Spectral Analysis of Surface Waves-S » ACI 228.2R

Spectral Analysis of Surface Waves (SASW) investigations are typically applied to assess material stiffness and condition, and layer thickness.

The Spectral Analysis of Surface Waves (SASW-S) system is designed for the following applications:

1. Condition assessment of concrete, including liners in tunnels, slabs, and other structural concrete members.
2. Evaluation of alkali-silica, fire, freeze-thaw and other cracking damage.
3. Surface-opening crack depth measurement.
4. Determination of abutment depths of bridges.
5. Determination of pavement system profiles including the surface layer, base and subgrade materials with optional WINSASW software.

The SASW method uses the dispersive characteristics of surface (Rayleigh) waves to determine the variation of the shear wave velocity (stiffness) of layered systems with depth. The SASW testing is applied from the surface making it both nondestructive and non-intrusive. Once the shear wave velocity profiles are determined, shear and Young's moduli of the materials can be calculated through the use of simple mathematical equations. If optional WINSASW software is purchased, shear wave velocity profiles can be determined from experimental dispersion curves (surface wave velocity versus wavelength) and compared to actual SASW measurements through a process called forward modeling or through an inversion process. This allows the user to find the best thickness and stiffness model for the layered system of interest. The SASW method can be performed on any material provided there is an accessible surface for receiver attachments. SASW is also used for geophysical purposes in estimating shear wave velocity of soils and rock ***(see the SASW Section in the Geophysical Engineering Section, page 38)***.

Features:

- Receivers mounted on the SASW-S bar allow for fast and accurate field measurements
- Real-time waveform display while testing
- System is compact, durable, and easily transported allowing for multiple tests per day
- Measurements accurate to within 5% for the determination of the thickness and stiffness of the top layer in a pavement system or of the concrete liner of a tunnel
- Acquisition and analysis software are compatible and easy to use yielding fast and accurate results

» Applicable On:
Asphalt
Concrete
Masonry
Stone
Wood
» Test For:
Layer Thickness
Material Moduli
Shear Wave Velocity Profiles

Model	Advantages
SASW-S Model	Rapidly performs SASW tests with receiver spacings between 2.4" and 31.5" (6 and 80 cm). Includes SASW Bar.
SASW-A Model	Performs testing with accelerometer receiver spacings up to 12 ft (3.6 m). *Does not include SASW Bar.*
SASW-SA Model	Most complete SASW system. Includes SASW Bar and two accelerometers for testing with receiver spacings up to 12 ft (3.6 m).
Option	**Advantages**
WINSASW Software	Allows determination of pavement system profiles

Freedom Data PC or NDE 360 Required, Sold Separately

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Method

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, in order to investigate material properties to a depth D, the line of receivers on the surface must extend to at least a distance equal to 1.5D, preferably 2D. Once the receivers are mounted to the surface, acoustic energy is generated by an impactor and measured on the receivers.

Data Collection

The user-friendly SASW software is written and tested at Olson Instruments' corporate office in Colorado. We do not outsource any tech support questions and, should you require software support, we welcome your questions and comments. It should be noted the SASW-S data is usually displayed and analyzed with our WinSW software. Additionally, more detailed analysis and modeling is possible with a program called WINSASW, available from the University of Austin Texas.

Available Models

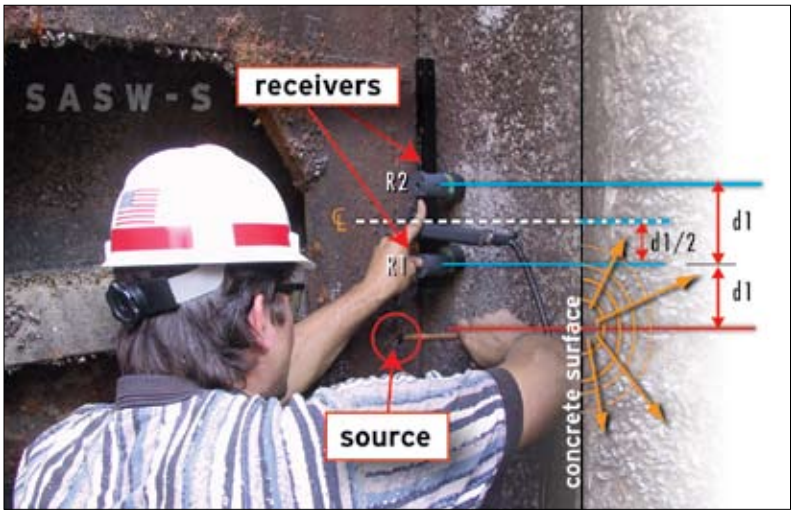
The Spectral Analysis of Surface Waves system is available in three different models which can be run from Olson's Freedom Data PC or NDE 360 Platforms:

1. Spectral Analysis of Surface Waves - S (SASW-S)
2. Spectral Analysis of Surface Waves - A (SASW-A)
3. Spectral Analysis of Surface Waves - SA (SASW-SA)

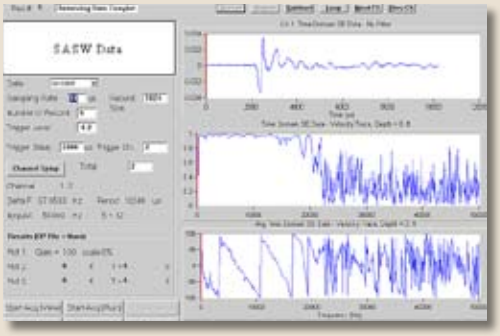
The **SASW-S Model** is the base model and includes the SASW receivers mounted to the SASW bar, the SASW cable, and ball-peen hammers for impacting the surface. This system is used for testing with receiver spacings between 2.4" and 31.5" (61 mm and .8 m). These spacings are appropriate for depth investigations down to approximately 2.6 ft (0.8 m).

The **SASW-A Model** is comprised of two accelerometers. This system is appropriate for testing with receiver spacings up to 12 ft (3.6 m).

The **SASW-SA Model** is the most complete SASW system as it includes both the SASW bar and a two accelerometers, which will allow for investigations up to approximately 12 ft (3.6 m).



Data Example » 1



SASW results showing good quality data taken on good quality concrete

It's important in the field to limit the accepted data to those wave forms that originate at zero volts with good repeatability. Once the data is accepted, it is important to check the coherence and the phase analysis of the data, which appear in the lower two plots. Good quality data on good quality concrete consists of high coherence and multiple saw-tooth phase cycles.