RETURN PERIOD OF UNITED STATES DESIGN GROUND MOTION MAPS

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ABSTRACT

Since publication of the 1997 NEHRP Provisions, the USGS design ground motion maps have been derived using a combination of probabilistic and deterministic procedures. The probabilistic maps were based on a 2475 year return period until the 2009 NEHRP Provisions adopted a risk-targeted approach for ground motion specification, described further below. This long return period produced ground motions that were considered by many structural engineers as too high in areas near highly active faults, and hence various degrees of capping have been applied using deterministically derived ground motions in which the controlling fault and fractile level of ground motion are specified. Hence, while most portions of the US have design ground motions based on probabilistic ground motions, a few areas of high ground motion hazard employ these deterministic caps.

In the 2009 NEHRP Provisions, an alternative definition of ground motion was presented as part of Project 07. A procedure was developed whereby the ground-motion hazard was convolved with a generic collapse fragility to derive ground motions with a spatially uniform collapse probability. This risk-targeted approach provided ground motions that in many areas were broadly consistent with the 2475-year hazard level. This process was not applied in areas with deterministic caps where, as with prior editions of the NEHRP Provisions, higher risk is tolerated.

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As part of Project 17, we are charged with re-considering this approach to derive design ground motions. Possible increases to the risk targets of design ground motions (equivalent to reductions to nominal return periods) are being contemplated. This could enable elimination of deterministic cap zones, and provide a more uniform risk across the US. A key consideration in this regard is that design ground motions should at least represent the median ground motion that can reasonably be expected if a credible local seismic event were to occur. We are checking a range of risk targets at selected locations in relatively low seismicity portions of the US to see if an increased risk target could potentially be adopted without running the risk of a large foreseeable urban disaster. As part of this process, an alternative use of deterministic ground motions is also being considered to set a floor (lower bound) based on a specified fractile level of ground motion in low seismicity areas. Recommendations on these issues will be formed by the time of the 2018 NCEE.