Dispersion-Curve Analysis aided by HVSR Peak Resonance Frequency

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The multichannel analysis of surface waves (MASW) is commonly used to acquire active single-component seismic data for surface-wave analysis and shear-wave velocity inversion. When open space or time is limited, horizontal-to-vertical spectral ratio (HVSR) measurements can be used in collaboration with MASW surveys to provide 1D measurements and estimate depth to bedrock or shear-wave velocity outside those MASW alignments. These HVSR measurements can then be used to develop a site-specific regression curve for quick estimations of bedrock depth.

After surveying various field sites, estimated peak frequencies from HVSR appeared to correlate with oscillation-point frequency on MASW dispersion curves. In general, the peak resonance frequency corresponds to the overburden-bedrock contact when a 2:1 velocity contrast exists between those layers. And in its simplest case, the oscillation point on a dispersion curve is also often related to the interface between soil overburden and bedrock. Therefore, the peak resonance frequency from HVSR was used to guide dispersion-curve interpretation, specifically to help determine the frequency of its oscillation point, when met with challenging data sets. Some variability between these frequencies exists, which may be due to contributions from non-surface wave waves in the HVSR estimations. This peak frequency- oscillation frequency relationship is demonstrated using case studies from multiple US locations where HVSR frequency was consistently slightly lower than the oscillation frequency.