

EFFECTS OF BLAST VIBRATION ON CONSTRUCTION MATERIAL CRACKING IN RESIDENTIAL STRUCTURES

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ABSTRACT

The Bureau of Mines studied the problems of blasting-vibration-induced structural response and cracking of low-rise residential structures in a series of research projects between 1976 and 1983. This paper summarizes the published Bureau findings and presents them from the point of view of the cracking and failure of the construction materials used for homes.

The damage data suggest that, for plaster and wallboard attached to the superstructure, an increase in the rate of cracking is not likely to result from blasts generating vibrations of less than 0.5 in/s. Data on cracks in masonry walls suggest that blast-induced vibration levels of up to 3.0 in/s may be a threshold for local block-length cracks. However, additional data are needed to quantify vibration level effects necessary to generate stair-stepped cracks in masonry walls, which indicate loss of shear load capacity.

INTRODUCTION

Ground vibrations from blasting have been a continual problem for the mining industry, the public living near the mining operations, and the regulatory agencies responsible for setting environmental standards. Since 1974, when the Bureau of Mines began to reanalyze the blast damage problem, several field and laboratory studies have been conducted; the results of the most recent were published in RI 8969, in 1985 (1). The studies examined blast vibrations with respect to generation, propagation, structural response, cracking potential, instrumentation, and fatigue (2-4). A similar series of studies was conducted for airblast (5-6).

This paper summarizes the material on cracking of construction materials used in low-rise residential structures; the data are excerpted from two comprehensive Bureau vibration studies, RI 8507 on dynamic response and damage and RI 8896 on fatigue and long-term influences (3-4). Specifically, the paper discusses the cracking of plaster, wallboard, and masonry from blasting and other influences, giving an overall perspective to the blast vibration impacts as part of the total lifetime dynamic load for such materials.

CRACKING AND BUILDING PRACTICES

Current residential construction practices address basic human safety and not specifically