

Spectral Analysis of Surface Waves

SASW tests allow the user to determine the different profiles in pavement layers or soil layers, including the depth, velocity and also the condition of each of these layers. It is all done non-destructively from the top surface of the pavement. The test can be performed on concrete, asphalt, masonry, soil and wood and can be used to investigate profiles up to 90 meters deep.

How it works

Surface wave testing uses the dispersive characteristics of surface waves to determine the variation of the shear wave velocity (stiffness) of layered systems with depth. The SASW testing is applied from the surface which makes the method non-destructive and non-intrusive. In SASW tests, two receivers are placed on the surface, and a hammer is used to generate the wave energy. An Olson Instruments' Freedom Data PC or NDE 360 records the hammer input and the receiver output.

Access

The SASW method requires an accessible surface for receiver attachments. The extent of the accessible surface limits the investigation depth. As a rule of thumb, if one is interested in material properties to a depth D , then the accessible surface should extend in the line of receivers direction to a distance equal to $1.5D$, preferably $2D$.

Setup Arrangement

Receiver spacings ranging from 15 cm to more than 90 m have been used in the field to investigate depths from 5 cm up to greater than 90 m.

Accuracy

SASW measurements are accurate to within 5% for the determination of the thickness and stiffness of the top layer during pavement layer analysis or of the concrete liner of a tunnel.

Correlation between SASW and Crosshole Seismic tests on soil sites showed that the values from both tests typically compare within a 10% difference.



Applications

Surface wave analysis can determine:

- Road layer or pavement system profiles including the surface layer, base and sub grade materials.
- Determination of soil profiles including soil velocities needed for earthquake and dynamic loading analysis
- Determination of abutment depths of bridges
- The condition assessments of concrete liners in tunnels, and other structural concrete conditions
- Crack depth in monolithic concrete

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Collection of Data

In SASW tests, two receivers are placed on the surface, and a hammer is used to generate the wave energy. Short receiver (typically accelerometers) spacings are used to sample the shallow layers while long receiver (typically velocity transducers) spacings are used in sampling the deep materials.

Two profiles, a forward profile and a reverse profile, are typically obtained in SASW measurements where the accessible surface is struck by a hammer on two opposite sides of the receivers. A signal analyser is used to collect and transform the receiver outputs to the frequency domain. Two functions in the frequency domain are of great importance in SASW tests:

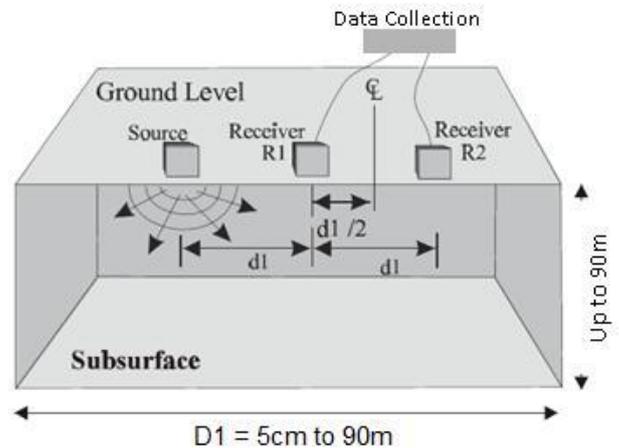
- The cross power spectrum between the two receivers (used in the preparation of the experimental dispersion curve)
- The coherence function (used to ensure that high signal to-noise ratio data is being collected).

Case Study

The figure right shows dispersion curves determined from SASW measurements on asphalt pavement. Shown in this figure is the variation of the surface wave velocity (modulus) as the asphalt layer warms up. The SASW measurements were also effective in determining the thickness of the surface layer.

Platforms Available

We offer two devices available for the SASW technique. These include the NDE 360 and Freedom Data PC. These offer differing levels of mobility and on-site analysis. Please see the individual webpages for more in depth specifications for the platforms.



About PCTE

PCTE have over 30 years' experience in the measurement and testing of construction materials. PCTE can provide more than just the equipment, they can provide expert training. PCTE have a service centre in Sydney in which they can provide calibration, repairs and warranty repairs.

Other Equipment

PCTE supply three main ranges: NDT, Lab and Geotech Instrumentation.

NDT includes: Rebound Hammers, Covermeters, Ultrasonics, GPR, Corrosion Testing, Coating Testing and Foundation Testing

Lab includes equipment for: Concrete, Cement, Aggregate, Soil, Asphalt and Metal

Geotech Instrumentation includes: Strain Gauges, Piezometers, Inclometers, Extensometers, Tiltmeters, Load Cells and Dataloggers