Fragility of a Structure, System, or Component for Seismic Performance

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Performance-based design of structures, systems, and components (SSCs) has gained increased interest in recent years among structural engineers, researchers, code committees, and regulatory bodies. This is evidenced by publication of codes for the performance-based design of traditional buildings, and consensus standard for evaluation of seismic performance of nuclear facilities. Performance-based design is an engineering approach in which the design process is structured to achieve performance requirements (limit states) specified by the owners for asset protection and/or to meet a risk level specified in regulations to ensure adequate protection of public health and safety. Performance evaluation of SSCs exposed to natural hazards (e.g., wind and earthquake) is important because, given a specific performance criterion; failure of an SSC is expected to have an increased probability of occurrence under these conditions than during normal operations. SSC is determined by convolving the seismic hazard curve for the site of the proposed facility with the fragility curve of the SSC, defined as a conditional limit state probability of occurrence expressed in terms of a given earthquake ground motion demand quantity (e.g., spectral acceleration, spectral velocity). This paper examines various available methods that can be used for development of a fragility curve for an SSC, and focuses on the comparison of the results using the Conservative Deterministic Failure Margin method and using other methods.

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