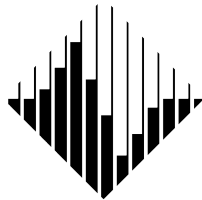


PBEE Research Needs in Transportation

Marc Eberhard, Joel Conte



PEER

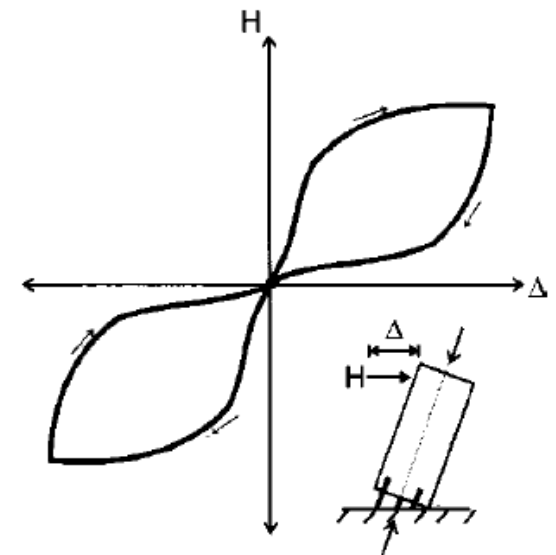
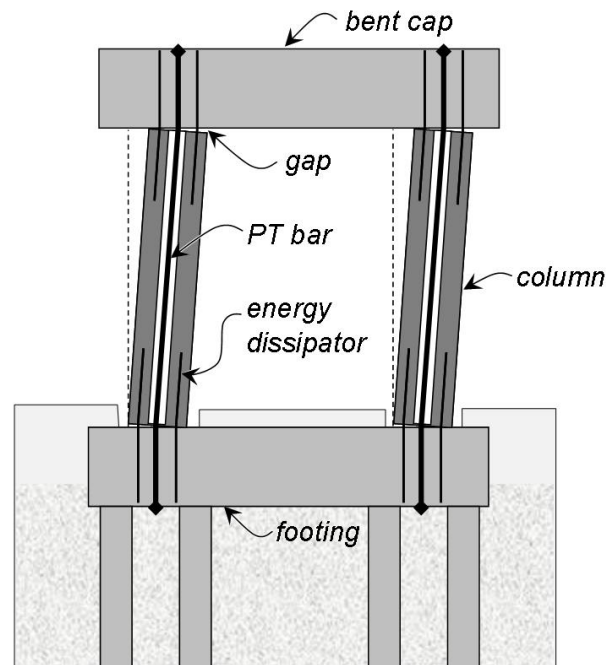
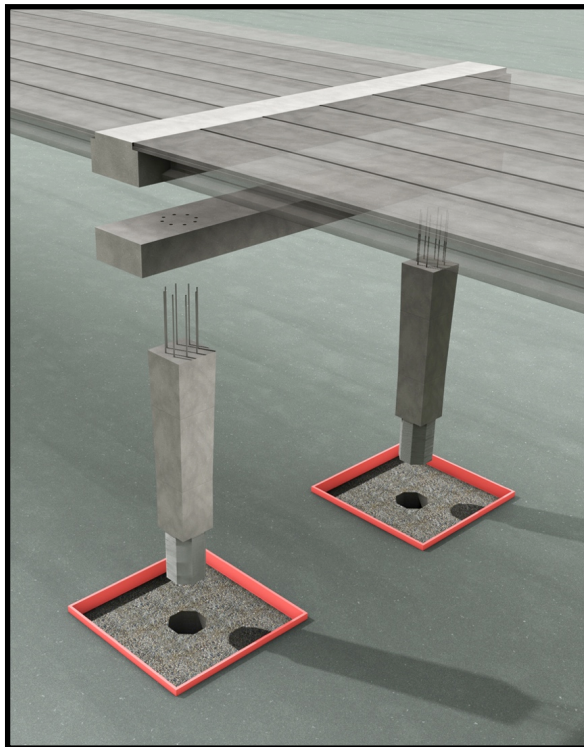
Marc Eberhard, Joel Conte
Charles Sikorsky
Kevin Thompson
Gayle S. Johnson
Discussion

Why do PBEE?

- Rigorous probabilistic framework integrating:
 - Seismic hazard analysis
 - Structural demand prediction
 - Structural capacity/damage prediction
 - Loss analysis (death, dollar, downtime)
 - ... Resilience/sustainability analysis
- Make informed decisions in the face of uncertainty
- Consider a variety of performance levels
- Evaluate and develop:
 - New materials, components & systems
 - Seismic response modification devices
- Balance competing objectives
 - e.g., economy, safety, disaster resilience, sustainability

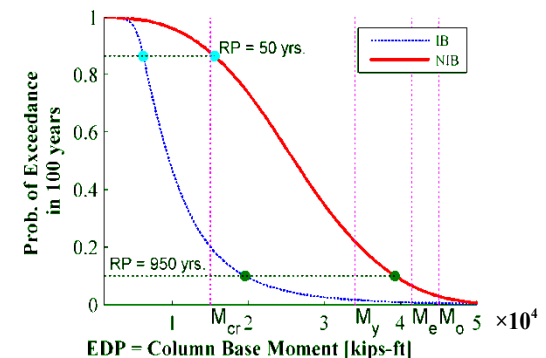
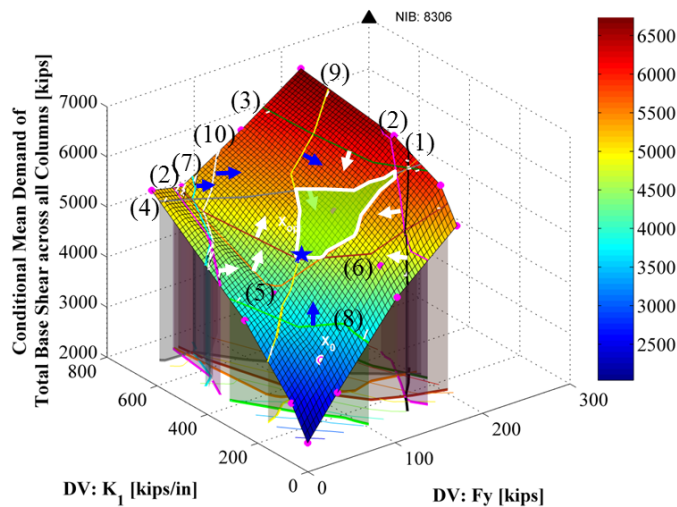
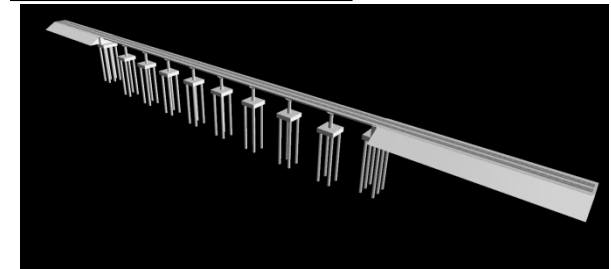
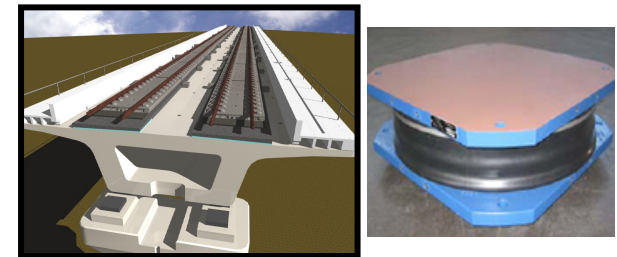
Recent and Current Research Projects

- Rapid construction of resilient (i.e., low-damage, damage-free) bridge columns
- Seismic response of bridges with rocking shallow foundations



Recent and Current Research Projects

- Probabilistic Performance-Based Optimum Seismic Design applied to California High-Speed Rail bridge prototype



Transportation Systems

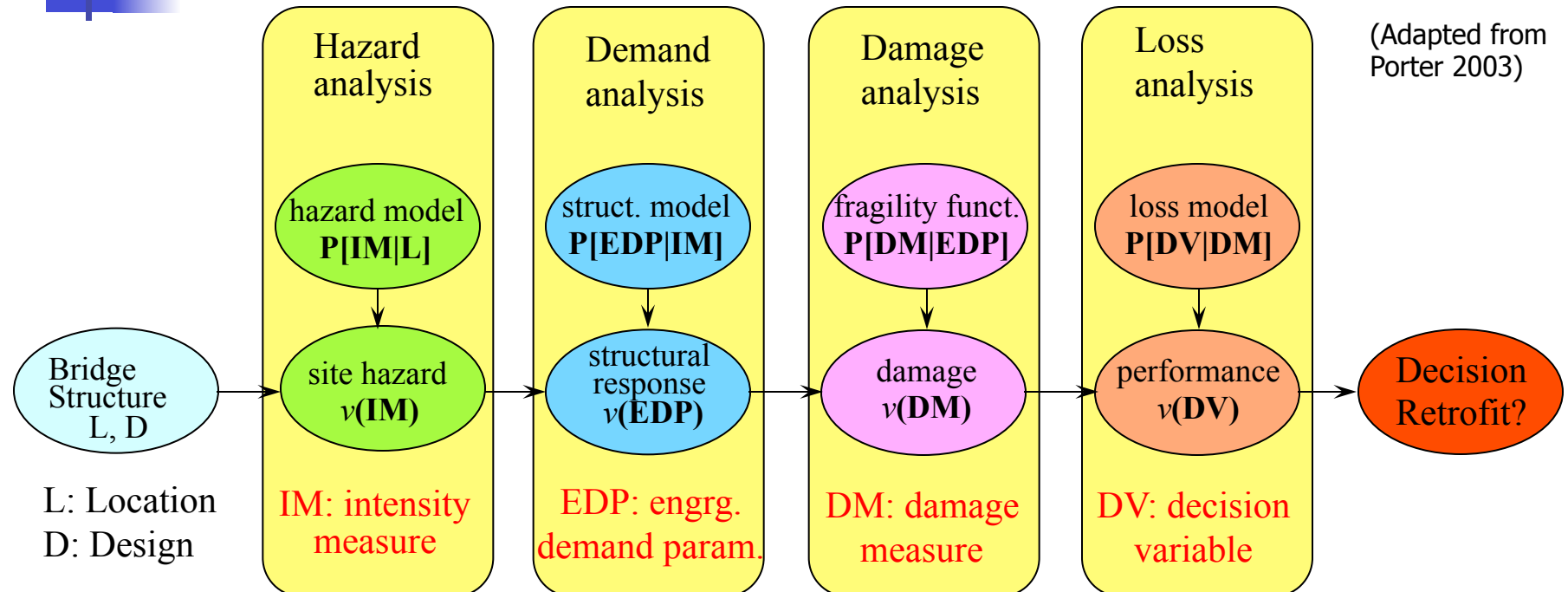
- Highway systems
- High-speed rail systems
- Port facilities
- Airports
- Pipelines



Questions to Consider for the Discussion

- What are the main current and future Research Challenges in Performance Based Design of new structures or Evaluation of existing structures?
- What could be opportunities for collaboration with PEER (how to leverage PEER resources to solve current challenges)?
- What are the opportunities to extend the PBEE methodology to support the development of resilient communities?

Performance-Based Earthquake Engineering (PBEE) Methodology Developed at PEER



(Adapted from Porter 2003)

Mean annual rate (MAR) of Decision Variable exceeding any particular value

“How likely is an event of intensity IM, for this location?”

“What engineering demands (force, deformation, etc.) will this bridge experience?”

“What physical damage will this bridge experience?”

“What loss (deaths, dollars, and downtime) will this bridge experience?”

“Is the performance of the bridge acceptable?”

$$v(DV) = \iiint G\langle DV | DM \rangle \cdot |dG\langle DM | EDP \rangle| \cdot |dG\langle EDP | IM \rangle| \cdot |dv(IM)|$$

PBEE Research Needs in Transportation

- Point 1
 - Sub point 1
 - Sub point 2
- Point 2

Summary – Slide 1

- 3 key highlights from session [*show, don't talk – **30 sec***]
 - Relevant past work
 - Relevant current research
 - Unresolved research problems

Summary – Slide 2

- Short term opportunities (1-2 years) [*talk – **3 min***]
 - Resources – interested people
 - Stakeholders, funding
 - What is needed to pursue?
- Long term topics (2-4 years) [*talk – **1.5 min***]
 - Resources – interested people
 - Stakeholders, funding
 - What is needed to pursue?

