or international organizations
  - for the purpose of establishing or improving codes, standards, and practices in the U.S.
- The decision criteria and guidelines for conducting studies are not intended to preclude situations where NIST is requested by other U.S. agencies, industry, private organizations, governments of other nations, or international organizations to provide technical assistance, on a reimbursable basis, in the reconstruction process for international disaster and failure events.



# NIST Decision Criteria and Guidelines

- NIST has developed Decision Criteria and Guidelines that provide a rational basis for evaluating whether NIST should conduct a study.
  - NIST considers staff availability, resource availability, staff safety, and the quality and adequacy of information and artifacts available to conduct a meaningful study.
  - To the extent practicable, NIST will deploy a team in a timely manner after a disaster or failure event.



# Disaster and Failure Events Data Repository Scope

- Extreme events test buildings and infrastructure in ways and on a scale that cannot easily be replicated in a laboratory – buildings and infrastructure are built without being tested at full scale. The “real world” is the laboratory for buildings and infrastructure.
- Collection and analysis of data and artifacts from the field and other sources is essential to improve the understanding of hazards, the real-world performance of buildings and infrastructure during disaster and failure events at both the component and the system levels, and associated emergency response and evacuation procedures.
- The results of disaster and failure studies using such data and artifacts will enable recommendations to enhance disaster-resilience at the structure and community levels through improvements to building codes, standards, and practices and identification of gaps in current knowledge about buildings, infrastructure, emergency response, and human behavior.



## Repository Scope (cont.)

- NIST will create and maintain the repository to facilitate disaster and failure studies and widely disseminate the data, findings, and recommendations from these studies.
- Other federal agencies, state and local governments, research institutions and industry organizations that are engaged in parallel efforts and can provide input for the repository will be engaged in the development of the database.



# Repository Data Types

- As the database grows, it will include data on significant hazard events.

Data Types
Site Documentation and Collection of Artifacts
Hazard or Threat Event Data
Safety and Performance Data
Design, Construction, Operation and Maintenance Information
Evacuation and Emergency Response Information
Findings, Conclusions and Recommendations
Changes to Standards, Codes and Practices Based on Recommendations



# NIST Repository Workplan

- Phase 1 – World Trade Center dataset
- Phase 2 – HUB technology pilot
  - Chile dataset
  - Joplin dataset
- Phase 3 – Implementation plan



# Phase 1 – World Trade Center Dataset

- Data previously released from NIST's 7-year investigation of the collapses of three buildings at New York City's World Trade Center
- Over 94,000 photos and videos
- Computer simulations
- Complete set of technical reports
- Repository created and managed by NIST
- Website publically released in August 2011



# Phase 2 – HUB Technology Pilot: Chile Dataset

- Develop event-specific, web-based repository
- Data-rich event that will support the National Earthquake Hazards Reduction Program (NEHRP)
- Opportunity to coordinate with the Network for Earthquake Engineering Simulation (NEES)
- NIST retained a contractor to assist with obtaining data previously collected by others (American Society of Civil Engineers - ASCE, Earthquake Engineering Research Institute - EERI, and Los Angeles Tall Buildings Council study teams)



# Phase 2 – Chile Dataset: Contents

- 100 fields of data on 273 building structures (1985 Valparaiso and 2010 Maule earthquakes)
- Hundreds of drawings
- 22,000 photographs (searchable by keyword)
- Landing page to guide user and provide references



# Phase 2 – Joplin Dataset: Contents

- 800 building drawing files
- ~3,000 photos obtained by NIST
- Video imagery
- Damage data such as field reports
- Modeled tornado wind field
- GIS layers (fatalities, building damage, etc,)
- Audio files from first responder radio traffic



# Phase 3 – Implementation Plan

- Finalize user requirements / system design document
  - Creating standard taxonomy / ontology for each hazard type
  - Setting minimum criteria for data to be accepted by NIST
  - Exploring and developing software requirements for geospatial enhancements of data in repository
  - Finalizing which types of data to be included
  - Determining criteria for inclusion in repository (which events?)
- Select operating platform based on user requirements



# Phase 3 – Implementation Plan (cont.)

- Develop standard data collection systems for different kinds of events
- Populate with selected high-impact data from historical and future events
- Develop plan to maintain, update, operate and improve accessibility of the repository
- Maintain, update, and operate ongoing communication with stakeholder / user community





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## Questions/Discussion

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