PEER Transportation Systems Research Program Meeting - Overview of PEER Activities

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PEER's Mission

- Advance and apply performance-based earthquake engineering tools to meet the needs of various stakeholders
- Problem-focused, multi-disciplinary research built upon foundation of engineering and scientific fundamentals
- Close partnerships with government, industry and engineering professionals
- Strong international research collaboration, focusing on Pacific Rim

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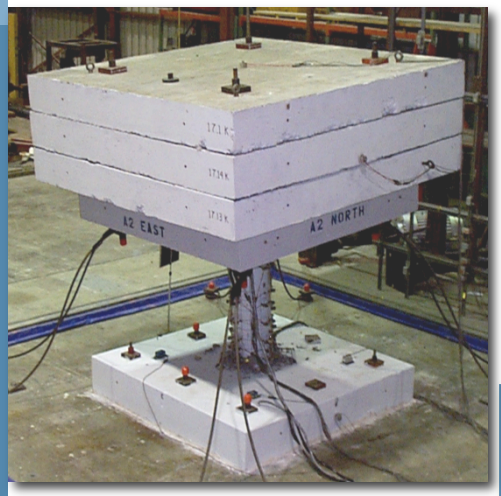
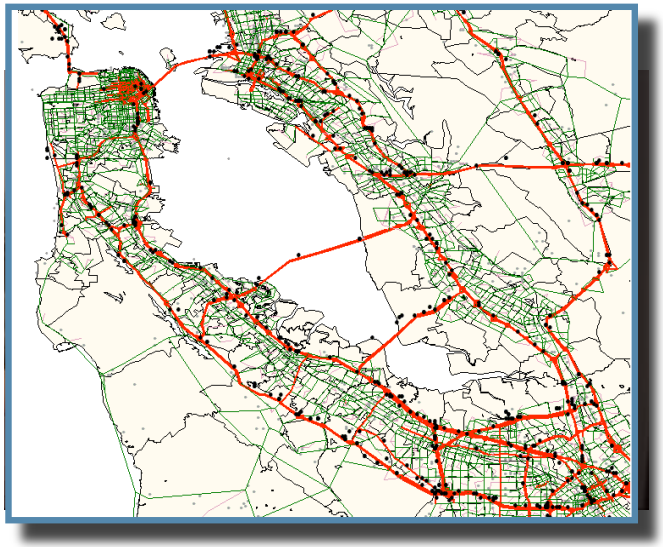
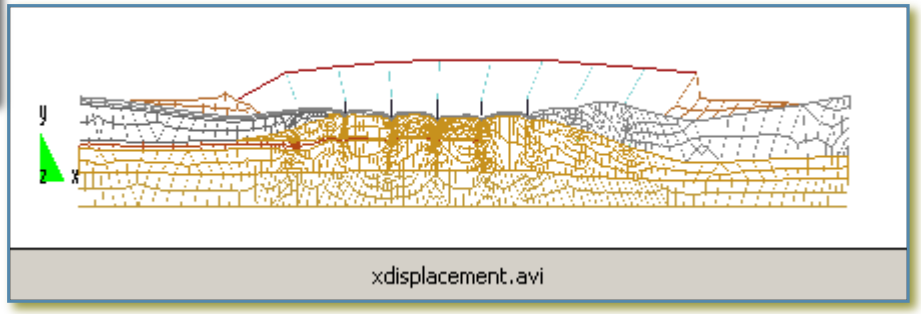
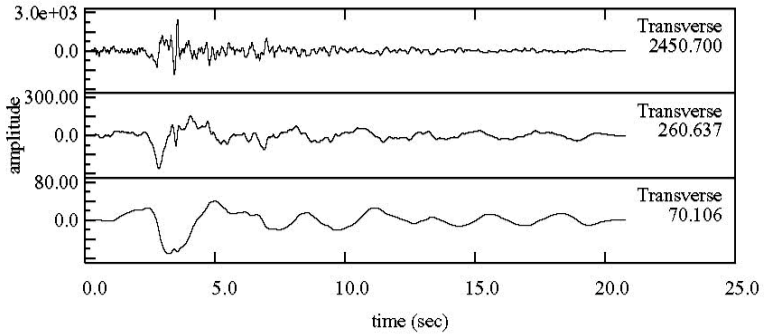
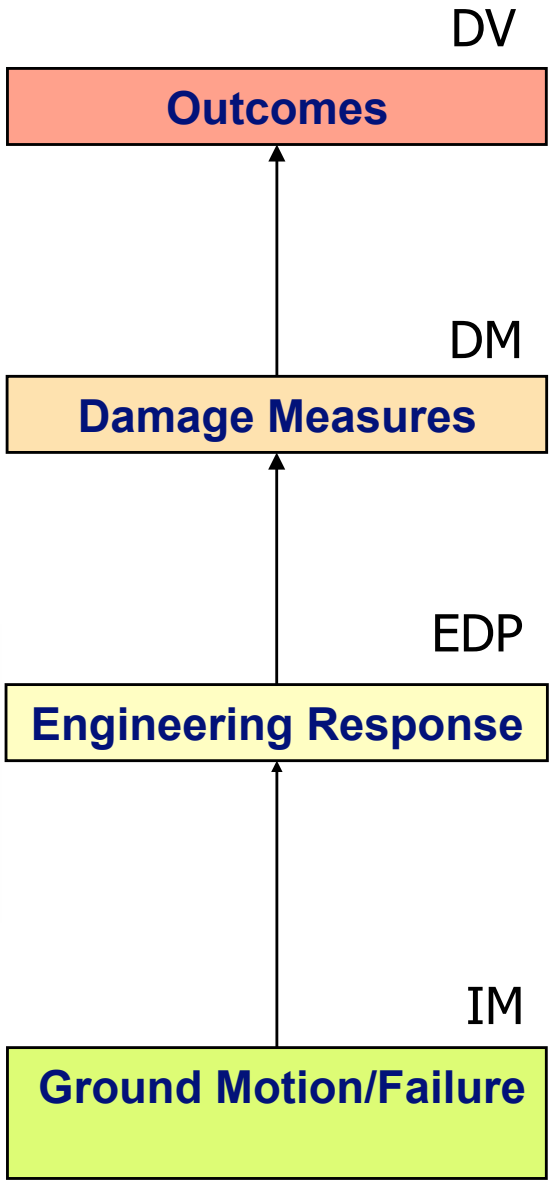
PEER takes an integrative, quantitative approach to PBEE











Scope of Activities

- Vulnerable existing buildings
  - Evaluation and retrofit
- New Buildings
  - Design criteria for tall buildings
  - Sustainable and natural hazard resilient buildings
- High Performance Simulation
- Lifeline systems
  - Earthquake hazard assessment
  - Electrical power distribution systems
  - Nuclear power plants
  - LNG storage facilities
- Transportation Systems
  - Highway bridges
  - High-speed rail systems

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Transportation Systems Research Program: Objectives

- Devise and validate transportation systems that are more:

  Economical, reliable, sustainable and disaster resilient

  - Lessen post-earthquake disruption through better planning, engineering and technology advances (DV: downtime, direct and indirect costs,deaths; resilience framework)
  - Reduce environmental impact (sustainable materials, improved construction methods, etc.)
  - Achieve faster, more economical and safer construction (Accelerated Bridge Construction)
  - Increase traffic flow (new systems)

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Current Projects

Ground motions & hazard assessment		
Guidelines for selection of ground motion time histories for PBEE	J.Baker	Stanford
Stochastic modeling and simulation of near- and far-field ground motions for use in PBEE	Der Kiureghian	UC Berkeley
Calibration of hybrid simulation methodology for high and mid frequency IMs	Stewart	UCLA & SCEC
GMSM working group	many	
NGA projects	many	

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Current Projects

PBEE Development and Applications		
Application of PBEE tools to actual bridge	Bray & Stojadinovic Caltrans	UC Berkeley & Caltrans
Performance-based seismic assessment of skewed bridges	Taciroglu and Zareian	UCLA & UC Irvine
Detailed PBEE studies of bridges with foundations allowed to uplift	Panagiotou	UC Berkeley
Pilot PBEE studies on next generation bridge systems	Stojadinovic	UC Berkeley
Bayesian framework for PBEE assessment and risk management of transportation systems	Der Kiureghian	UC Berkeley
Contributions to OpenSees Framework for PBEE Analyses of Bridges	Conte	UC San Diego
Integrated Graphical User Environment for Dynamic Analysis and PBEE of Bridges	Elgamal, Mackie, Hachem	UC San Diego, UCF, Consultant

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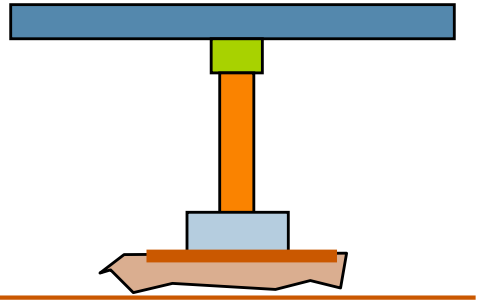
Current Projects



PBEE issues related to soils & foundations		
Simplified Design Procedure for Piles Affected by Lateral Spreading based on 3D Nonlinear FEA using OpenSees	Arduino and Mackenzie	Univ. of Washington
Mitigation of lateral spreading effects on bridges	Boulanger, Elgamal, Ashford	UC Davis, UCSD, OSU
Simulation of global bridge response to 3D shaking and lateral spreading	Brandenberg and Zhang	UCLA
Last hurdles for implementation of rocking foundations for bridges	Kutter et al	UC Davis
Damage-Resistant Pile to Wharf Connections	Roeder and Lehman	Univ. of Washington
Use of PBEE to validate LRFD approaches for pile foundations	Kramer and Stewart	Univ. of Washington /UCLA

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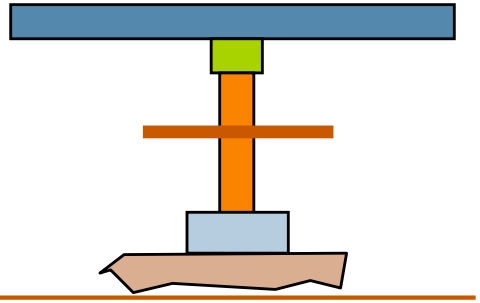
Current Projects



PBEE issues for structures		
Self-compacted Hybrid Fiber Reinforced Concrete for Bridge Columns	Ostertag & Panagiotou	UC Berkeley
Ductile High-Performance Fiber -reinforced Concrete for Durable, Resilient Bridge Columns	Billington	Stanford
New seismic isolation concepts for improving the seismic performance of bridges	Mahin	UC Berkeley
Advanced Precast Concrete Dual-Shell Steel Columns	Restrepo	UC San Diego
Rapid Construction of Self-Centering Precast Bridge Bents, plus extension of PEER column performance database	Eberhard and Stanton	Univ. of Washington
State-of-the-art report and workshop on seismic design of high-speed rail systems	Bardet	USC

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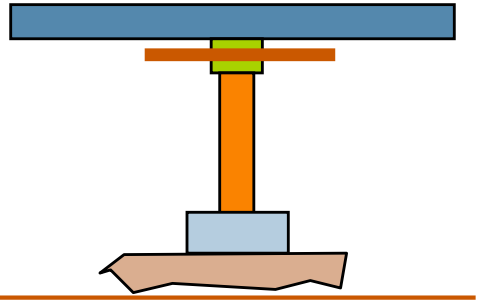
Current Projects



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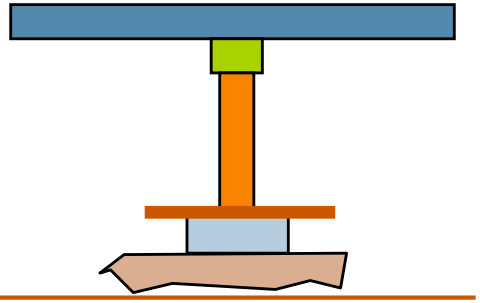

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Finite Element Analysis of Large Columns	Mosalam	UC Berkeley
Tests of Large Diameter Columns	In progress	TBD

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Current Projects

- State-of-the-art report and workshop on seismic design of high-speed rail systems: JPBardet - USC
- PEER-Caltrans Seminars (biannual), next one in January-February
- PEER annual meeting (2+ sessions on transportation systems and keynote talk).

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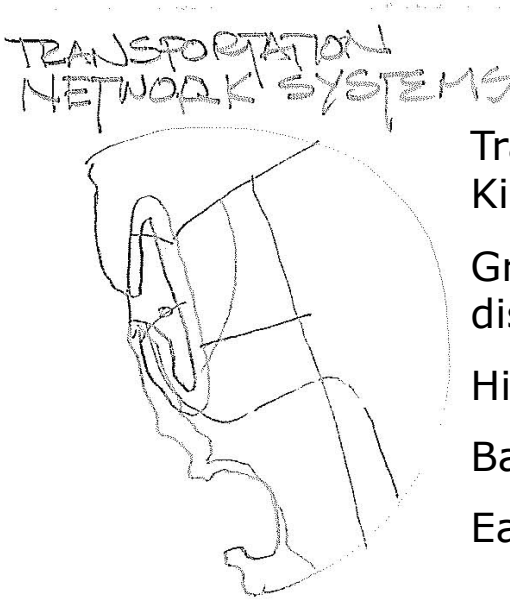


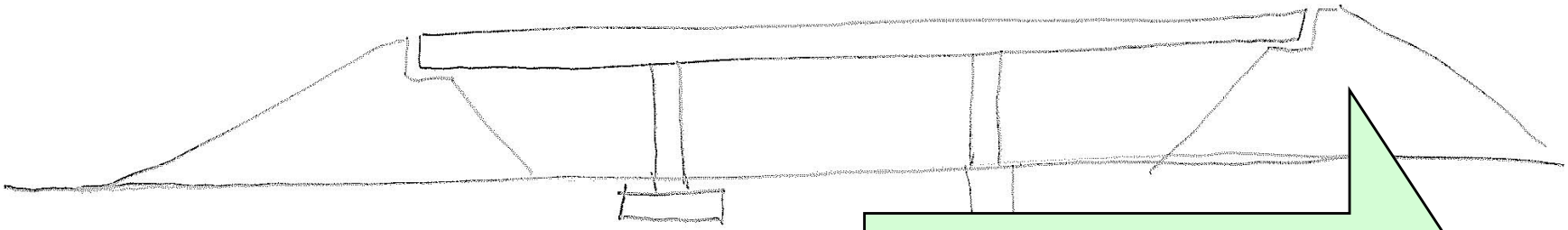
Transportation Systems Workshop - Kiremedjian/Der Kiureghian

Ground motion characterization and selection for distributed systems - Baker

High Speed Rail Systems: State of the Art - Bardet

Baysian Network Models - Der Diureghian

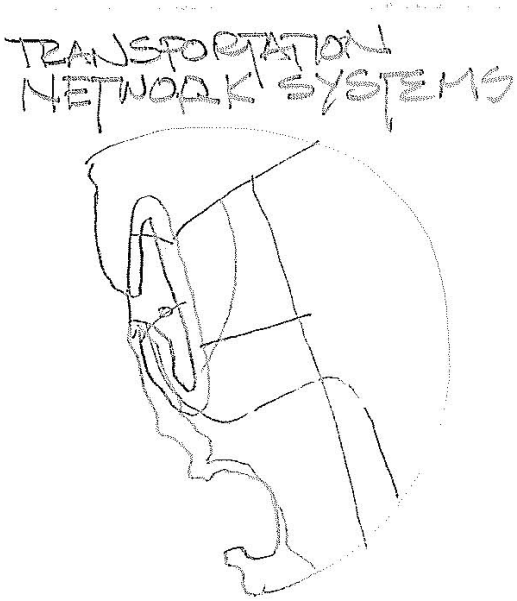
Early warning systems - pending



Assistance with applying PBEE - Stojadinovic/Bray

PEER/Caltrans Seminars

BRIDGE ASSETS



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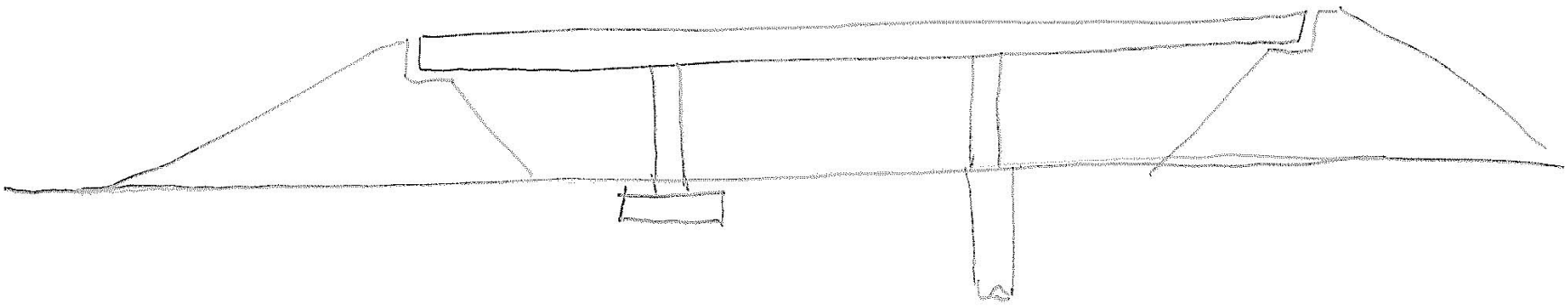

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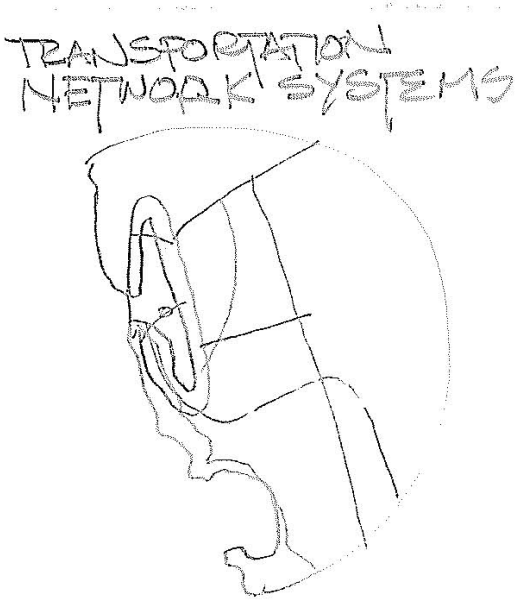

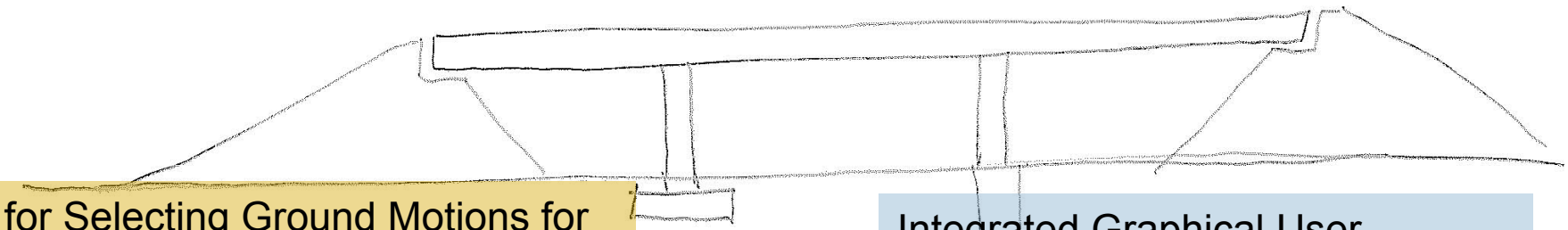

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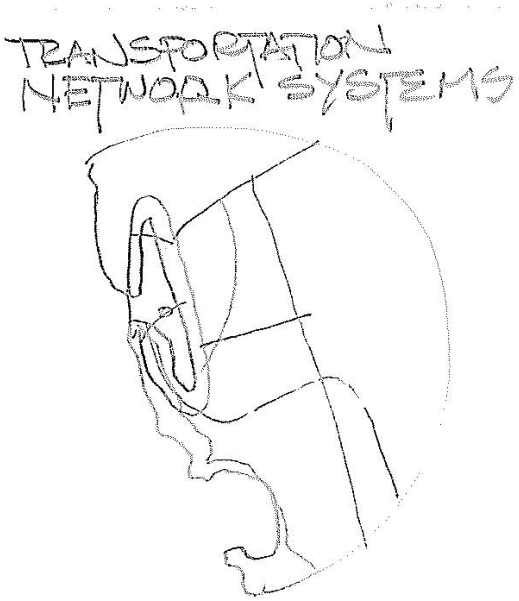
Calibration of hybrid simulation methodology for high and mid frequency Ims - Stewart et al

Improved IDA methodology - pending

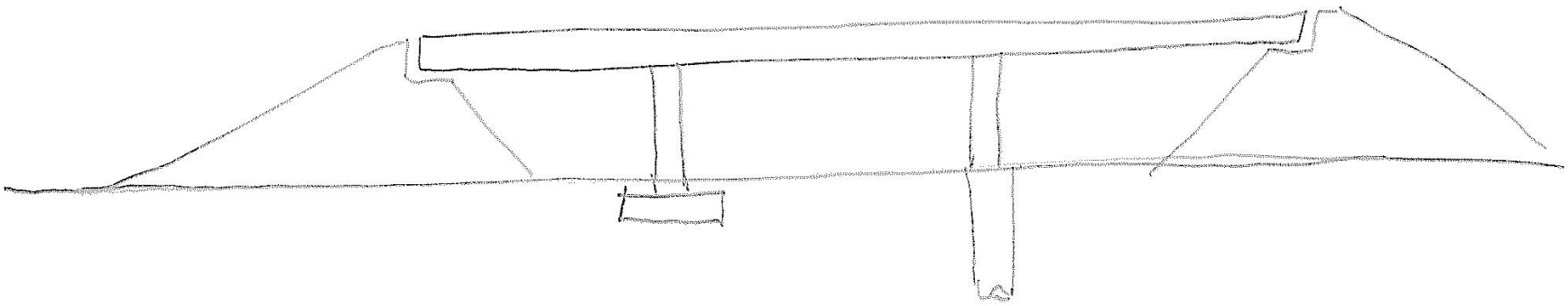
Integrated Graphical User Environment for Dynamic Analysis and PBEE of Bridges - Elgamal, Mackie, Hachem

Improved Opensees sensitivity and optimization capabilities for PBEE - Conte

Improving OpenSees - Pending



Abutment modeling - Part of project by Taciroglu and Zareian



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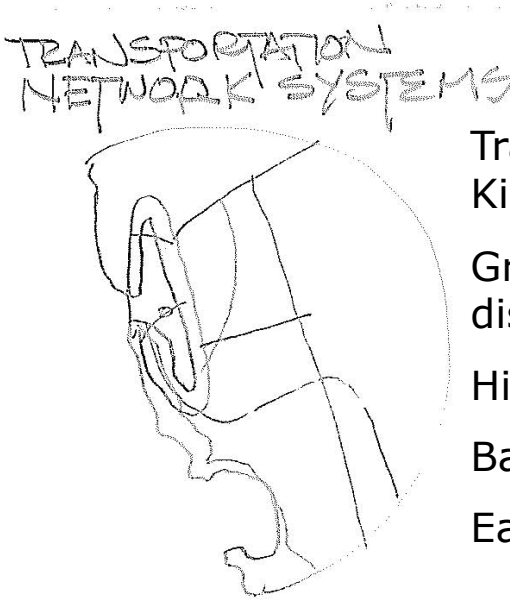

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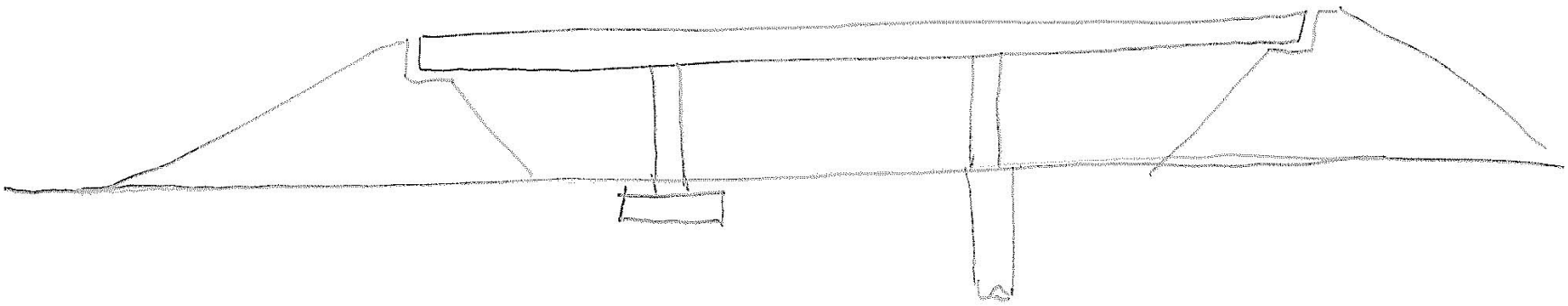

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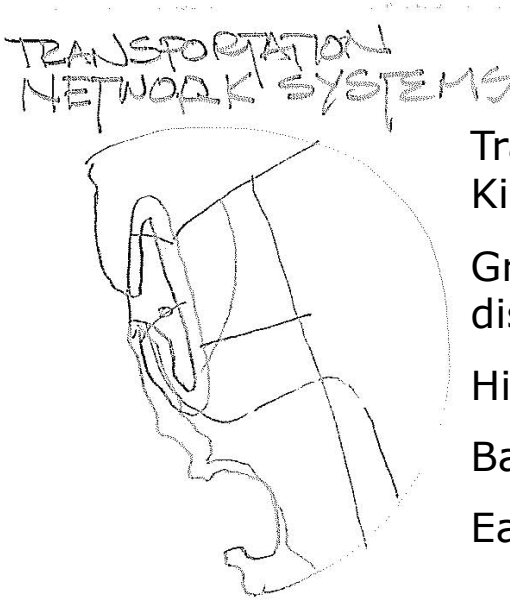

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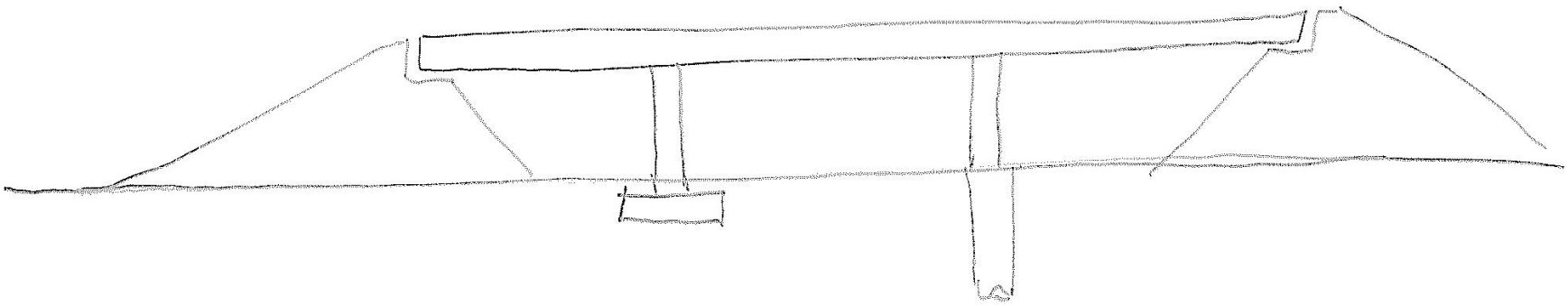

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