

Memorandum

To: Dean Eric Johnson

From: Carmine Polito

Date: 12 November 2019

Subject: Potential Reutlingen Masters-Student Project

This memo outlines the basic parameters of a project for a Reutlingen Master's student visiting Valparaiso University for one semester. The project would probably be best suited for an Electrical Engineering student, however, it should also be viable for a Mechanical Engineering student.

The project would involve the development of a bender-element system to collect small-strain shear wave velocity data in soil specimens and development of software to process and analyze the collected data. Bender elements systems typically consist of a pair of piezoelectric elements (one transmitter and one receiver). When subjected to an electrical signal, the transmitting element deforms, causing a shear wave to propagate through a soil specimen. When the shear wave contacts the receiving element, the element deforms, generating an electric signal. An oscilloscope is used to generate the transmitted signal and to record the received signal. The difference in the time between signal generation and reception, coupled with the distance between the elements, allows for the calculation of the shear wave velocity of the soil and, subsequently, the small-strain shear modulus of the soil.

In addition to the construction of the bender-element apparatus, the project would require the development of software for processing of the collected data. The software would be required for filtering and signal stacking of the data.

A general description of bender-element systems and the related data processing can be found at:

https://www.controls-group.com/eng/soil-mechanics-testing-equipment/bender-elements_.php