A Systematic Computational Framework for Multi-Span Bridge PBEE Applications

PEER Transportation Systems Research Program

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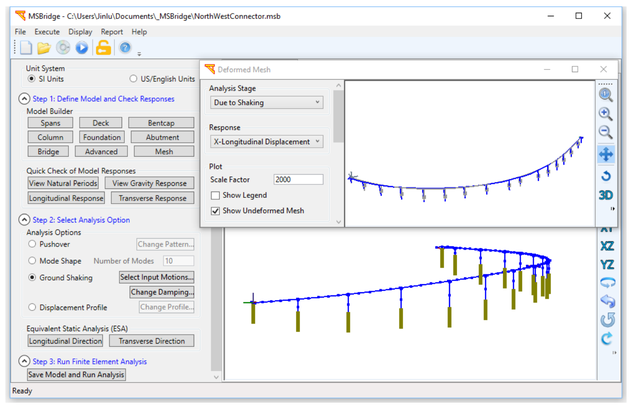
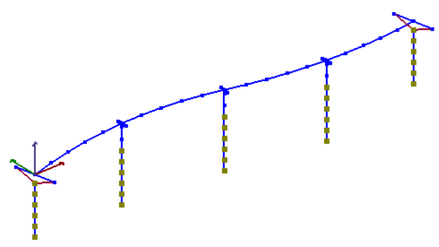
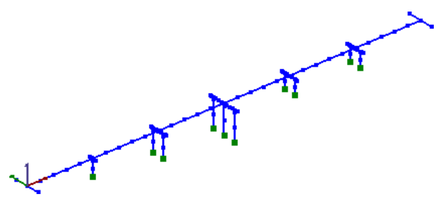
MSBridge User Interface

A computational user interface (MSBridge) is developed to combine nonlinear Time History Analysis (THA) of multi-span bridge systems with an implementation of a PEER PBEE methodology which quantifies the probabilistic bridge response in terms of repair cost, repair time, and carbon footprint. OpenSees is employed to conduct nonlinear THA.

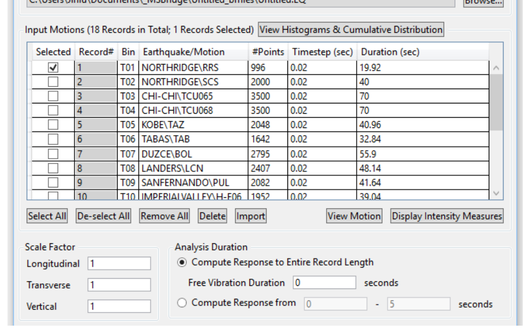




Foundation response represented by soil springs



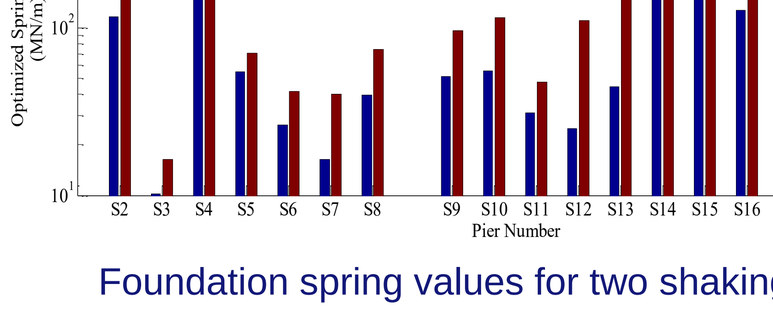
Foundation response represented by Foundation matrix



Suite of ground motions

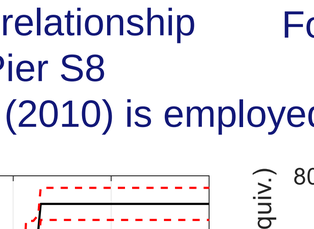
Bridge Case Study using MSBridge

The 20-span Samoa Channel Bridge near Eureka in northern California is a 764 m long and 10.4 m wide structure connecting Samoa Peninsula and Indian Island.

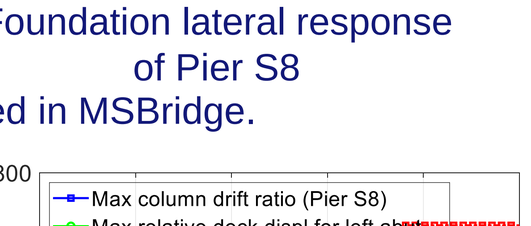


Samoa Channel Bridge (http://www.strongmotioncenter.org)

Finite Element (FE) model (Created in MSBridge)



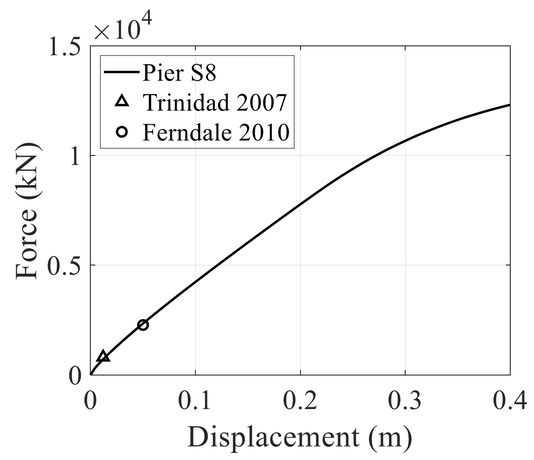
Elevation of Pier S8



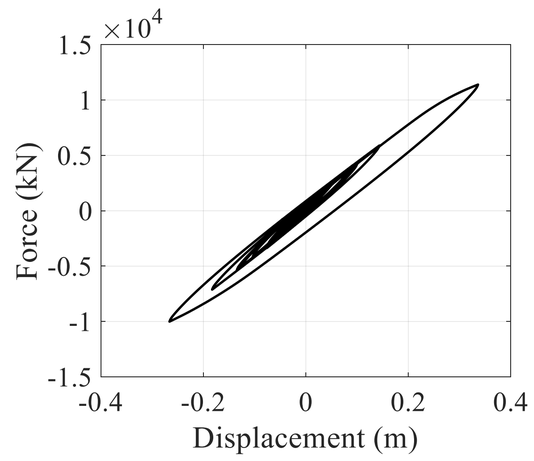
Column detail of Pier S8

- **Calibrated Model** The FE model was calibrated by using a nonlinear Foundation matrix material to account for the reduction in the lateral foundation stiffness as the amplitude increases.

Foundation spring values for two shaking events

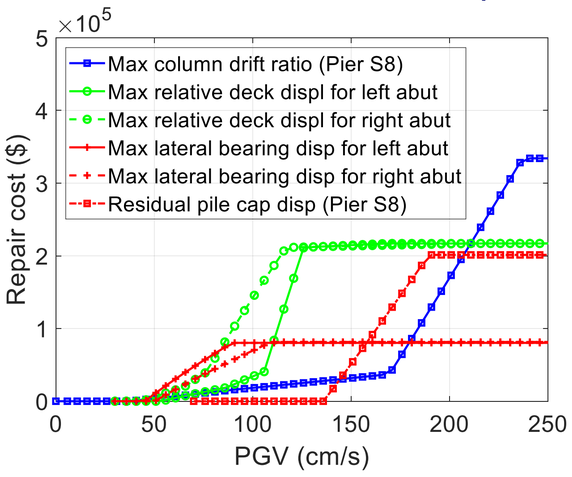


Lateral force-displacement relationship for the foundation at Pier S8

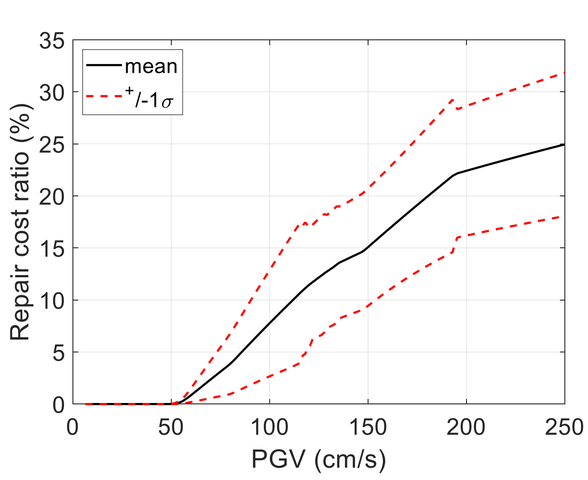


Foundation lateral response of Pier S8

- **PBEE Outcomes** Implementation of the PEER PBEE methodology by Mackie et al. (2010) is employed in MSBridge.

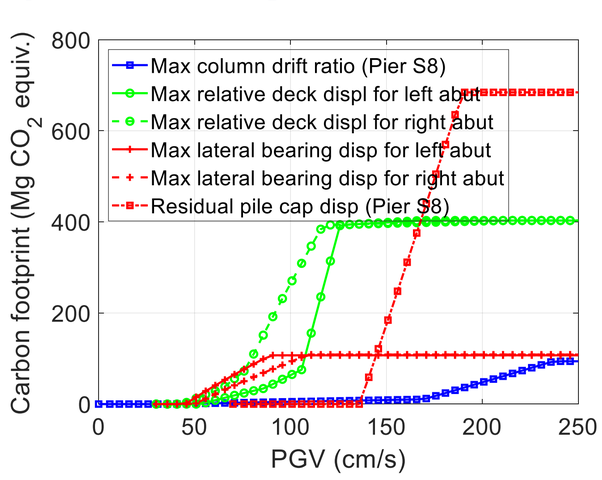


Disaggregation of repair cost by PG (Performance Group)



Repair cost

Repair time



Disaggregation of carbon footprint by PG

Acknowledgment

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