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Design and Analysis of Concrete Buildings under Strong Earthquake Ground Motions

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Abstract

Performance-based seismic design and assessment of buildings increasingly is relying on inelastic dynamic analysis methods. Such methods require selection of earthquake ground motions to represent the seismic hazard. In the United States, this is usually done using site-specific seismic hazard analysis, with ground motions selected (and scaled) based on considerations of shaking intensity, rupture mechanism, duration, and, for near-fault motions, the presence of ground motion pulses. Some procedures used in recent projects in the United States will be reviewed briefly.

For new building designs, nonlinear dynamic analysis is especially useful in defining the force demands on structural elements that are intended to remain essentially elastic. A common consideration is the shear force demand in shear walls and columns. An example will be presented for the determination of shear forces in columns of special moment frames, where it will be shown that current prescriptive provisions can be unconservative. An alternative design approach is suggested.

Older building construction commonly lacks detailing that promotes stable nonlinear response. Such structures can be particularly sensitive to the characteristics of the earthquake ground motion, and require analytical models capable of representing degradation under cyclic loading. Recent tests exploring this behavior will be reviewed, along with analytical models to simulate observed responses.