



## **Are Our Buildings Safe Enough for Controlling Earthquake Mortality Risk?**

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Structural engineers design buildings strictly according to the earthquake actions (demand) specified in code of practice, whilst the rationale behind such requirement is commonly untold. In fact, even if a structure is designed strictly in accordance to the best standard and practice in the world, there is still a (small) chance of failure or collapse in an extreme earthquake event, due to the uncertainties in material properties and actual ground motion characteristics. This is called the residual risk, which is unavoidable, and should be taken as a governing parameter for determining the performance goals of seismic design. Eurocode 8 is not a risk targeted code as its design requirements refer to return periods of ground motion rather than to collapse probabilities and/or probability of fatalities. The US International Building Code (IBC 2012) and the 2010 structural design standards of ASCE 7-10 target collapse probabilities for all levels of ground motion and accept a 1% collapse probability in 50 years as acceptable for design. Consequently, the input ground motion to design is no longer a hazard map for a uniform return period. However, we show that this risk target is not generally compatible with the intention to keep the fatality risk below the  $10^{-6}$  per year threshold in code-compliant buildings. Moreover, the metric of individual fatality risk may not be appropriate as for (technological) incidents many regulations define requirements for the F-N curve so that loss events with, for instance, 100 fatalities in one event should occur much less frequently than events with 10 or more fatalities.