Perspectives on the state of practice in site characterization for site response analyses

Alan Yong
United States Geological Survey, Earthquake Science Center
yong@usgs.gov

I present perspectives on the use of noninvasive single- and multi-station seismic site characterization methods and their impact on estimating site response parameters, including indices such as the site fundamental frequency (f_0) and site dominant frequency (f_d), as well as the time-averaged *S*-wave velocity (V_S) of the upper 30 meters (V_{S30}). I describe the current state of knowledge and practice using traditional independent array-based techniques through results from the 2015–2021 Consortium of Organizations for Strong Motion Observation System (COSMOS) Site Characterization Project (Yong *et al*., 2022)[1]. I also compare results for V_S profiles from single-station methods—such as the Nagashima *et al*. (2014)[2] eHVSR technique—against those by traditional multi-station array-based approaches (Stephenson *et al*., 2022)[3] as presented by Yong *et al*. (2024)[4]. Through recent investigations, including results by Asten *et al*. (2022)[5], I propose optimal procedures for applying single-station and array-based methods to acquire: V_{S30}, f_0 and f_d. For V_{S30}, I show that V_{R40}, the Rayleigh-wave phase velocity at the 40 m wavelength, is suitable to estimate V_{S30} for the majority of cases encountered. Through results in our Wang *et al*. (2023)[6] article, I show how selections of f_0 or f_d are affected by analyst bias and propose how to address such uncertainty, as well as best practices for calculating these frequency-dependent indices.

[1] https://doi.org/10.1007/s10950-022-10104-w (last accessed: 28 August 2024)
[2] https://doi.org/10.1785/0120130219 (last accessed: 28 August 2024)
[3] https://doi.org/10.1007/s10950-022-10102-y (last accessed: 28 August 2024)
[4] https://central.scec.org/publication/13955 (last accessed: 28 August 2024)
[5] https://doi.org/10.1007/s10950-021-10059-4 (last accessed: 28 August 2024)
[5] https://doi.org/10.1785/0120210304 (last accessed: 28 August 2024)