DBELA: A New Methodology for Earthquake Loss Assessment

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DBELA (Displacement-Based Earthquake Loss Assessment) is a new methodology for loss estimation that is currently under development. Predictions of the degree of structural and non-structural damage to building classes under both ground shaking and liquefaction-induced ground failure can be carried out with this method. Building classes might encompass reinforced concrete buildings, buildings with structural walls or dual (wall-frame) system buildings. Earthquake actions and structural reactions are represented in DBELA by displacements following the evident correlation between building damage and lateral displacements. The main concept of DBELA is to compare the displacement capacity of the building stock and the imposed displacement demand from the earthquake. Under ground shaking, the relationship between the frequency content of the ground motion and the fundamental period of vibration of the building is considered through the use of displacement response spectra. The displacement capacity of a building class is found by first transforming the structure to a single-degree of freedom (SDOF) system and then by relating the lateral deformation potential of this system to its period of vibration. In this way, both the demand and the capacity are defined in the same displacement-period space and direct comparisons can be made at any period to ascertain whether the demand is greater than the capacity, and thus whether failure occurs. A probabilistic framework has been incorporated into the methodology to account for the epistemic (knowledge-based) uncertainty in the capacity parameters and the aleatory (random) variability in the demand spectrum. DBELA has many advantages over alternative methods for loss estimation, though perhaps the most important is the ease with which the method can be calibrated for use in different locations all over the world.

KEYWORDS earthquake loss estimation; displacement-based; reinforced-concrete