UNIVERSITI TEKNOLOGI MARA

TIME FREQUENCY DOMAIN ANALYSIS ON SHOTCRETE BONDING STATE

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ABSTRACT

The slope reinforcement issues in tropical soil become challenges to geotechnical engineers in designing the support system in order to prevent the major failures. Some of the major failures of shotcrete such as slope reinforcement are due to stress waves which caused by the vibration from heavy vehicles, rock deformation and shrinkage and also the blasting activity. All these causes may results to shotcrete debonded, thus reflect problems such as corrosion, buckling, fractured and internal voids creation overtime. The debonded shotcrete may cause severe instability problem. Therefore, in situ boring process is needed in order to investigate any young shotcrete that affected by the vibration. However the in situ boring process also may lead to the structural damages, hence will results in additional cost of repair. An effective evaluation and analysis method for these influential factors are required in determining reliable design, safe construction and effective operation in designing the soil support system. This study focuses on determining time-frequency analysis technique for quality control characteristic applied onto tropical soil in Malaysia. The IE and IE-SASW non-destructive test applied to the shotcrete to investigate the bonding state by using an advanced signal-processing technique known as STFT (IE-STFT) and WT (IE-WT). The effect of the bonding state on IE-STFT and IE-WT signal characteristics were obtained through the laboratory and field studies. For time-frequency analysis there are three main factors to be considered i.e. the effect on bonding state, thickness of the shotcrete and curing time. Comparative analysis in all factors are presented and interpreted in the shape of the time-frequency domain contour plot, value of the correlation coefficient, level of dominant frequency, geometric damping ratio and the resonance duration. Both methods were studied and compared in order to determine the suggested technique of non-destructive evaluation. In addition, both techniques also provide a different result based on time-frequency analysis. However, the field test gave more reliable results in supporting selection of technique and therefore it can be concluded as an appropriate technique that can be proposed for practical purposes.

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