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THE EFFECTS OF PARTICLE SIZE, DRAWPOINT WIDTH, AND DRAWPOINT SPACING UPON THE DRAW BEHAVIOR OF BROKEN ROCK IN CAVING

by

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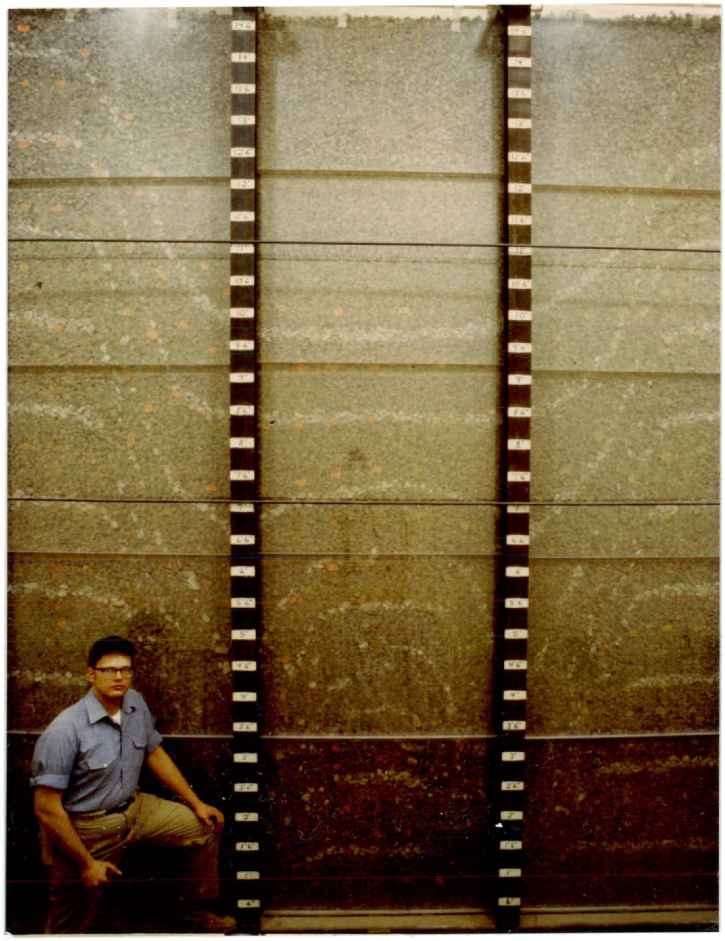

Frontispiece. View of caving model (4-ft drawpoint spacing test at draw 43) with author. White marks on beams are every 6 in.

"The public demands certainties. But there are no certainties."--H.L. Mencken

ABSTRACT

The shape and width of draw of broken rock was determined for draw tests involving nominal rock size groups of 0.5-in., 1.0-in., and 1.5-in., and a 1:1:1 mixture of these sizes in combination with 4-in., 8-in., and 12-in. drawpoint widths. From these tests, it was found that the draw envelope has a cylindrical midsection and an ellipsoidal top and bottom, rather than the traditionally accepted ellipsoidal form of constant eccentricity postulated by the draw ellipse flow model of Kvapil (1965a, b).

The shape and width of the draw envelope were relatively constant for the different rock sizes used. However, the drawpoint width appears to have a significant effect upon the draw envelope. For these model tests, the optimum drawpoint width (i.e., the one which produces the widest draw) is between 8.5 and 10 in. The 1:1:1 mixture of rock sizes acted almost identically to the 0.5-in. rock, suggesting control of the draw process in the mixture by its smallest component size.

During most of the draw process, the envelope grows faster vertically than it does laterally, and it reaches its maximum width over a portion of its length prior to break-

through. Large draw heights, such as those possible with the caving model, produce the cylindrical zone described.

The draw envelope is highly sensitive to horizontal pressure. The application of pressure to the rock mass causes lateral diversion (one-sided application) or narrowing (two-sided, equal application) of the draw envelope.

The angle of draw at the bottom of the draw envelope reaches a stable value during draw and decreases only after the draw height begins to decrease. The stable angle of draw was always less than 70° in these tests. The stable angle of draw on the passive zone between drawpoints increases with decreasing drawpoint spacing.

Hang-ups were stable and frequent to continuous at drawpoint width/rock size ratios of about 5:1 or less. The 1:1:1 mixture showed some control by its larger component sizes by forming hang-ups during the 4-in. drawpoint test, unlike the 0.5-in. rock which did not experience any hang-ups.

The maximum spacing (limit of interaction) at which the draw envelopes will still interact appears to be about 4 ft (for the 1.0-in. rock and 12-in. drawpoint combination). At spacings less than this, the draw envelopes do not overlap but merely meet along a vertical boundary and grow upwards. The height of the passive zone is about 64% of the edge-to-edge drawpoint spacing when the spacing is less than the limit of interaction.

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