Discussion of "Accounting for Ground-Motion Spectral Shape Characteristics in Structural Collapse Assessment through an Adjustment for Epsilon" by Haselton CB; Baker JW; Liel AB; and Deierlein GG.

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In page 335, the proposed procedure for calculation of the epsilon (ε) for different return periods is based on Equation (1).

$$\frac{1}{RP_{S_a \geq x}} = \left(\frac{1}{RP_{Characteristic\ Event}}\right)[P(S_a \geq x | Characteristic\ Event)] \qquad (1)$$

For example for $RP_{S_a \geq x} = 2475$ we have $\varepsilon = \Phi^{-1}(1 - \frac{200}{2475}) = 1.3997$, where Φ is the standard Gaussian cumulative distribution function. The corresponding ε which has been reported in the paper is 1.43 that is different from 1.39. It is worth emphasizing that the mentioned difference for the parameter ε is not negligible. Also, the expected ε for $RP_{S_a \geq x} = 475$ is achievable as $\varepsilon = \Phi^{-1}(1 - \frac{200}{475}) = 0.20$, however, it was calculated 0.3 in the manuscript (again in page 335).

On the other hand, which is more important, by rearranging Equation (1) it can be re-written as:

$$P(S_a \geq x | Characteristic\ Event) = \frac{RP_{Characteristic\ Event}}{RP_{S_a \geq x}} \qquad (2)$$

As any probability shall lie between 0 and 1, we can claim that; $RP_{Characteristic\ Event} \leq RP_{S_a \geq x}$. In other words the ε value cannot be calculated for the return periods less than the characteristic event return period ($RP_{Characteristic\ Event}$), which is 200 years in the paper example. For clarify of exposition, the ε for the return period equal to 209.3 can be calculated by $\varepsilon = \Phi^{-1}(1 - \frac{200}{209.3}) = -1.7$ which has been assigned to 7.2 year return period in page 335 of the paper. The physical meaning of this issue can be interpreted on the hazard curve. The hazard curve for a single characteristic event (as for the paper

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example) has a value equal to $\frac{1}{RP_{Characteristic\ Event}}$ for the starting point ($S_a = 0$). It means that the higher annual probability of exceedance than $\frac{1}{RP_{Characteristic\ Event}}$ (lower return periods) cannot be defined in this hazard curve.