The Seismic Performance Prediction Program (SP3)

Curt B. Haselton, PhD, PE
Professor of Civil Engineering @ CSU, Chico
Co-Founder @ Seismic Performance Prediction Program (SP3)

www.hbrisk.com

EERI Annual Meeting
San Francisco, CA | April 6, 2016
FEMA P-58 is a performance prediction methodology (10 years in the making, $12M budget, some further development ongoing)

FEMA P-58 output results:
- Repair costs
- Repair time [business disruption]
- Fatalities & injuries

FEMA P-58 Benefits:
- Tailored for building-specific analysis (vs. methods for building class)
- Standardized and objective methodology (not a black box)
- Standardized component fragilities
- Tool/graphics to communicate with clients (and for reports)
Overview of FEMA P-58

Ground Motion Hazard

Structural Response

Economic Loss

Casualties

Repair Time

Component Damage

[Source: Some graphics from presentation by Ron O. Hamburger on FEMA P-58.]
Average Repair Cost (8-story concrete frame, LA):

Loss Contributions by Component Type for a 475 Year Ground Motion

Total Average Loss: 15%
In early 2014, Jack Baker and I decided to start a software project with the goal of helping make FEMA P-58 feasible at the pace of an engineering office.

**Our Goal:** Help enable adoption of FEMA P-58 in structural engineering practice (make it doable!).

Our three components of this work are as follows:

- b) Maintain software over time (fragilities, etc.).
- c) Improve and extending the methodology in the future (especially after current ATC/FEMA Phase II work is done).

**ATC Coordination:** We have been in coordination with ATC from the start (so all pulling in same direction).
The SP3 Software

- **Step 1: Site Hazard**
  - Soil and hazard curve
  - Ground motions (if needed)

- **Step 2: Structural Responses**
  - Option #1: Structural analysis
  - Option #2: Predictive equations

- **Step 3: Damage Prediction**
  - Contents
  - Fragility curves

- **Step 4: Loss Estimation**

  Structure: Cloud-based computational platform, fast Matlab engine

  USGS Soil and ground motion database
  - We implement the FEMA P-58 calculations, plus a number of other features.
  - Building contents are auto-populated (using FEMA P-58 and enhanced options)

  Two-level structure:
  1) Use initial pre-populated values
  2) Modify inputs and dig deeper
The SP3 software is complete and is currently being used by early-adopter companies for:

- new resilience-based design,
- retrofit projects,
- seismic risk evaluations (both mortgage and insurance), and
- U.S. Resiliency Council trial ratings.

This is a commercial software and we have both commercial and research/educational licenses available.

We are just starting the phase (over past few months) of being more public and marketing SP3 (I am a researcher and not naturally a sales/marketing person!).
Seismic Performance Prediction Program
by Haselton Baker Risk Group

We equip engineers with tools needed to consider damage and loss reduction directly in the building design process.

SP3 enables something never before feasible in a design office.
We help engineers and owners calculate their seismic risk by understanding and predicting earthquake performance in a whole new way.

Total number of simulated earthquakes to date

94,393,220

Comprehensive
SP3 implements cutting-edge research to equip engineers to comprehensively estimate seismic damage, loss, and building repair time.

Efficient
SP3 uses stream-lined analysis methods to give results in a matter of hours (rather than days or weeks), with user-defined inputs to refine the analysis at any step.

SP3 in the Marketplace
Thank You

- Thanks you for your time.
- Questions?

SP3 Software contact information:
  - www.hbrisk.com
  - E-mail: curt@hbrisk.com
  - Direct (cell): (530) 514-8980

CSU Chico faculty contact information
  - www.csuchico.edu/structural
  - E-mail: chaselton@csuchico.edu