

Some thoughts on methods to compare the seismic performance of alternate structural designs

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ABSTRACT

The process of structural design ultimately hinges upon the selection of the top alternative designs from a group of viable choices, ideally choosing the one that best satisfies the requirements, as set by codes or guidelines. Comparing structural configurations to find the best candidate has thus remained a favorite subject of researchers and engineers alike, especially in the case of seismic loads. With the emergence of performance-based earthquake engineering, such comparisons now need to be performed on the basis of the performance of the structure, preferably at several limit-states. Such a direct evaluation can be cumbersome, therefore shortcuts and simpler techniques have been introduced that are generally based on the concept of system fragility, as estimated through the various methods of structural analysis. Still, there is not a general consensus on the metrics that can be used for such an evaluation; some researchers adopt force, or displacement, response quantities derived from static or dynamic methods, while others prefer intensity or reliability-based variables. In order to even out the field, we perform a comparative evaluation of the available choices and point out the pros and cons of each, showing some of the common fallacies that plague the results of such comparisons.