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MODELING OF A MODIFIED ROCHA SLOT TEST IN WELDED TUFF*

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ABSTRACT

The design of nuclear waste repositories in hard rock underground requires an understanding of how the jointed rock mass responds to the various loads introduced. The Nevada Nuclear Waste Storage Investigations (NNWSI) is conducting a series of field tests in G-Tunnel on the Nevada Test Site to characterize the behavior of welded tuff. In particular, one of the ways its modulus of deformation is being measured in situ is by means of a slot loaded by a pressurized flatjack. This is called the Modified Rocha Slot Test, after Manuel Rocha who pioneered investigations using this type of test.

In its development, the Rocha Slot Test was designed for a volume of material in which joint orientation was not considered. The present application to welded tuff, a rock with strongly directional joint sets, has required a reexamination of the design parameters to consider anisotropic effects. Of particular interest is the effects of various joint orientations with respect to the slot, the magnitude of expected deformations, and the extent and nature of the applied stress distribution within the rock mass.

Numerical calculations were undertaken using the stress-wave dynamic finite difference code STEALTH. Using dynamic relaxation, the code is able to follow the quasi-static loading curve quite closely, so that the path-dependent aspects of the solution are captured economically. The material model (CAVS) represents an elastic-plastic rock matrix with evenly-spaced joints in three mutually perpendicular planes. The joints have nonlinear normal compliance, shear cohesion, and shear strength that depend on the slip history. Slip-induced dilation of the joints is also taken into consideration.

Results of the calculations are presented which illustrate the stresses, deformations, and joint slippages resulting from the application of pressure loading in the slot. The stress field is remarkably sensitive to joint orientation and cohesion, but rather insensitive to the normal compliance. The effect of a confining in situ stress field is also examined.

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