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# Comparative Analysis of Shear Wave Velocities from SCPTu and MASW in Dam Monitoring Applications

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## Introduction

Monitoring is an essential method for the operational management of dams. Traditionally, geotechnical instrumentation has been widely used for this purpose. However, this type of monitoring requires long-term planning, systematic recording of readings, and careful data processing, which is time-consuming and provides only point-based information about the structure. In this context, geophysical methods offer significant advantages, such as the generation of large volumes of data, rapid acquisition, and extensive spatial coverage, making them efficient tools for dam monitoring. This study explores seismic velocities obtained through Seismic Cone Penetration Testing (SCPTu) and Multichannel Analysis of Surface Waves (MASW), evaluating the correlation between the results provided by these methods. Furthermore, the integrated application of MASW with Ambient Noise Seismic Interferometry (ANSI) is demonstrated, aiming to enhance the efficiency of subsurface geophysical monitoring.

## Method and/or Theory

Data acquisition was carried out at the BL1 dam at the Tapira mining complex (CMT), located in the state of Minas Gerais, Brazil. SCPTu tests provide detailed shear wave velocity (Vs) profiles, along with other geotechnical parameters, at specific points. These Vs profiles are used for comparison with MASW results, which although less detailed, is a non-invasive seismic method. In addition, the combined use of MASW and ANSI, which employs sensor pairs to record variations in S-wave velocities occurring within the structure, is presented as an approach to improve subsurface geophysical monitoring.

## Results and Conclusions

The comparison of Vs values obtained from SCPTu and MASW, analyzed at each one-meter intervals, revealed differences of up to 46%, indicating high variability. However, when averaged over five-meter intervals, the maximum variation ranged from 5% to 24%. Another approach to compare the velocities was through MASW data interpolation, which also demonstrated good correspondence between the velocities obtained in data comparison. Using MASW velocity data together with interferometry it was possible to see in absolute values the variation in wave velocity in the structure. The integration of MASW velocity data with ANSI allowed for the observation of absolute variations in shear wave velocity throughout the dam structure.