APPLICATION OF EARTHQUAKE EARLY WARNING FOR TALL BUILDINGS

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Abstract

The ShakeAlert Earthquake Early Warning (EEW) system aims to provide advance notice to residents on the US West Coast seconds before ground shaking begins, if the expected intensity exceeds a set threshold. However, occupants of tall buildings may feel amplified motion due to the buildings' unique dynamic response. Therefore, efforts are underway to improve ShakeAlert by accounting for building response, to better estimate shaking intensity in high-rises. Currently, using detailed Finite Element models of buildings for this purpose is not feasible. The author recently reviewed simple methods for estimating Peak Floor Acceleration (PFA) and found them impractical for real-world application (Ghahari et al., 2022a). This paper explores an alternative by extending the Performance-Based Earthquake Engineering (PBEE) framework from the Pacific Earthquake Engineering Research Center (PEER) to EEW, acknowledging that each component of building response prediction is uncertain in the EEW context. Although others have proposed this idea (Iervolino, 2011; Cheng et al., 2014), it has two main issues: 1) the simple beam model introduces unquantified modeling uncertainty, and 2) ground motions in probabilistic demand models are unsuitable for EEW. This work addresses these issues by incorporating modeling errors into the beam model (Ghahari et al., 2022b) and using new ground motions. The approach was demonstrated using data from a 52-story building in Los Angeles (Ghahari et al., 2024), showing that accurate Peak Ground Acceleration (PGA) estimation can predict expected human comfort levels in tall buildings.

References

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