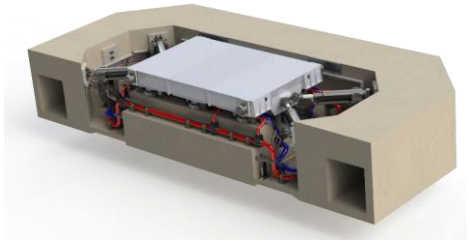
National Science Foundation

University of California at San Diego
NHERI
Natural Hazards Engineering Research Infrastructure

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Structural Engineering

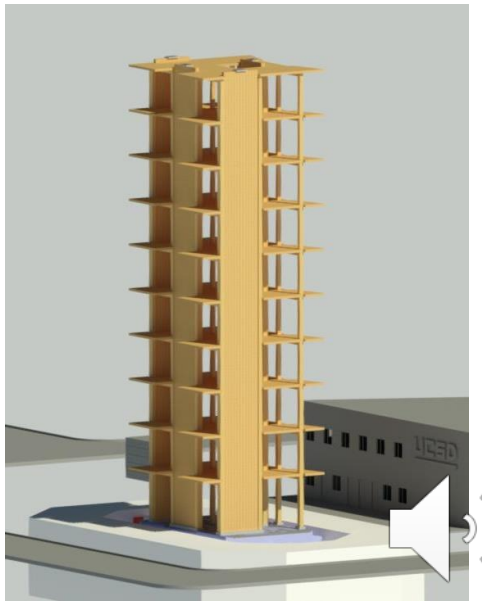
Preparing an NSF Proposal to Utilize NHERI@UCSD

John W. van de Lindt, Colorado State University



NHERI@UC San Diego User Training Workshop

December 15-16, 2022
University of California, San Diego



“I skate to where the puck is going to be, not where its been.”

….Wayne Gretzky

A few short stories….

Story 1: Right place, right time

…but put yourself there!

- 2001 NEES Consortium
- 2002 UCSD NSF workshop
- 2003 Elevator Speech
- 2004 Visit to Japan
- 2006 Park City, UT – 1st NEES Annual Meeting - Hayama-San (Director General, NIED)
- 2009 Miki City, Japan

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Story 2: Back yourself into a corner

…then fight your way out!

- Great recession of 2008
- Ten round trips to Japan in 2009 for NEESWood
- Every time I boarded to go back to Colorado I needed to find $$$ within a week
- Left computers in the office and picked up nail guns for the last month

Let Societal Need Drive Research

- Don’t solve a problem because you can; solve it because society needs you to….
- Academic solutions alone are going away for large projects
- Community (or private entity) partnerships to enable positive change; engagement
- Broader impact isn’t just education – which is important – it’s making your research impactful in society
- No matter how technical your work is – find a way to explain it to anyone; and do – make a case for it before it is proposed

How I write a proposal – especially when they include big tests

- Convince reviewers there's a problem and the world needs this solution
- Convince them you or your team are the researchers to solve it
- Convince them your workplan can do it; time, money, process
- Pay attention to details
- Think of a novel
  - You have less than a page to get reviewers attention
  - Foreshadowing; reminders of importance;
  - Organization and structure

An example from 2013 @UCSD…

But first – the most important component

Team, team, team….!!!

The Capstone Team

NEESWOOD

John van de Lindt

Colorado State University

Steven Pryor

SIMPSON Strong-Tie

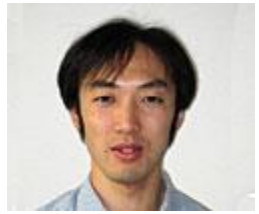
Shiling Pei

Colorado School of Mines

David Clyne

MAUI HOMES

Hidemaru Shimizu

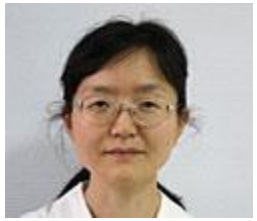


NIED National Research Institute for Earth Science and Disaster Prevention

Hiroshi Isoda

信州大学 SHINSHU UNIVERSITY

Izumi Nakamura



NIED National Research Institute for Earth Science and Disaster Prevention

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SIMPSON Strong-Tie

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Colorado State University

Kate Pfretzschner

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Kazuki Tachibana

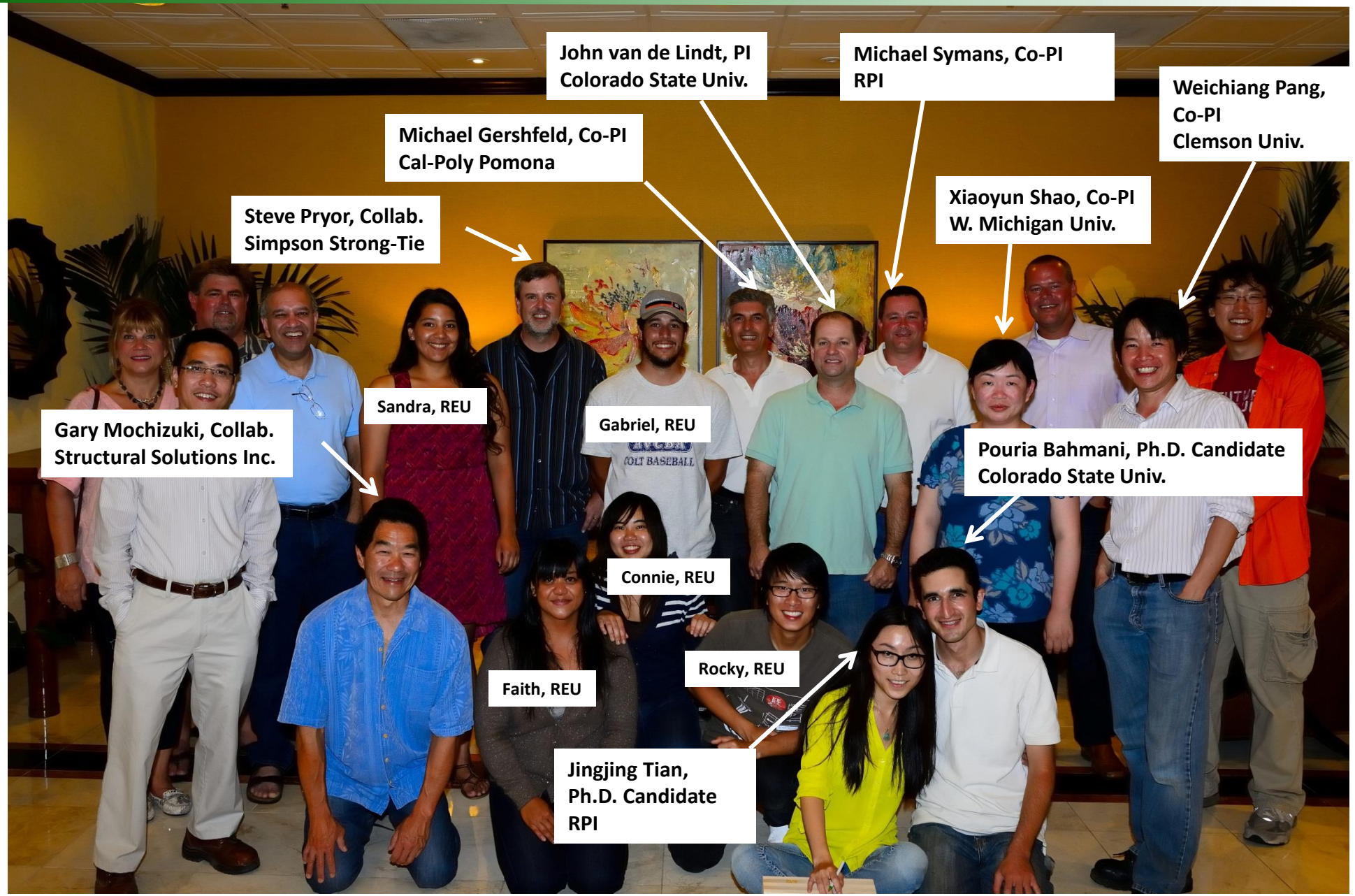
THE UNIVERSITY OF TOKYO

Tomoya Okazaki

信州大学 SHINSHU UNIVERSITY

Colorado State University

The NEES-Soft Site Team



NIST CoE Executive Team

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Bruce Ellingwood
Co-Director

Jamie Kruse
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University of Illinois at Urbana Champaign

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Shannon Van Zandt
Task 2: IN-CORE Outreach and Sustainability
Texas A & M University

Harvey Cutler
Task 3: Mitigation and Recovery
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Andre Barbosa
Task 4: Verification and Validation (V&V) of IN-CORE
Oregon State University

Jamie Padgett
Task 5: Modeling of Complex Systems
Rice University

Paolo Gardoni
Task 6: Modeling of Interdependencies and Propagation of Uncertainty
University of Illinois at Urbana Champaign

NIST CoE Senior Research Team



CAL POLY POMONA


Oregon State University OSU

KU THE UNIVERSITY OF KANSAS



ILLINOIS UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN






COLORADO STATE UNIVERSITY


RICE


East Carolina UNIVERSITY
Stony Brook University


The UNIVERSITY of OKLAHOMA

USA

Georgia Tech





TEXAS A&M UNIVERSITY

USNA UNITED STATES NAVAL ACADEMY


2013/08/17 AM11:09:20
CAM4 C1GRGSE


NEES @ UCSD

Uniqueness of Proposals that Include a Large Test

- NSF cannot fund the entire test program typically, so don't ask
- Thread at least two concepts through the proposal/proposed work
  - Fundamental research – NSF
  - Industry research – fundraising/collaboration
- Put the "A" team together even if its expensive
  - Choose people based on skill set & their ability to collaborate

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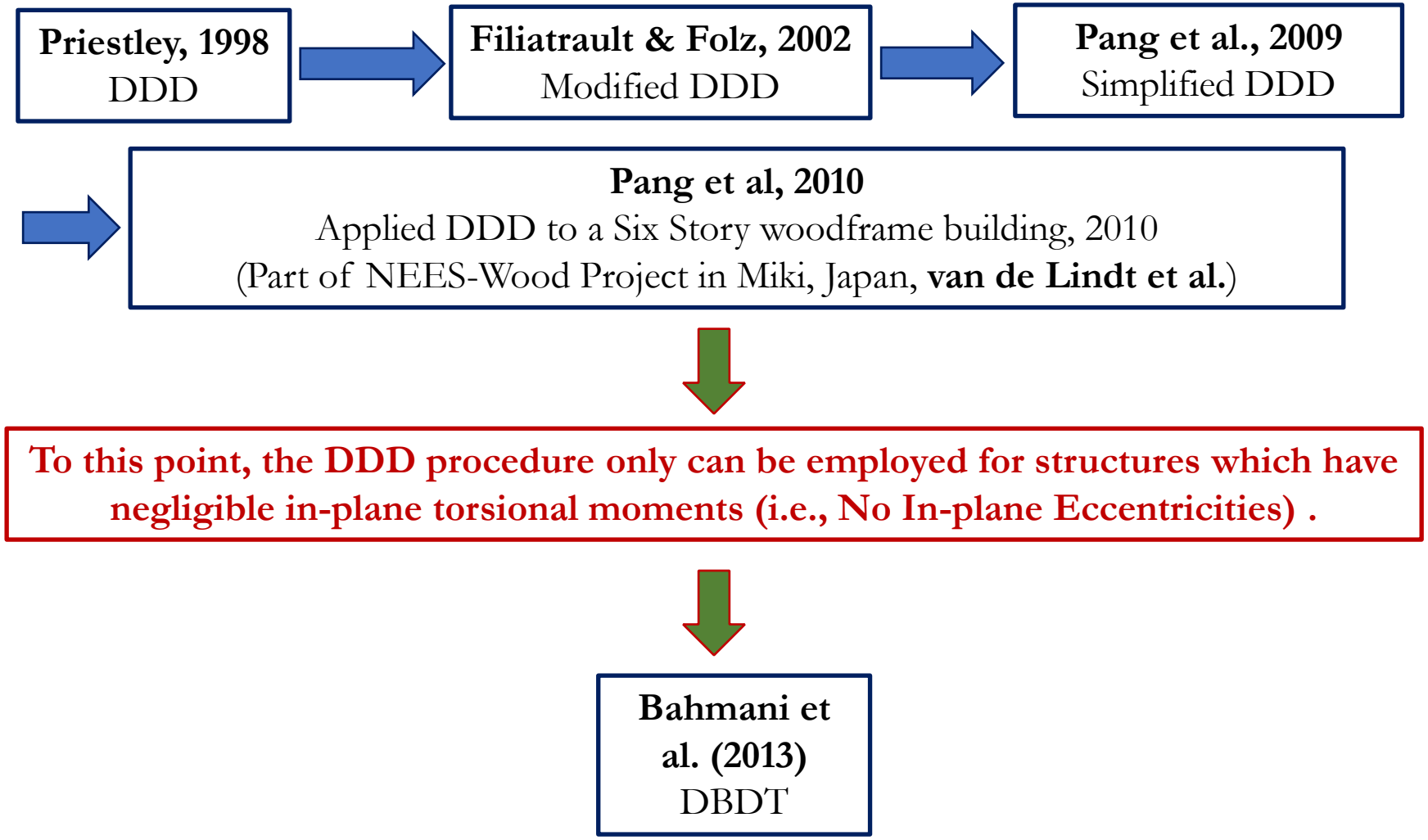
Fundamental Research Component 1 – NEES-Soft



Bahmani, P., van de Lindt, J., and Dao, T. (2014). "Displacement-Based Design of Buildings with Torsion: Theory and Verification.", *J. Struct. Eng.*, 140(6), 04014020.

Fundamental Research Component 2 – NEES-Soft

- Develop better models of woodframe collapse mechanisms
- Model needed for better P695 and other analysis (ATC project – Pang et al)

Corotational Model for Cyclic Analysis of Light-Frame Wood Shear Walls and Diaphragms
•February 2012
•Journal of Structural Engineering 129(8):1303-1317
DOI:10.1061/(ASCE)ST.1943-541X.0000595

Example: City of San Francisco

The San Francisco Soft-Story Ordinance

John Dal Pino, S.E. and James Enright, P.E., LEED AP in Lessons Learned 0

In 2013, the City of San Francisco embarked on an ambitious and groundbreaking endeavor: the mandatory seismic retrofit of its wood-framed soft-story apartment buildings. The 1989 Loma Prieta earthquake caused considerable damage to such buildings in the Marina District (*Figure 1*) and exposed the vulnerability of buildings with soft and weak first stories. Yes, even wood-framed buildings, thought by most engineers to be the most naturally earthquake resistant type of structure due to their lightweight nature and reserve strength, can collapse under the right (or perhaps wrong) circumstances. According to a 2016 report by the Association of Bay Area Governments, San Francisco had 6,700 soft-story buildings, far more than the rest of the region combined.

Figure 1. Soft-story building collapse in the 1989 Loma Prieta Earthquake.

FILE NO. 130119 AMENDED IN COMMITTEE 3/25/2013 ORDINANCE NO. 66-13

[Building Code - Mandatory Seismic Retrofit Program - Wood-Frame Buildings; Optional Evaluation Form Fee]

Ordinance amending the Building Code to establish a Mandatory Seismic Retrofit Program for wood-frame buildings of three or more stories or two stories over a basement or underfloor area that has any portion extending above grade, and containing five or more dwelling units where the permit to construct was applied for prior to January 1, 1978, and the building has not been seismically strengthened; establishing a fee for administering the program; adopting environmental findings and findings of local conditions under California Health and Safety Code, Section 17958.7; establishing an operative date; and directing the Clerk of the Board to forward the legislation to specified State agencies.

NOTE: Additions are *single-underline italics Times New Roman*; deletions are *~~strike-through italics Times New Roman~~*. Board amendment additions are double-underlined; Board amendment deletions are ~~strikethrough normal~~.

Be it ordained by the People of the City and County of San Francisco:

Section 1. General Findings.

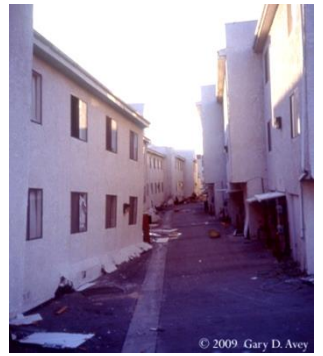
(a) At a duly noticed public hearing held on February 20, 2013, the Building Inspection Commission considered this ordinance.

(b) The Planning Department has determined that the actions contemplated in this ordinance comply with the California Environmental Quality Act (California Public Resources Code Section 21000 et seq.). Said determination is on file with the Clerk of the Board of

2013: Motivation for NEES-Soft

”Seismic Risk Reduction for Soft-Story Woodframe Buildings”

- Many buildings built prior to the 1970s are prone to collapse during major earthquake event due to insufficient lateral resistance of their first story.
- Community Action Plan for Seismic Safety (CAPSS)
- FEMA P807
- NEES-Soft: Seismic Risk Reduction for Soft-Story Woodframe Buildings
  - Five-university-industry NSF-funded collaboration
  - Develop better understanding of soft-story woodframe behavior through numerical analyses and experimental testing
  - Experimental validation of FEMA P807
  - Performance-based retrofit methodology and techniques
  - Develop better models of woodframe collapse mechanisms



Bahmani, P., J.W. van de Lindt, S.E. Pryor, G. Mochizuki. (2020). “Performance-Based Seismic retrofit Procedure with Shake table Validation.”, *Engineering Structures*, 205 (2020) 110012.

Jennings (Sutley), E.N., J.W. van de Lindt, E. Ziaei, P. Bahmani, S. Park, X. Shao, W. Pang, D. Rammer, G. Mochizuki, M. Gershfeld. (2015). “Full-Scale Experimental Verification of the Soft-Story-Only Woodframe Building Retrofits using Hybrid Testing.”, *Journal of Earthquake Engineering*, 19 (3).

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Industry Research Collaboration/Components – NEES-Soft

- Collapse Testing
  - Better understand collapse mechanisms of soft-story woodframe buildings
  - Politically, provide visual for retrofit communication/motivation

- Integration of industry products for use in both FEMA P807 & PBSR
  - Partnered with Simpson Strong Tie Co – SSMF & ATS

- FEMA P807 Experimental Validation
  - All work numerical during development of approach
  - Prevented collapse at 60% MCE target

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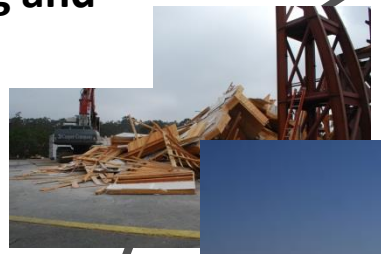
SIMPSON
Strong-Tie
Strong Frame
MOMENT FRAME
BM 1
BM 2

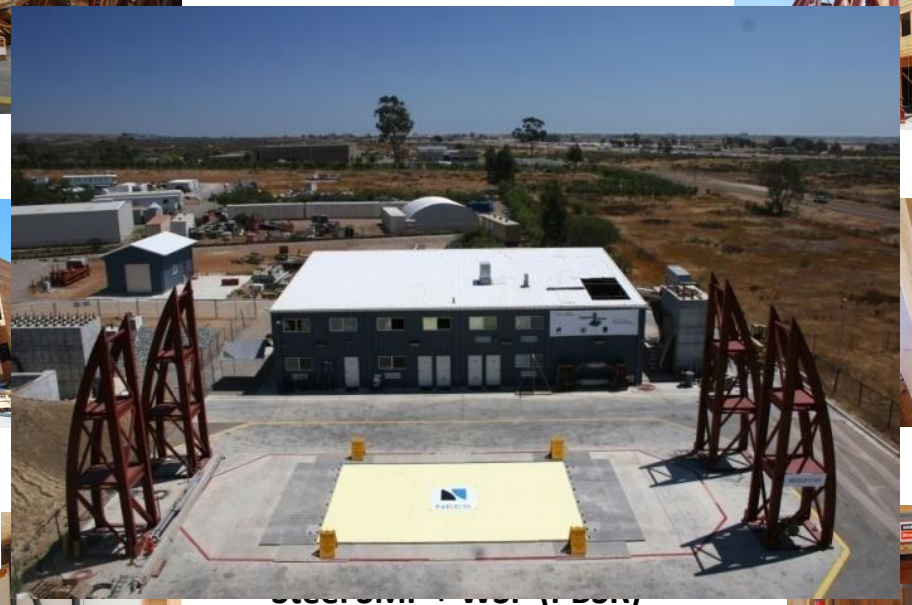
The lifecycle of the test building

Construction

Recycling and Disposal



Ready for testing



Collapse Testing

Cross laminated timber rocking walls

Viscous damping devices + WSP (PBSR)

Steel SMF (FEMA P807)

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Takeaways

- Solve something of broad interest; narrow won't cut it for this size program
  - Industry must have something to gain, e.g. information, data, publicity
- Be sure there are (at least) two major components
  - Fundamental research - $$
  - Industry/mainstream - $$$$
- Engage collaborations at the writing stage if possible; engage UCSD; otherwise early
- Form an industry or project advisory committee and use them (when funded)
- If these four are there, then don't worry about having all the $$$ when it starts
  - Interest develops quickly, but can be nerve racking
  - Everybody must contribute; no free rides (be equitable!)
- The professional reward outweighs the negatives, so write-write-write

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NEES-Soft Acknowledgements

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Thank you

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