# A statistical analysis of reinforced concrete wall buildings damaged during the 2010, Chile earthquake

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Abstract

This research article investigates the correlation between a suite of global structural parameters and the observed earthquake responses in 43 reinforced concrete shear wall buildings, of which 36 underwent structural damage during the $M_w$ 8.8, 2010, Maule earthquake. During the earthquake, some of these buildings suffered brittle damage in few reinforced concrete walls. Damage concentrated in the first two building stories and first basement, and most typically, in the vicinity of important vertical irregularities present in the resisting planes. This research consolidates in a single database information about these 36 damaged buildings for which global geometric and building design parameters are computed. Geometry related characteristics, material properties, dynamic and wall-related parameters, and irregularity indices are all defined and computed for the inventory of damaged buildings, and their values compared with those of other typical Chilean buildings. A more specific comparison analysis is performed with a small benchmark group of 7 undamaged buildings, which have almost identical characteristics to the damaged structures, except for the damage. A series of ordinal logistic regression models show that the most significant variables that correlate with the building damage level are the region where the building was located and the soil foundation type. Most of the damage took place in rather new medium-rise buildings, and was due in part to the use of increasingly thinner unconfined walls in taller buildings subjected to high axial stresses due to gravity loads, which in turn are increased by dynamic effects. Time–history analyses are performed in five damaged buildings to analyze in more detail the dynamic effect in these amplifications of the average axial load ratios. Finally, a simplified procedure to estimate this dynamic amplification of axial loads is proposed in these buildings as an intent to anticipate at early stages of the design the seismic vulnerability of these structures.