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Rupture to Rafters to Response: Completing the Loop of Earthquake Science, Engineering and Policy

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Ground motion definition is the link between seismic hazard and structural response, the first two elements of performance-based earthquake engineering. Site- and structure-specific ground motion selection is enabled by improved ground motion prediction and considerations of important seismic parameters for nonlinear dynamic analyses. Ground motion databases are growing, with denser instrumentation that provides more empirical recordings, high performance computing that facilitates large-scale simulations, and breakthroughs in geophysical understanding that push the frontiers to the high-frequency range. Structural models are also evolving with enhanced accuracy and complexity to capture important structural behaviors such as collapse, cumulative damage and 'in-cycle' strength and stiffness degradation. In the past decade, significant progress has been made in the performance-based earthquake engineering framework to interpret structural performance results in terms of structural response, damage and loss. At the same time, Great ShakeOut Earthquake Drills are extending beyond California to improve earthquake preparedness, with over 24.7 million participants worldwide in 2013. The advancements in hazard characterization, structural modeling, performance interpretation, and emergency response offer a unique opportunity to integrate these elements to complete the loop of earthquake science, engineering and policy to reduce risk.