EVALUATION OF THE SEISMIC PERFORMANCE OF A 14-STORY REINFORCED CONCRETE BUILDING USING THE CAPACITY SPECTRUM METHOD

Alvaro Tello[1], Juana Gresia[2]

[1] *Faculty of Civil Engineering, Peruvian University of Applied Sciences, Lima, Peru*

[2] *GERDIS Research Group, Pontifical Catholic University of Peru, Lima, Peru*

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ABSTRACT

In recent years, the real estate demand for medium- and high-rise buildings in Peru has increased in different regions of the country, especially in Lima. However, in past seismic events, these buildings, mostly reinforced concrete and structural wall systems, have presented behaviors and failures different from those assumed at the design stage. This is because the methodology being applied does not consider the behavior of buildings in a non-linear range. Therefore, it is necessary to analyze the structures in a non-linear range to determine their structural behavior due to the effect of probable earthquakes in the study area. In this paper, a 14-story reinforced concrete and structural wall system building is evaluated for structural performance. First, the capacity of the building is determined by applying a non-linear static analysis (Pushover Analysis). Then, 08 seismic records belonging to the most intense earthquakes that occurred in the last 60 years in the study area (Peruvian coast) are considered, whose spectra are compatible with the Peruvian seismic code E.030 spectrum. Once capacity and demand have been defined, the capacity spectrum assessment method known as FRACAS (FRAgility through CApacity Spectrum assessment) is applied. This methodology allows sophisticated capacity curve idealizations, the use of several hysteretic models for systems with a single degree of freedom in the inelastic calculation of demand, and the construction of fragility functions by using several statistical model fitting techniques. As a result, for a design earthquake demand, the building has a 60% probability of incursion into a Functional damage state, complying with the design philosophy indicated in Peruvian standard E.030. Likewise, for severe earthquakes, with accelerations of 1.0g, the building has a 35% probability of incursion into a Collapse damage state. Finally, this methodology is an excellent approach to determine the damage state that a structure would present due to the impact of several earthquakes that can occur during the structure's lifetime.

Keywords: Fragility Curves, Structural Performance, Nonlinear Analysis, Reinforced Concrete, FRACAS