FEATURES OF DEFORMATION AND DESTRUCTION OF THE WASTE SPACE ROOF DEPENDING ON ITS EXTENSION

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As the mined-out space develops, the stress-strain state of the enclosing rock mass undergoes significant changes, due to both the geometric dimensions and position of the workings, and the deformation-strength properties of the rocks that make up the massif. An analytical description of the formation and development of a stress-strain state is known, for the case when the roof of the mined seam is represented by strong, elastic rocks and maintains integrity at all stages of the goaf development.

However, this situation does not always occur, and often an avalanche collapse of the roof occurs when certain strength criteria for the roof rock are met. When collapsed in a thin layer, the loosened rock completely fills the void and, starting from a certain moment, inflates the roof, preventing the development of its further collapse.

The deformation and strength behavior of the geomaterial is evaluated by a criterion similar to the Drucker-Prager criterion, according to which, when the elastic limit is reached, a transition to plastic flow occurs. In this case, the elastic behavior of the geomaterial follows Hooke's law, which specifies a linear relationship between the deviator of the stress tensor rates and the strain rate tensor. The elastic state of the medium in the space of stresses is limited by the surface of the limiting state, upon reaching which the process of inelastic, plastic deformation, or destruction begins.

In fact, the parameters of this surface are determined as a result of laboratory or full-scale experiments.

For this purpose, a surface close to the Drucker-Prager cone was used for the calculations for the material representing the roof rocks (sandstone). In this case, the plastic deformation upon reaching the elastic limit is determined using the plastic potential.

The formulation of the problem ultimately boiled down to a gradual increase in the length of the mined-out space while maintaining the values characterizing the strength properties of the roof and, accordingly, its possible destruction. In calculations, it was assumed that the thickness of the removed layer is 2 m, and the length of the worked-out space varied from 40 m to 80 m. Calculations for various strength parameters of the roof rocks made it possible to reveal the trigger nature of roof collapse during various advances of the face.

Note that in the study, the main result is the identification of the fact that there is an abrupt change in the state of the entire massif with the formation of significant areas of destroyed material in the top of the formation. Obviously, the dimensions of the destroyed area depend, in addition to the strength properties of the material, also on the dimensions of the goaf. Those. in this mining situation, an unstable nature of deformation is realized, when the displacements in the rock mass remain small as the length of the mined-out space increases, i.e. within the limits of elastic deformation, and when the limiting length is reached, the stability of the roof is lost.