EVALUATION OF THE SEISMIC RESPONSE USING THE RANDOM VIBRATION THEORY IN THREE DISTRICTS OF LIMA, PERU

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Received: 00/00/0000 Accepted: 00/00/0000

ABSTRACT

In the current engineering practice, seismic response analyses are performed using a minimum number of seismic records as input motions in order to achieve a statistically strong estimation. Unfortunately, the available information recorded from the current seismic networks is still scarce regarding events with considerable magnitude. In this context, the Random Vibration Theory (RVT) arises as an alternative tool for performing site response analyses without the need of seismic records, since it only requires adequate probabilistic seismic hazard assessments.

In this study, RVT was applied to three shear-wave velocity profiles in Lima city with distinct geomorphological origin. These profiles are characteristic for gravelly, sandy and fine deposits so the influence of each soil type in their corresponding transfer function was taken into account. For San Miguel and Villa el Salvador profiles, the response spectra calculated by RVT was appropriately enveloped under the design spectra specified in the Peruvian Seismic Code. For La Punta profile, RVT gives values of spectral acceleration higher in the large period range. This could suggest that the characterization of soil profiles based on the time-averaged shear-wave velocity in the upper 30 m might be insufficient to evaluate the overall seismic behavior. Therefore, it might be adequate to redefine the limits of Vs30 for soil classification and to include additional parameters that consider the influence of the deeper part of soil deposits, such as the fundamental period of vibration.

Keywords: Site Response Analysis; Probabilistic seismic hazard analysis; Shear-wave velocity profiles; Random Vibration Theory; Lima