

A LABORATORY INVESTIGATION OF UNDERGROUND EXCAVATION IN MONOLITHIC AND JOINTED ROCK BY EXPLOSIVE CHARGES

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Laboratory-scale experiments were performed to measure the mass of rock rubble dislodged into a cylindrical subterranean cavity by nearby detonations of explosive charges. The charges were cylindrical in shape with a length-to-diameter ratio of about 8. Porous Salem limestone was tested in two conditions, monolithic and artificially jointed. The mass of the rubble and the geometry of the excavation were measured for several parameters. The results were very repeatable. Parameters of variation included depth of the charge, orientation of the charge, diameter of the cavity, and joint density. The results show a slight dependence on charge depth, a significant dependence on charge orientation, and a very strong dependence on joint density.

Introduction

Excavation of underground cavities by drill and blast techniques is common in the mining and construction industries, and decades of experience have resulted in the ability to economically produce underground excavations. However, scientific studies of this process are hampered by the expense and safety of large-scale tests and the difficulty in measuring and controlling rock properties over large volumes. The test program presented in this paper aims to contribute to the understanding of explosive excavation through laboratory-scale experiments in which all the parameters, including rock properties, are carefully controlled.