

Building-Specific Seismic Risk Assessment of Wood Light-Frame Buildings using the Seismic Performance Prediction Program (SP3)

Curt B. Haselton, PhD, PE

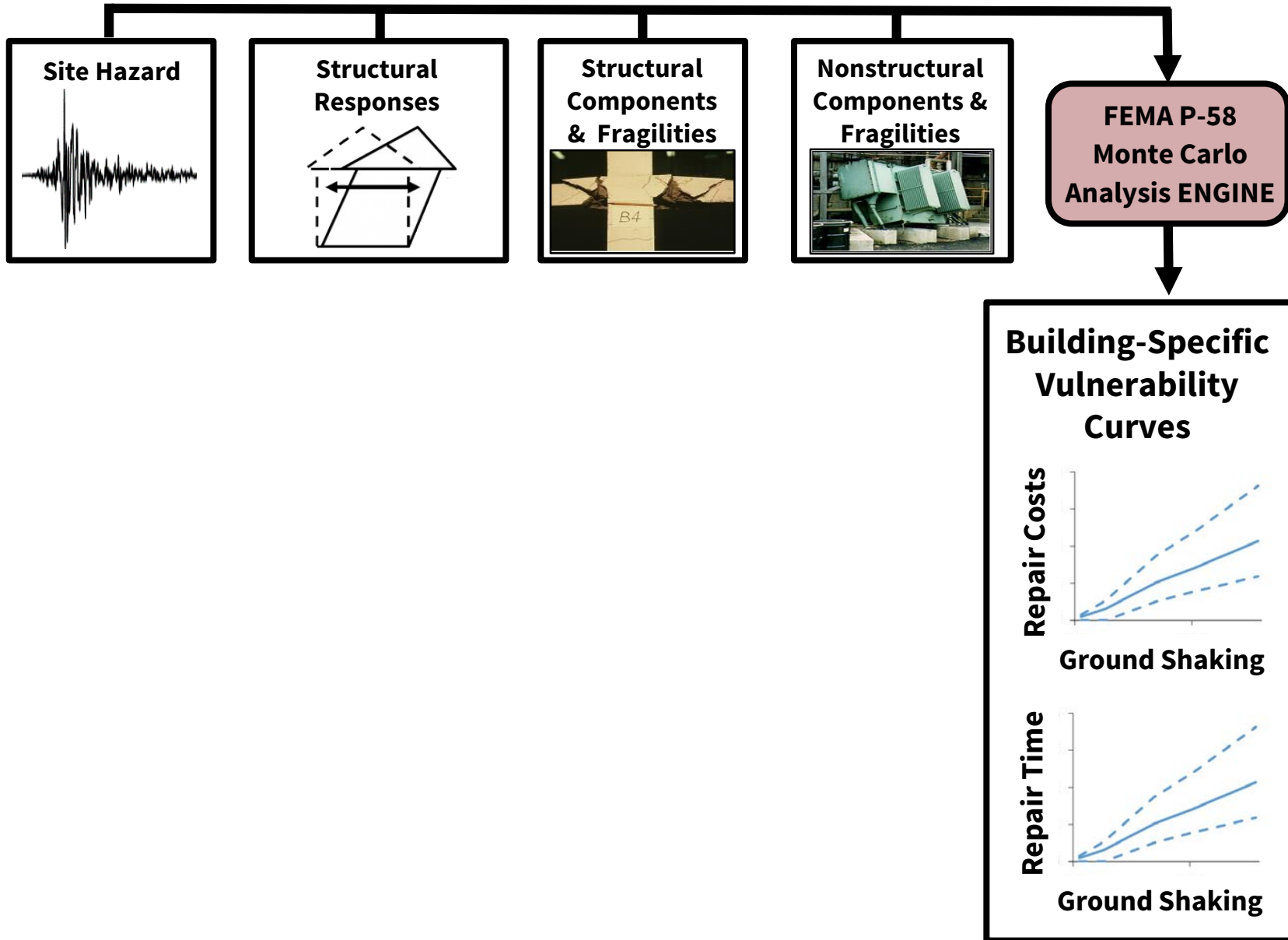
*John F. O'Connell Endowed Professor @ CSU, Chico
Co-Founder and CEO @ Haselton Baker Risk Group*

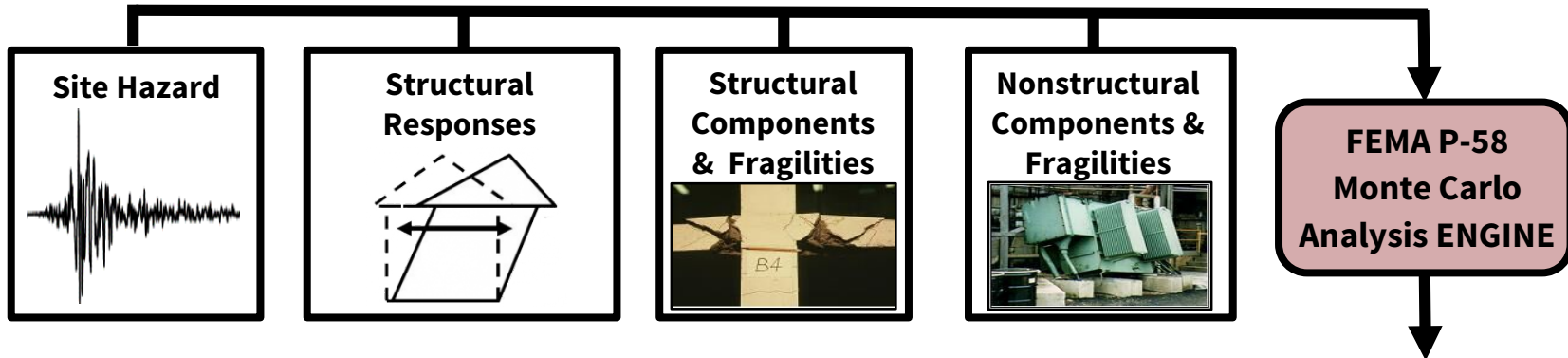
Jack W. Baker, PhD

*Associate Professor @ Stanford University
Co-Founder @ Haselton Baker Risk Group*

SP3 | where research meets practice

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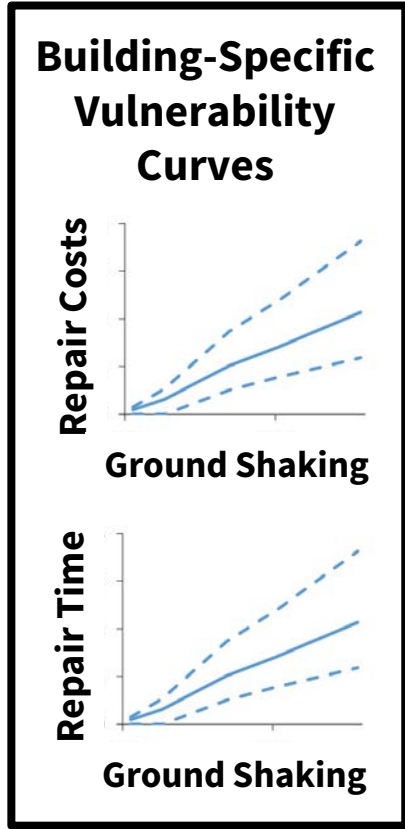


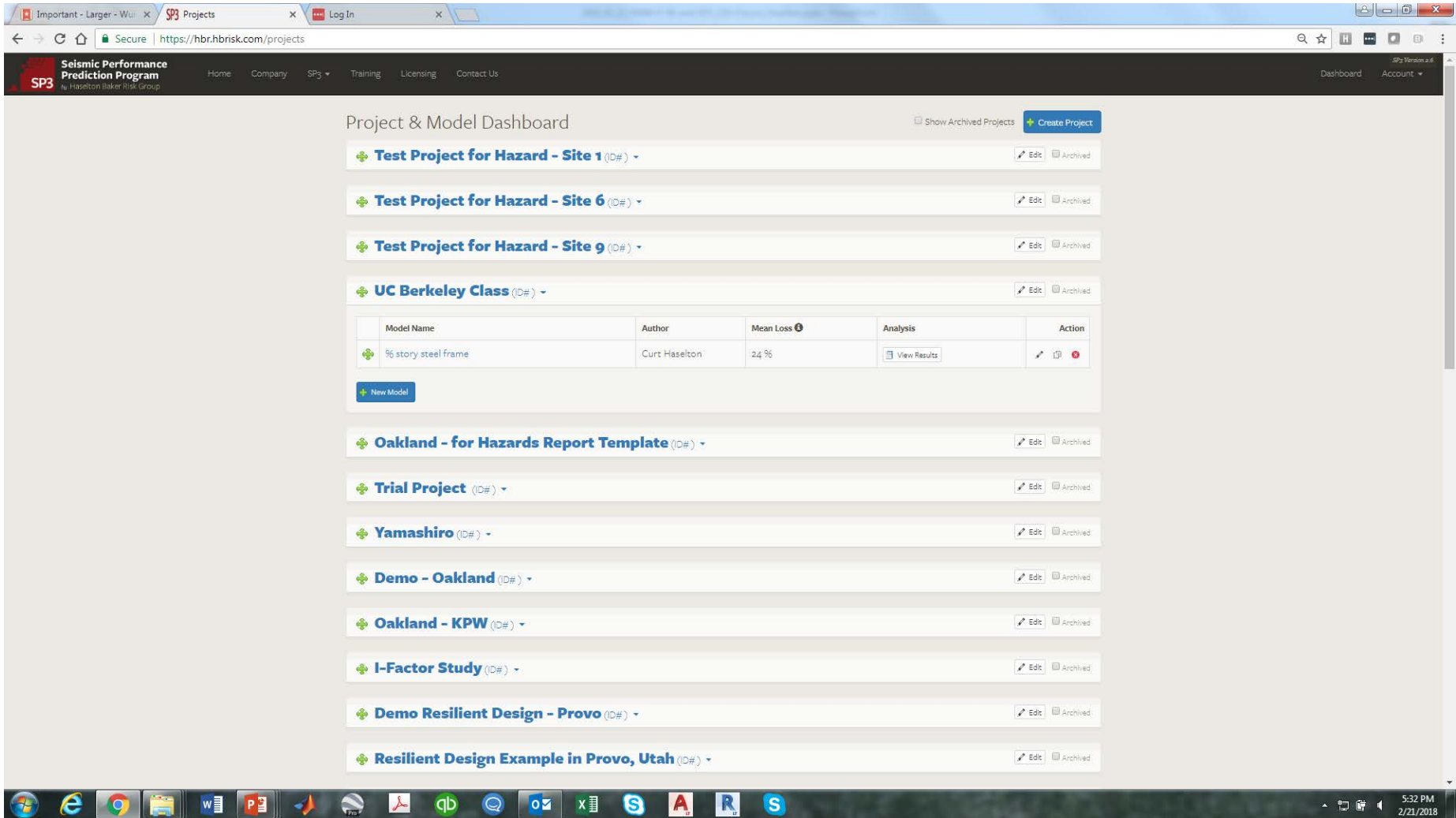
Detailed Building and Site Information
(e.g. wall and finish information, roof mass information, etc.)



SP3_Engineering

Licensed Engineer: In the *SP3_Engineering* tool, inputs are done by a licensed engineer on a building-specific and site-specific basis (with some provided automation).





The screenshot shows a web browser window displaying the 'Project & Model Dashboard' for SP3. The browser address bar shows 'https://hbrisk.com/projects'. The dashboard header includes the SP3 logo, 'Seismic Performance Prediction Program', and navigation links for Home, Company, SP3, Training, Licensing, and Contact Us. On the right side of the header, there are links for 'Dashboard' and 'Account'.

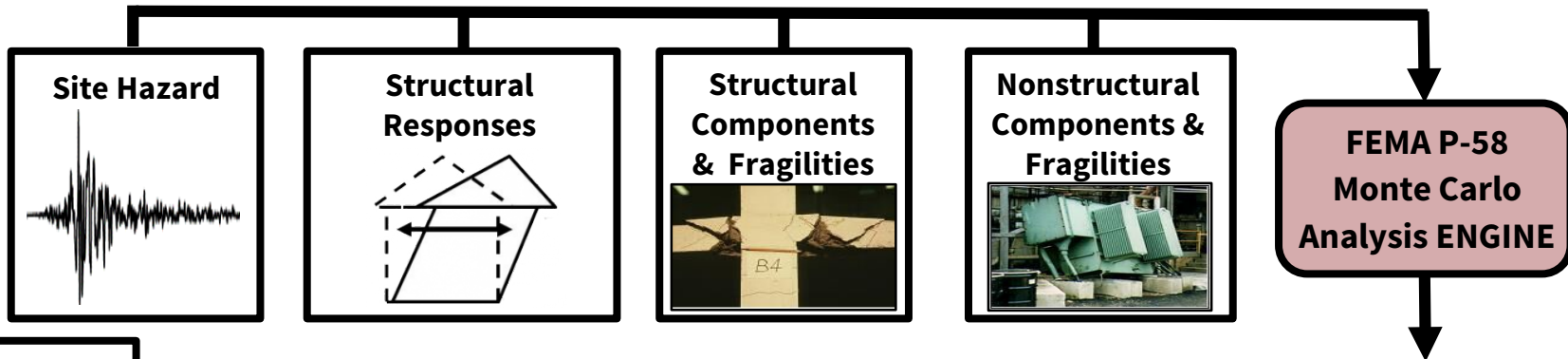
The main content area is titled 'Project & Model Dashboard' and includes a 'Show Archived Projects' checkbox and a 'Create Project' button. Below this, there is a list of project entries, each with a plus icon, a project name, and an '(ID#)' dropdown menu. Each entry also has 'Edit' and 'Archived' buttons. The projects listed are:

- Test Project for Hazard - Site 1 (ID#)
- Test Project for Hazard - Site 6 (ID#)
- Test Project for Hazard - Site 9 (ID#)
- UC Berkeley Class (ID#)
- Oakland - for Hazards Report Template (ID#)
- Trial Project (ID#)
- Yamashiro (ID#)
- Demo - Oakland (ID#)
- Oakland - KPW (ID#)
- I-Factor Study (ID#)
- Demo Resilient Design - Provo (ID#)
- Resilient Design Example in Provo, Utah (ID#)

Below the project list, there is a table with the following data:

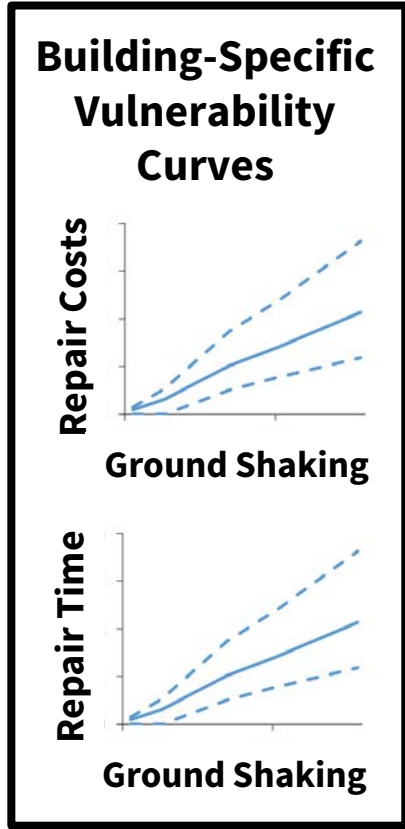
Model Name	Author	Mean Loss	Analysis	Action
6 story steel frame	Curt Haselton	24%	View Results	Edit Archived

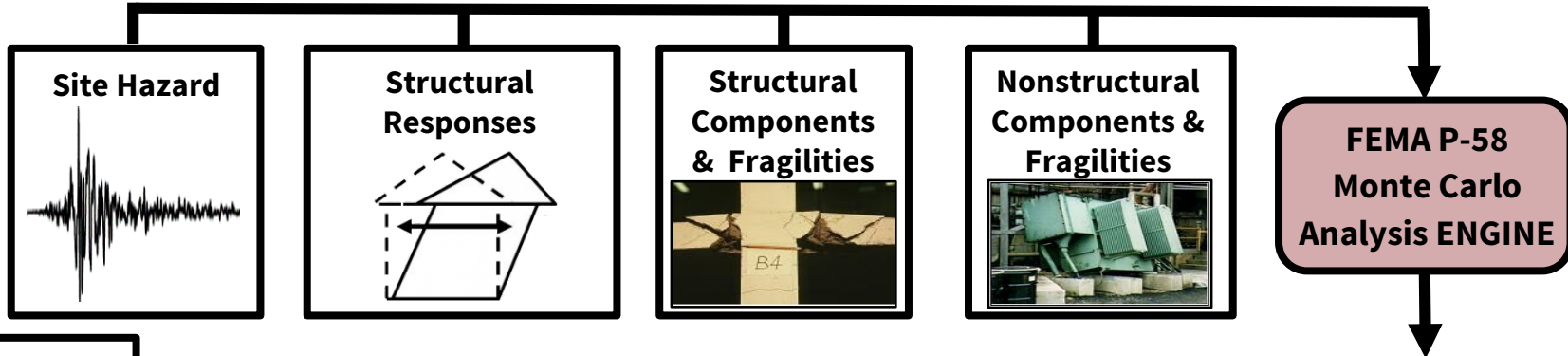
At the bottom of the table area, there is a 'New Model' button. The Windows taskbar at the bottom of the screenshot shows various application icons and the system clock indicating 5:32 PM on 2/21/2018.



Basic Building and Site Information
 (e.g. location, construction year, etc.)

Additional Secondary Modifiers
 (square footage, numbers of beds/baths, roof type/mass, chimneys, foundation, etc.)





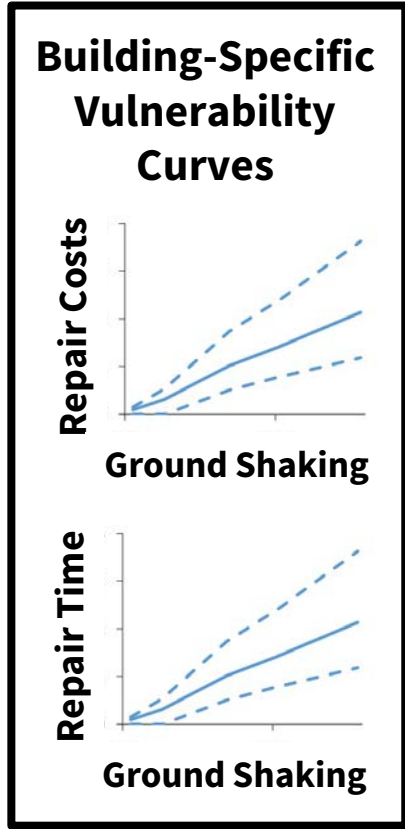
Basic Building and Site Information
 (e.g. location, construction year, etc.)

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SP3 BUILDING-SPECIFIC RISK MODEL
 Full FEMA P-58 engineering-based risk assessment framework

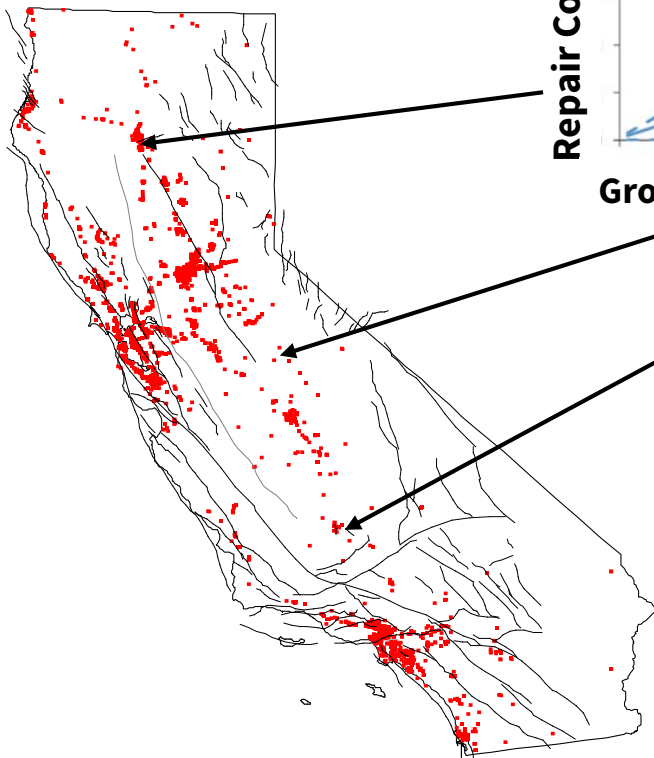
Automation through many research-backed analytical SP3 Engines and SP3 Databases (Building Code Database, Archetype Design Database, Structural Response Engine, etc.)

When full automation is used, this provides building-specific and site-specific vulnerability curves quickly and can be used for large inventories (with support from *SP3_Batch*)

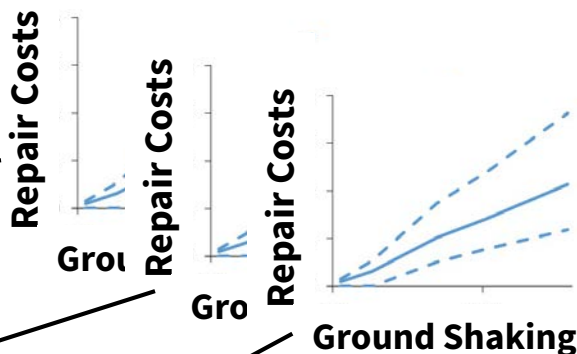


How to we use this new technology to assess the risk in a large portfolio?

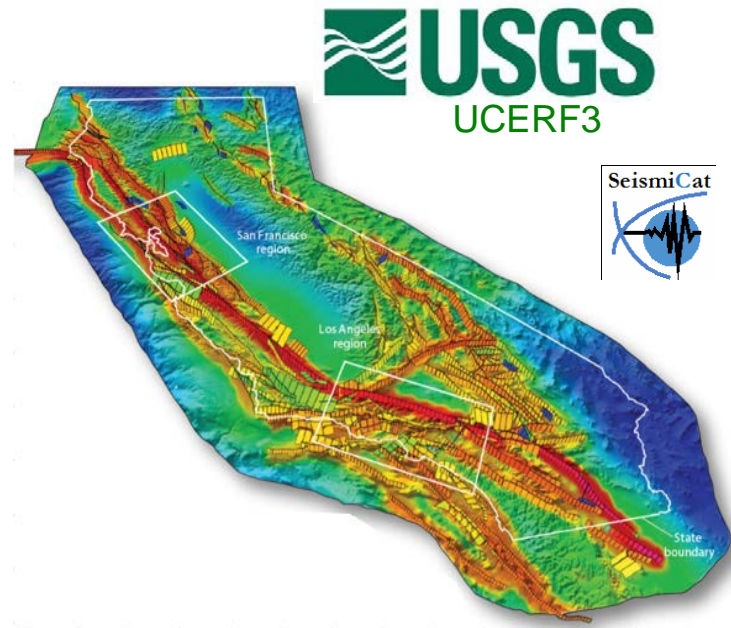
Inventory
(with basic inputs and any secondary modifiers)



Building/Site-Specific Vulnerability Curves



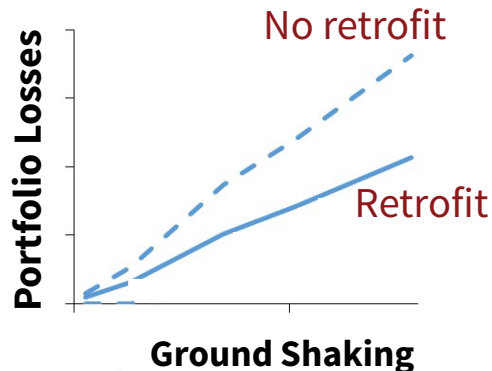
Portfolio Risk Assessment



SP3 Building-Specific Risk Model and SP3_Batch



How do we use this new technology to assess the risk in a large portfolio?



This process results in typical portfolio results, i.e.:

- Various loss types – e.g. ground up, insured
- Various metrics – e.g. expected annual losses, losses for various scenario, losses for a return period
- Effects of decisions – e.g. retrofit of portion of building stock, etc.

Big picture outcomes:

- This now allows stakeholders to utilize the transparent and public-domain methods developed in the past 25 years of PEER and ATC/FEMA research, in an inventory/portfolio format that they are used to.
- This process provides risk information that can account for more building/site-specific information (when it is available).
- This improved knowledge can be used to:
 - ✓ Compare with typical risk assessments from vendor models.
 - ✓ Formulate decisions on retrofit rebates, reduced premiums incentives, and on reinsurance.
 - ✓ Etc.

Current SP3 Uses (with focus on WLF building):

- 1) Building-specific resilience assessments (retrofit, design, insurance underwriting, acquisition, etc.)
- 2) Large inventory assessments (e.g. all of CA)

Impediments to Broader Use (for further discussion):

- Awareness, especially for the SP3_RiskModel and SP3_Batch which were finalized last year
- Perception of this being a “Cadillac method” that is hard to use (the reality is that all the automation makes even the engineering evaluation fast)

Summary of Key Benefits of FEMA P-58 and SP3:

- Provides more building-specific risk information (not just by building class), for both detailed evaluations and large inventories/portfolios
- FEMA P-58 is comprehensive and credible (\$16M, 15 years, 100+ developers)
- FEMA P-58 is transparent (open-source method for all to see)
- FEMA P-58 is standardized and repeatable (standard research-based databases provide the foundation)
- SP3 makes this comprehensive FEMA P-58 risk assessment quick and accessible

- **Discussion Question:** How can new tools like SP3 (and others) be leveraged to:
 - provide better risk information for residential buildings and to
 - promote more resilient buildings (for both retrofit and new design).

- **Feedback Welcomed:** Our goal is to support adoption of more building-specific risk assessment, and resilience-based design, and we welcome any feedback and suggestions.

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