AN ABSTRACT OF A THESIS

RANDOM VIBRATION EXCITATION IN THE DETERMINATION OF THE LENGTH OF WOODEN PILES USING DIAGONAL CONNECTIONS

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In 1983 the Tennessee Department of Transportation (TDOT) approached Tennessee Technological University (TTU) to develop a system to predict the length of embedded timber bridge piles. TDOT required that the system be easy to use, accurate, and provide immediate results. Previous studies have been performed at TTU to address the needs of TDOT. These studies used random vibration excitation to create Frequency Response Functions (FRF's) via perpendicular connections to the side of the pile. The FRF was used to determine the natural frequency of the pile. The length was calculated using the natural frequency and an experimentally determined stress wave velocity. However, due to connection problems and signal transmission issues these systems failed to meet TDOT's requirements.

Another study was performed at TTU to determine the viability of using random vibration excitation to determine pile length. This study was able to determine that it was possible to predict pile length using random vibration excitation when testing piles end-to-end. It was determined that the pile length could be predicted to within an error range of 9%. However, this system was not applicable to "real world" situations. Thus, it did not meet the needs of TDOT.

A study was begun to determine the possibility of using random vibration excitation via diagonal connections to the side of the pile to predict length. Various methods were used to determine the natural frequency of the pile from the FRF's. It was determined, from the result of the study, that it was possible to predict timber pile length using certain frequency determination methods to an error range of 6.7%. Although this study did not meet the requirements of TDOT, it was determined that a system that would provide the original requirements could be pursued.