Shallow Shear-Wave Seismic Velocity Testing in Jackson, Mississippi

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ABSTRACT

Regions underlain by thick deposits of unconsolidated to poorly consolidated sediments, such as areas within the Mississippi Embayment, are known to experience greater levels of earthquake damage due to amplification of seismic waves than areas underlain by rock. Earthquake hazards studies of communities in the Mississippi Embayment have shown the importance of measuring properties of the subsurface. One key parameter in determining the dynamic response of a site to earthquake waves is the shear-wave (S-wave) velocity structure of the subsurface. S-wave velocity can be measured directly using surface or downhole seismic methods. We collected downhole seismic data at a site in Jackson, Mississippi, one of the largest metropolitan areas in the Mississippi Embayment. At the site, on the Millsaps College campus, a test hole was drilled by the Mississippi Office of Geology (MOG), cased with 2-1/2" ID PVC casing, and grouted in place. The test hole encountered Pre-Loess Terrace deposits (Pleistocene) at the top and continued through the Yazoo Clay (U. Eocene), Moody's Branch Formation (U. Eocene), Cockfield (M. Eocene), and finally bottomed in the Cook Mountain Formation (M. Eocene). The MOG collected a suite of geophysical logs (including SPR and Gamma) and we have preserved continuous core from the upper 30 m (~98 ft) of the hole. Downhole S-wave seismic data were acquired using a three-component borehole geophone system. The sensor was locked to the borehole wall and moved up the hole at 1-m (~3-ft) intervals. S-wave travel times from a source (sledgehammer impacting a steel I-beam) at the surface were recorded and the S-wave velocity structure at the site was determined. The results of this project provide an S-wave velocity dataset for future ground motion response modeling in the Jackson area.

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