

Zero Risk: A new Approach to Earthquake Hazard

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Recent disasters suggest that earthquake hazard remains nature's most dangerous killer at large. Advances in earthquake engineering have been offset by the proliferation of high-rise structures on soft ground. The central objective, which is zero risk to life and limb, tends to be neglected or lost sight of, in favor of cost-effective but less humane damage limitation policies.

The strong correlation between earthquake damage and soft-ground conditions is highly suggestive. As the Mexico City experience indicates, available models can account for the observed spectral frequencies but not for the highly correlated monochromatic waveforms or the long duration of ground motion.

The peak of the response spectrum of the 1985 Mexico earthquake for 5% damping overtops recent seismic provisions in the building code by 250%. Search and rescue operations in collapsed reinforced-concrete frame structures are particularly difficult, because floor slabs are not easily removed without endangering the entombed victims. Such structures are typically damped at less than 5% of critical damping, while an automobile features at least 23% of critical damping.

No-risk design and construction of housing should involve at least three steps: (1) the routine prevention of resonance by damping and/or base insulation, in such a way that the response spectrum for the design earthquake fits effortlessly under the design spectrum, (2) full-size model structures to be fully field-tested under realistic conditions, (3) all housing on soft ground which exceeds a specified number of floors to be inspected during construction under the full responsibility of the design engineers.