Bay Area Geophysical Society Seminar Series

The application of novel survey geometries on passive surface wave method - and the influence on data quality

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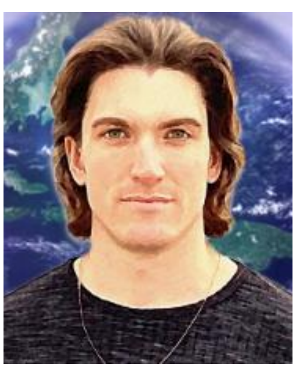
Abstract: A passive surface wave method has been applied to delineate geologic structure in urban and agricultural areas of Napa, CA. In 2014, south Napa was the epicenter of a deadly M6.0 earthquake, causing widespread destruction. To better understand the earthquake risk hazards for the city of Napa, the Napa Valley Seismic Project (NVSP) was founded in 2020 and 100+ passive surface wave method surveys were performed roughly equally spaced across an area 70 sq km. Arrays varied in size from 35-1500 meters in size, with the average array being 50-80 meters in diameter. During the process, different array geometries were experimented with depending on the site conditions. In order to better understand the effect of array design on data quality, five different array geometries were compared using 16 receivers with 2Hz geophones under identical environmental conditions on the same day, The array

geometries tested were a triangle, L-shape, linear, circular, and a Fibonacci spiral, with 30 minutes of data being collected for each. Array sizes had a maximum receiver spacing of about 50-80 m. A special auto-correlation method was applied to 30 minutes of vertical component of micro-tremors data. Dispersion curves were calculated in the frequency range between 1 and 30 Hz. Fundamental mode of dispersion curves are clearly obtained for each array geometry. A one-dimensional inversion using a non-linear least square method has been applied to the dispersion curves and one-dimensional S-wave velocity structures were obtained. At each step of the data processing, data quality can be compared, and RMSE values for each array geometry were obtained before and after 5 iterations of non-linear least-square-method inversions. The results from these five comparative arrays informed the array designs used for the ongoing NVSP, and other interesting passive- surface wave observations were made



Bio: Stefan Burns is a Sr. Geophysicist with Geometrics who earned his B.S. in Geology at UC Davis. Stefan started his geophysical career with Subtronic Inc, where he gained valuable experience with GPR and land magnetometry as it relates to civil engineering and archaeology investigations. Before joining Geometrics, Stefan was a co-host of the Science Channel show “Secrets of the Underground”, which brought geophysics to a mainstream audience. Now at Geometrics, Stefan has specialized in UAV magnetometry and passive-seismic methodologies. He has recently been conducting studies aimed at optimizing survey geometries of Multi-Channel Analysis of Surface Wave (MASW) surveys for characterizing the shear wave velocities in the near subsurface. This information is used to assess the site response to earthquakes.

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