

# Contributions of Earthquake Engineering

to Protecting Communities and Critical  
Infrastructure from Multihazards



EARTHQUAKE ENGINEERING  
RESEARCH INSTITUTE



**Tom O'Rourke**  
Cornell University

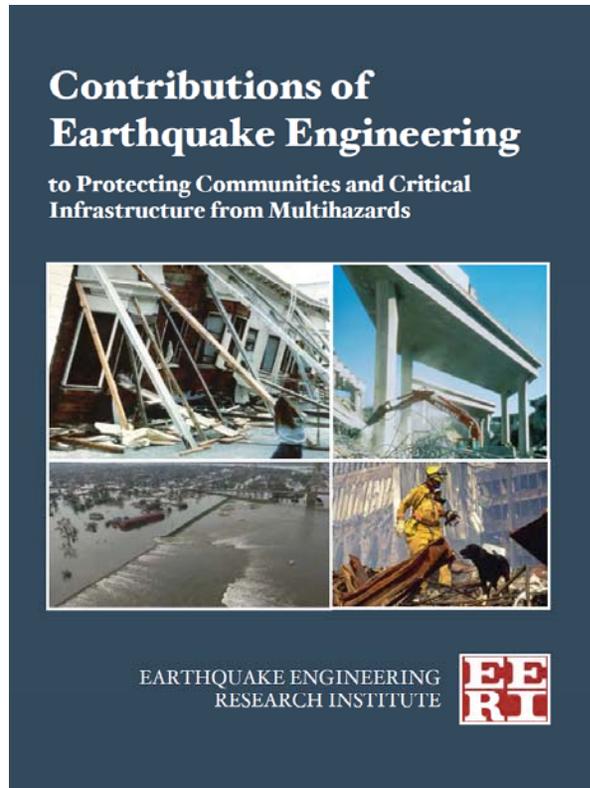
**Chris Rojahn**  
Applied Technology Council

**Jay Berger**  
Earthquake Engineering Research  
Institute

August 18, 2014  
NEHRP ACEHR Meeting  
Golden, CO

NEHRP Advisory Committee on Earthquake Hazard Reduction (ACEHR) Meeting  
August 18-19, 2014  
National Earthquake Information Center, Golden Colorado

# Contributions of Earthquake Engineering to Protecting Communities and Critical Infrastructure from Multihazards



- Grew from a small project supported by EERI at a 2003 workshop
- Steering Committee led by:
  - Tom O'Rourke (chair)
  - Tom Holzer
  - Chris Rojahn
  - Kathleen Tierney
- Published and distributed by EERI in 2008 with support from FEMA/DHS

## Intent of Report

Lay out the contributions of EE that enhance public safety and improve protection of U.S. communities **from hazards beyond earthquakes.**

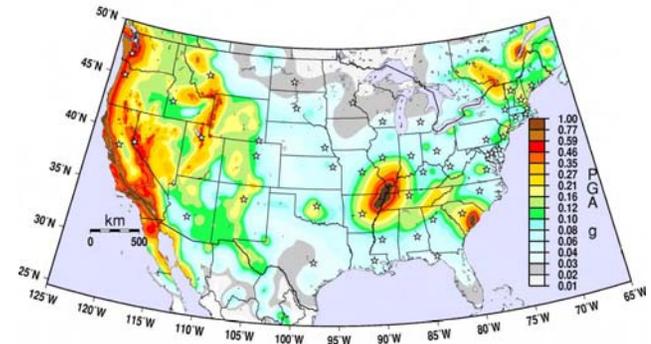
## Four Categories

1. Planning
2. Advanced Technologies
3. Emergency Response
4. Community Engagement

# Planning

➤ Risk Analysis, Hazard Assessment and Loss Estimation

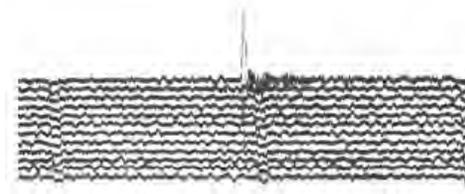
➤ Earthquake Design, Guidelines and Codes



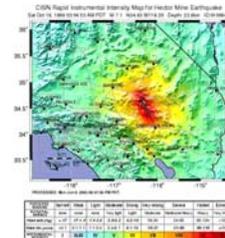
Performance  
Based Design

# Advanced Technologies

➤ Seismology and Nuclear Test/Explosion Monitoring



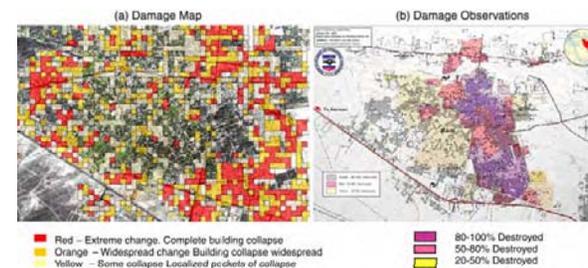
➤ Seismic Monitoring Networks



➤ Protective Systems



➤ Remote Sensing



# Emergency Response

➤ Post-Disaster Building Inspection



➤ Organization of Emergency Response



# Engaging the Community

- Risk Communication, Forecasts and Warnings
- Public and Organizational Response Following Disasters
- Loss Reduction Partnerships
- Multihazard Legislation and Policy



# More Recent Example

## Crowd Sourcing and Remote Sensing



DSC\_0024

## GEO-CAN Assessment of Buildings in Haiti 2010

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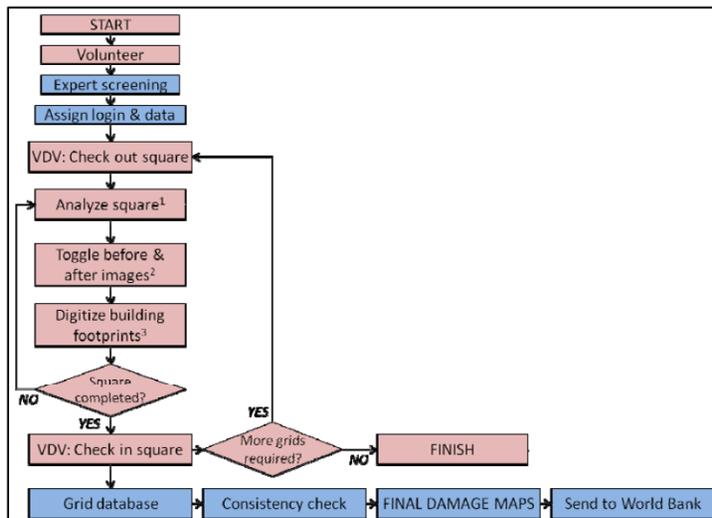


Figure 3. Workflow for each GEO-CAN volunteer (in pink)

	Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage) Hair-line cracks in very few walls. Fall of small pieces of plaster only. Fall of loose stones from upper parts of buildings in very few cases.
	Grade 2: Moderate damage (slight structural damage, moderate non-structural damage) Cracks in many walls. Fall of fairly large pieces of plaster. Partial collapse of chimneys.
	Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage) Large and extensive cracks in most walls. Roof tiles detach. Chimneys fracture at the roof line; failure of individual non-structural elements (partitions, gable walls).
	Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage) Serious failure of walls; partial structural failure of roofs and floors.
	Grade 5: Destruction (very heavy structural damage) Total or near total collapse.

Figure 4: Examples of damage states from the EMS-98 Damage Scale

## GEO-CAN Assessment of Buildings in Haiti – 2010

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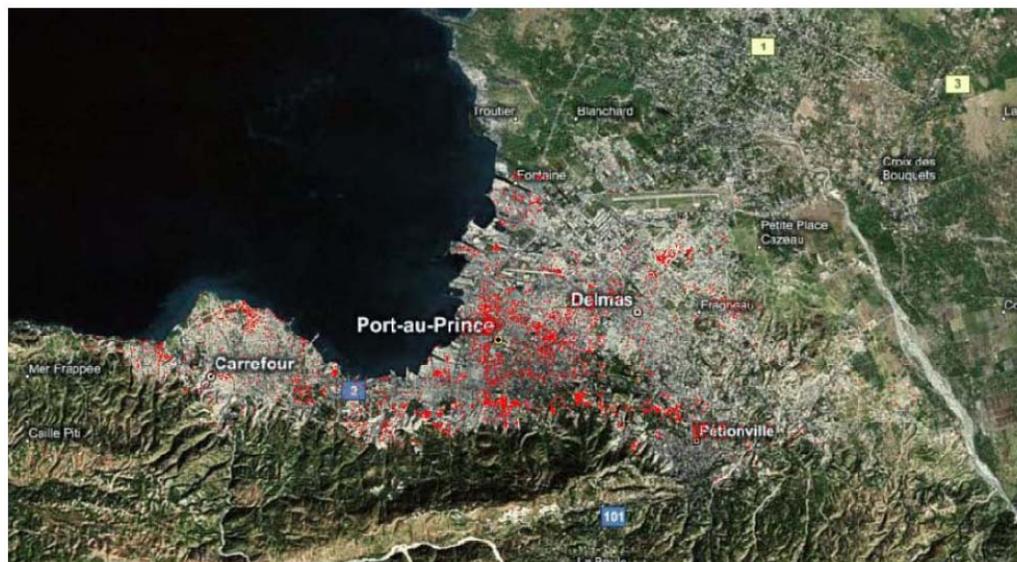
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*Figure 6: Point locations of collapsed structures (Phase 1)*

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