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Evaluation of the Depth of Surface Deterioration for Concrete Structure Using Dispersion Characteristics of Surface Wave

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Surface waves generated by an impact are used to assess depth of deterioration for concrete plate. The proposed method uses one receiver positioned away from the impacting source. The spectrogram of the group velocity obtained from the signal recorded from the receiver is calculated by Short-Time Fourier Transform and the reassignment technique [1]. Experiments were conducted on the concrete plate with different thickness of mortar top layer to simulate concrete with serious aggregate segregation and bleeding. In the experiment, the source-receiver distance for concrete plate with different thickness of weak top layer are explored. Figure 1 shows the comparison between displacement waveform and slowness spectrogram for the case with 0.1 m-thick mortar layer and 1.5 m impactor-receiver distance. The waveform on the right shows the lower frequency waves arrive sooner than the high frequency ones. After STFT and reassignment method, the slowness spectrogram on the left shows the change in slowness occurs at the frequency about 10 kHz. In Figure 2, the velocity profile shows the change of wave speed is at the wave length of 0.12 m which is 1.2 times the mortar thickness. Similar results were found for specimen with different thickness. The results also show the lower velocity corresponding to the weak layer can be identified for impactor-receiver distance as short as 0.5 m.

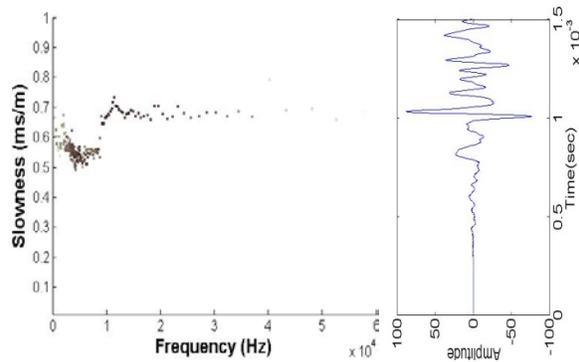


Figure 1. Displacement waveform and slowness spectrogram for the plate with 0.1 m-thick mortar layer and 1.5 m impactor-receiver distance.

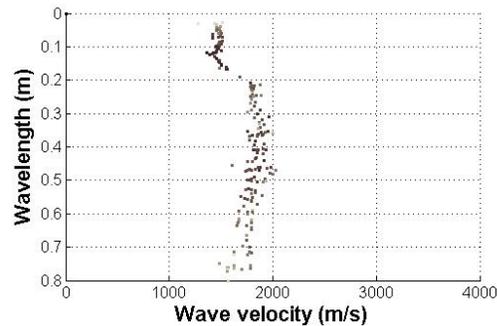


Figure 2. The velocity-wavelength profile for the plate with 0.1 m-thick mortar layer and 1.5m impactor-receiver distance.

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References:

1. S.A. Fulop, and K. Fitz, "Algorithms for computing the time-corrected instantaneous frequency (reassigned) spectrogram, with applications," *Journal of Acoustic Society of America*, Vol. **119**, No. 1, pp. 360-371 (2006).