

Spectral analysis of surface waves for the determination of the dynamic stiffness characteristics of layered media

Abstract

The Spectral Analysis of Surface Waves (SASW) is a non-intrusive in-situ technique that is particularly suited to the evaluation of soil and pavement sites. The test measures the change in the propagation velocities of elastic stress waves. Since these velocities are elasto-dynamically related to the stiffness of the propagation medium, any significant stiffness change can be directly determined without recourse to empirical correlations. The non-intrusive nature of the SASW test and the fact that it is based on stress wave propagation makes it ideal for evaluation purposes.

This research work presents the development of an optimized SASW test equipment and field procedure and a study of the measurement and interpretation methods to determine the dynamic deformation parameters of pavements and their subgrades.

A first part gives an overview of the theory of wave propagation in elastic media with emphasis on the surface wave propagation. The SASW method is situated among other in-situ seismic techniques. Analysis of the SASW signals is commented, the spectral analysis functions are presented and the procedure for performance of the SASW test on pavements is recommended.

In a second part the measurement results of the SASW control of every construction phase of a new highway in reinforced concrete are presented. Also the laboratory investigations on a small scale concrete plate with known irregularities are shown.

The mobility of the SASW test is studied in a third part by incorporating the test in a falling weight deflectometer test. This is done by a comparative study concerning the equipment and calculated moduli.

As a result of this research, conclusions are formulated concerning the usefulness of the SASW technique as a non-destructive in-situ test for the determination of the dynamic stiffness characteristics of layered media.

