

PEER Blind Prediction Contests and Announcement of the 2022 Contest Winner

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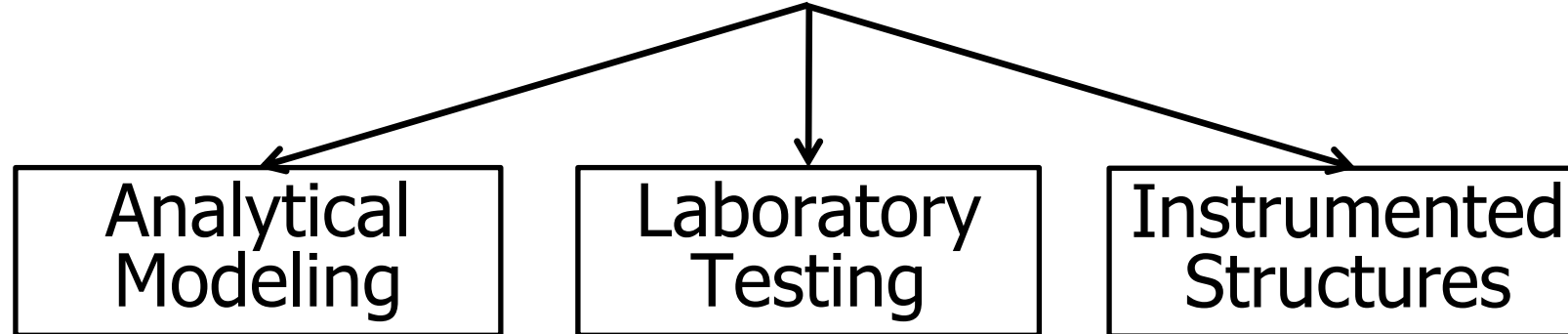
What is a Blind Prediction Contest ?

- A competition in which participants make predictions of physical phenomena without knowing the results or the outcome.
- In earthquake engineering, mostly used for predicting the results of large-scale experiments using analytical models.
- Participants are provided with all the necessary information for building analytical models: drawings, material properties, measured input motions or applied load protocol, and so on.
- Beyond the competition aspect, it is a community exercise to evaluate and improve the modeling and analysis capabilities of the structural/geotechnical engineering profession.












Why is Blind Prediction Important ?

Design and Assessment of Structures



- ❑ Analytical modeling is the most common method used for the design and assessment of structures.
- ❑ Computation power has been growing exponentially in the past decade that increases the efficient usage of analytical modeling.
- ❑ Blind predictions (a) inform the current analytical modeling capabilities, (b) identify the modeling areas that need improvement, and (c) provide guidance on how to improve them.
- ❑ Furthermore, they provide quantitative data regarding the uncertainty of analytical models for use in performance-based earthquake engineering evaluations.

PEER Blind Prediction Contests

 <p>Shaking Table Test Including an Impact Mass Damper (2022)</p>	 <p>Quasi-Static Cyclic Test of a RC Column (2021)</p>	 <p>Monotonic Test of a Thick Foundation Element (2021)</p>	 <p>Shaking Table Test of a Rocking Podium Structure (2019)</p>
 <p>Shaking Table Test of a Self-Centering Bridge Bent (2017)</p>	 <p>Shaking Table Tests of Shallow Foundations in Liquefied Soils (2018)</p>	 <p>PEER Hub ImageNet (PHI-Net)</p> <p>PHI Challenge: Image-based structural damage recognition competition (2018)</p> 	 <p>Shaking Table Test of a Full-Scale Bridge Column (2010)</p>

- Dynamic, quasi-static & monotonic tests
- Structural and geotechnical response
- Conventional (e.g., RC gravity column) and protective (e.g., rocking and self-centering) systems
- Tests conducted at the PEER experimental facilities and other laboratories around the world

PEER Blind Prediction Contests

Blind Prediction Contests



2022 Blind Prediction Contest

PEER is organizing a blind prediction contest for predicting the experimental results obtained from a Shaking Table test campaign carried out at the PEER Center, Berkeley, California, in collaboration with University of Trento, Italy. The experimental tests, performed on a steel Moment Resisting...



2021 Thick Foundation Element Blind Prediction Contest

We designed this blind prediction contest for relatively easy participation. We only ask that you predict the failure mode and strength of each of the two spans of the deep beam. You may use a strength calculation method involving any degree of sophistication that you choose, although the...



2021 Reinforced Concrete Column Blind Prediction Contest

We invite you to participate in the prediction of the response of a reinforced concrete column subjected to lateral deformation. This invitation is based on an experimental test of a concrete column conducted in 2020, the results of which have not yet been published. The test column is...

- More information about the PEER blind predictions is available at:

<https://peer.berkeley.edu/blind-prediction-contests>

- Please contact us if you have experimental results that you would like to use for organizing a blind prediction contest.
- A PEER blind prediction that is currently planned will be presented in a few minutes by Prof. Michael Scott: "Blind Prediction Contest for Wave Loading on a Steel Frame Structure"

What Did We Learn from the PEER Blind Prediction Contests ?



Shaking Table Test of a Self-Centering Bridge Bent (2017)

- For elastic response predictions, any small error in the period or damping result in large errors, this is mainly due to the shape of the response spectrum of several ground motions.
- To identify the source of errors in a more systematic way in the future blind predictions, it is recommended to add the natural periods to the list of predicted quantities. Also, the damping ratios in the elastic range should be provided to the contestants.

inform the current analytical modeling capabilities

Günay, S., Hu, F., Mosalam, K.M., Nema, A., Restrepo, J.I., Zsarnoczay, A., Baker, J. (2020). "Blind Prediction of Shaking Table Tests of a New Bridge Bent Design." Pacific Earthquake Engineering Research Center Technical Report, 2020/09, Berkeley, CA.



Shaking Table Tests of Shallow Foundations in Liquefied Soils (2018)

The average error of the participating teams in predicting the foundation settlement was lower than the corresponding value for the free-field settlements. This is an important observation illustrating better capability of the utilized numerical tools to predict the foundation response compared to the surrounding ground response.

identify the modeling areas that need improvement

Motamed, R., Orang, M. J., Parayancode, A., & Elgamal, A. (2020, February). Results of a class C blind prediction competition on the numerical simulation of a large-scale liquefaction shaking table test. In *Geo-Congress 2020* (pp. 334-342). Reston, VA: American Society of Civil Engineers.



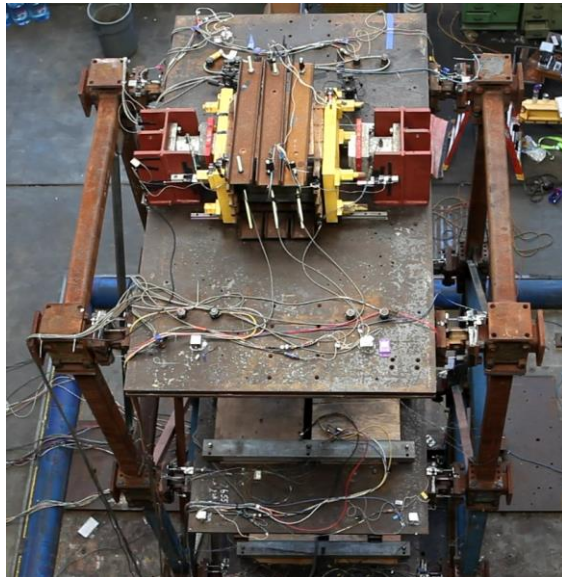
Shaking Table Test of a Rocking Podium Structure (2019)

In terms of rocking and wobbling seismic response modeling guidelines, this blind prediction contest confirmed that energy dissipation is a key factor that needs to be modeled, though not by means of Rayleigh damping. The models that best predicted the response used zero Rayleigh damping, but modeled energy dissipation directly through friction elements.

provide guidance on improvement

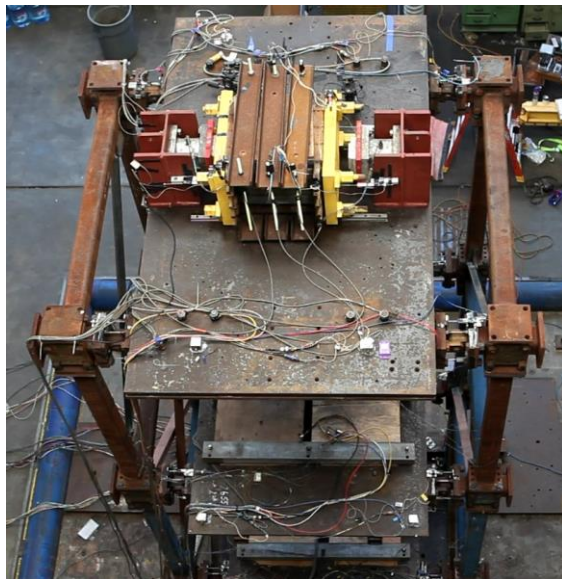
Vassiliou MF, Broccardo M, Cengiz C, Dietz M, Dihoru L, Gunay S, Mosalam KM, Mylonakis G, Sextos A, Stojadinovic B. Shake table testing of a rocking podium: Results of a blind prediction contest. *Earthquake Engineering & Structural Dynamics*. 2021 Apr;50(4):1043-62.

2022 PEER Blind Prediction Contest



- A blind prediction contest based on tests performed on the PEER 6DOF table.
- The tests conducted in collaboration with Dr. Roberto Andreotti & Prof. Oreste Bursi from the University of Trento, Italy.
- Motivation of the tests was to demonstrate the effectiveness of a new protective system, called Impact Mass Damper (IMD).
- The basic operating principle of the device is similar to a Tuned Mass Damper (TMD), with the difference of inducing impulsive counteracting forces.
- These impulsive forces have a high frequency content and only excite the higher modes of vibration with lower participating masses.
- Therefore, the structural response is reduced due to the counteracting impulsive forces, which do not introduce any additional dynamic effects on the structure.

2022 PEER Blind Prediction Contest



- Tests conducted on a three-story steel Moment Resisting Frame (MRF) with and without the IMD.
- This MRF was designed and constructed using PEER's REPEAT frame, with replaceable coupons in the clevises, eliminating damage in the frame members for multiple tests.
- What was new in this blind prediction:
 - ❑ Provided periods, mode shapes, and damping ratios
 - ❑ Asked RMS (root mean square) of response in addition to peak response
 - ❑ Model updating (ongoing)
- The contest participants included practicing engineers and researchers from academia.
- The software used by the participants included OpenSees, Strand7, PISA3D.

2022 PEER Blind Prediction Contest Winner

The winner is a two-member practicing engineer team from CoreBrace, LLC. Congratulations!

Chao-Hsien Li



Brandt Saxey



Please visit the poster of Chao-Hsien and Brandt for their winning submission at the poster session.