

Rock Excavation Seismic Monitoring at Show Low, AZ

Construction vibration monitoring of a trencher and a hoe ram was conducted in Show Low, AZ at a utility line project site. The rock at this site was competent basalt. The purpose of the monitoring was to characterize vibrations generated by the equipment shown in Figure 1. The in-situ speed of sound of the rock was 1695 ft/sec.



Fig. 1 Rock trencher (top) and impactor (bottom)

Seismographs were placed in arrays perpendicular to and parallel with the equipment as show in Figures 2. Trencher motor speeds of operation were 22.5 rpm and 19 rpm. The hoe ram cycle time was set at 11 milliseconds.



Fig. 2 Perpendicular (left) and parallel (right) arrays of seismographs towards the trencher

A plot of peak ground velocity versus distance, found in Figure 3, shows the attenuation of the ground motion with distance. Figure 4 is a plot of the peak ground velocity versus frequency within the U.S. Bureau of Mines safe blasting criteria that applies to blasting. This upper safe line represents the 100-percentile line for the onset of threshold cracking in structures (for data that fall above this line) as represented by fine, hairline cracking in interior drywalls (considered the weakest material in residential structures). Although this safe vibration criteria was developed for blasting (a far higher energy source than construction equipment vibrations), it is assumed that

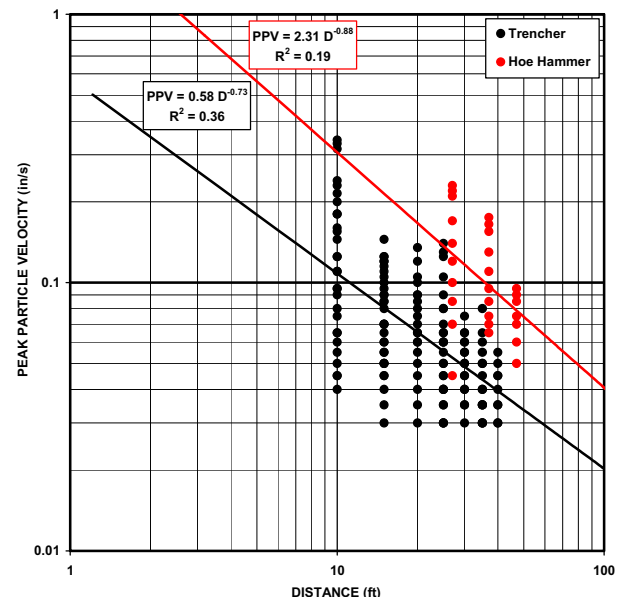


Fig. 3 Peak particle velocity versus distance

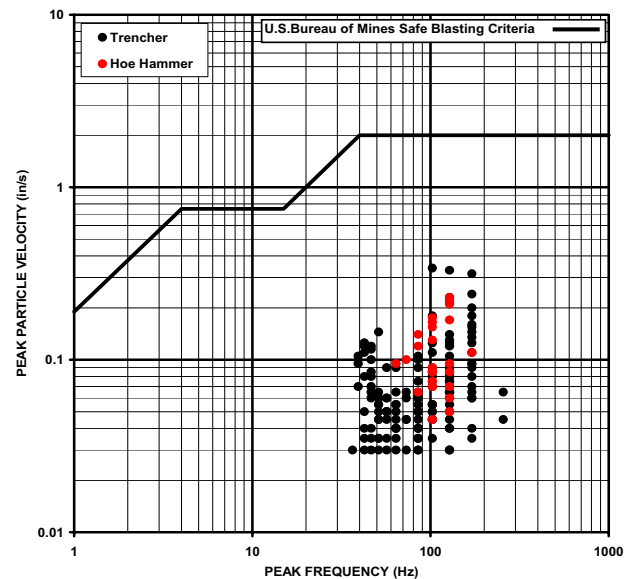


Fig. 4 PPV versus peak frequency

this criteria also applies to, and is protective of, structures subjected to construction vibrations.

In addition to vibration monitoring, A-weighted sound measurements were recorded for each excavator. For the trencher, measurements were taken close to the engine and the blade because noise levels were very different. An attenuation plot of the A-weighted sound measurements versus distances is presented in Figure 5. The continuous-noise of the trencher attenuates slower with distance than the impulsive hoe ram noise.

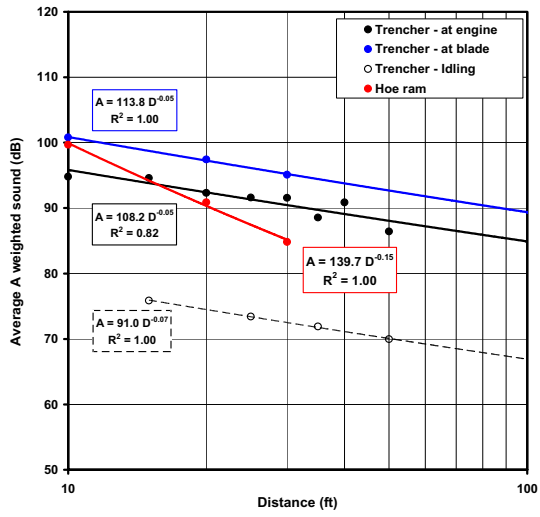


Fig. 5 PPV versus peak frequency