

BLAST VIBRATION MEASUREMENTS NEAR STRUCTURES

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ABSTRACT

Blasting near structures often involves vibration measurement to assess damage potential. Several methods of measurement are used worldwide; however, there is no consensus as to which methods are technically sufficient and yet practical for all situations.

The Bureau of Mines studied five placement locations for vibration transducers to determine the best method for monitoring blasting vibrations. The locations were--burial in soil next to the structure, attachment to the foundation at ground level, to the basement floor, or to a surface slab, and burial at a distance from the structure in undisturbed soil. Typical surface mine production blasts were used as vibration sources.

With the exception of the basement floor measurements and some of the distant measurements, waveforms were similar and amplitudes were generally within 10 to 30 pct of each other. The low-frequency part of the wave (5 to 10 Hz) was particularly uniform in measurements obtained at all five locations. Differences in peak values were mostly from minor shifts in phase of the high-frequency components, which are less significant to structural response and potential damage than the low-frequency waves. Shallow surface burial resulted in good signal detection and the least chance of mechanically induced error.

INTRODUCTION

The Bureau of Mines studied vibration measurement methods applicable to production blasting in surface mines (1). Blast vibrations are routinely monitored for one of two purposes: 1) to assess damage risk for nearby structures and 2) to derive predictive equations for vibration generation and propagation. Despite years of practice and several published studies on measurement, the industry has not adopted a uniform and consistent methodology. Occasionally, those monitoring blasts fail to obtain reproducible and accurate vibration records.

Three measurement methods are in common use: 1) direct attachment of the transducer to the foundation of the structure to be monitored, at or near ground level, 2) shallow burial of the transducer in the soil next to the foundation, and 3) measurement on a nearby concrete slab such as a driveway or walkway. The specific practices followed are often based on convenience. However, at sufficiently low vibration amplitudes, all three methods will give similar results. The many factors involved, such as transducer shape and size, soil or ground strength, and density, make for varied measurement requirements. Past Bureau studies did identify the need to anchor, attach, or bury vibration transducers for