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Hydro-geophysics in highway monitoring – new approach to jointing multimodal MASW and refraction surveying.

R. Matuła

Department Geophysics, Faculty of Geology , Geophysics and Environment Protection, AGH University of Science and Technology, Poland (rmatula@agh.edu.pl), Krakow

Multichannel analysis of surface waves(MASW) is low-cost and powerful active seismic method dedicated for solving subsurface geotechnical problems. There are several advantages like simple field acquisition, very good signal-to-noise ratio obtained for base impact sources, simply way of inversion and high reslolution of provided resluts. MASW is effective not only due to natural subsurface conditionings but also man-made geotechnical construction. Interferencial character of surface waves (SW) suggests that fundamental condition, which must be caused to observe Rayleigh waves, is only appearance of free surface. In other words for every seismic surveying registered records are dominated by strong surface waves amplitudes. Uniform properties of MASW, especially for geotechnical purposes, comes out from nature of SW propagation. Unnecessity of any regularly layered subsurface geological conditions with strong velocity contrast gives MASW better flexibility in wide-applicability in comparison to refraction and tomography connected with.
Despite of common usage of MASW method need to be supported by other engineering methods for elimination geophysical ambiguity, for example solving problems connecting with local water retention.
Many roads are located on a slope of hills where they cut natural drainage path, bringing road subsidence or in drastic cases, slipping whole embankment with the road.
Effective detection zones suspected for retention and fluid flow leading ground-water needs complexity approach fitted to on-side ground conditions. Well-known refraction ability to imaging saturation horizons can be a water indicator, dividing ground above bed-rock into part influenced by water and saturation-free. MASW is sensitive for any changes in variation of ridigity and density in low velocity zone (LVZ) above bedrock, but it direct connection with water activity is risky.
Every anomalies estimated from MASW for LVZ could be distinguished into by two groups below groundwater table and above. Refraction surveying gives only information about elevation of generally flat watertable with its average velocity, but non information about velocity variation inside this layer connected with discountinous retention zones. In most cases water-table is above bedrock and problem of velocity changes inside saturation zone can be solved by using MASW along refraction profile.
Simultaneously roadside surveys carried out at S-E from Cracow shows that jointing MASW and refraction methods is very effective for precise detection of water-connected anomalies. Furthermore obtained data suggests that there is some evident relation between appearance higher modes and local apperance of watertable. In addition MASW connected with shallow-borehole data are helpful in constructing LVZ velocity disctrubution for eliminating pitfalls in estimating bedrock's elevation.