

Multi-phase analysis of surface wave survey data obtained by Land Streamer

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High-resolution surface wave survey using Land Streamer has been widely employed in engineering geophysical field to obtain S-wave velocity structure at the near-surface. The survey parameter of the surface-wave survey is fundamentally the same as that of high-resolution seismic reflection survey when utilizing Land Streamer developed by the author. The difference between the parameters is only in the used geophones. Namely, in contrast to the seismic reflection survey, which usually uses 14 to 28 Hz geophones, 4.5 Hz vertical geophones are mainly adopted for the high-resolution surface wave survey. Owing to high dynamic ranges and wide frequency ranges in recent digital type geophones, the surface wave survey data often include relatively high-frequency P-wave reflection, direct SV like reflection phases along with dominant low frequency surface waves. Then it is possible to apply not only conventional multichannel analysis of surface wave (MASW), but also usual P- and S-wave reflection data processing to the acquired data. To ensure whether observed S-wave like reflection phase was SV-SV reflection or the converted one from P-waves, comparative measurements was conducted along the same line set on the soft ground. A 120-channel, at 50-cm intervals, SH-wave type Land Streamer was adopted for the high-resolution SH seismic reflection survey. Both data were processed through routine S-wave processing steps. As a result, the time sections were fundamentally the same as each other. P-waves reflection processing also successfully provided the near-surface P-wave time sections. In a recent case, a migrated depth section delineated a dipping bearing layer, and the depths of the layer were consistent with those directly identified by drilling and piling. In conclusion, when conducting surface wave survey compatible to the high-resolution seismic reflection survey, multi-phase analysis or P- and S-wave reflection data processing as well as MASW is available to the data to obtain the near-surface structure.

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