SASW measurements in civil engineering applications: using wavelengths to tailor profiling depths from 5 cm to 500 cm

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SUMMARY

Field seismic testing is an active and growing area in Civil Engineering, especially in the sub-disciplines of geotechnical, transportation, and structural engineering. Traditionally, intrusive seismic methods have been used. Over the past 15 years, nonintrusive surface-wave methods have undergone significant developments. One surface-wave method, the spectral analysis of surface waves (SASW), is briefly discussed. Development of the SASW method began in the mid-1980's out of needs in geotechnical earthquake engineering to determine shear wave velocity (V_s) profiles in hard-to-sample soils (e.g. liquefiable gravelly soils) and in pavement engineering to evaluate stiffness profiles without boreholes. Because the method is nonintrusive, applications within Civil Engineering have mushroomed. A brief background of the SASW method is presented. Case histories illustrating the range in applications and profiling depths are discussed. Some examples are: (1) detection of the onset of fatigue cracking in the asphaltic surface layer of a pavement using 2- to 20-cm long wavelengths, (2) evaluation of the improved zone in a liquefiable sand due to dynamic compaction using 0.3- to 30-m long wavelengths, and (3) determination of V_s profiles at Yucca Mountain, Nevada using 1- to 1000-m long wavelengths.