The use of pillar systems, especially at great depths, complicates the problem of driving and maintaining ventilation drifts. This is because when a ventilation drift is cut below the upper conveyer face, it comes into the abutment pressure zone. Because this zone is large, this involves leaving large coal pillars.

This means cutting ventilation drifts crosswise into the worked-out area. In the pits of the Donetskugol' group alone, on January 1, 1971 about 30 crosswise drifts were counted. With this method of cutting drifts, one of the main parameters is the size of the pillar left between the conveyer road of the upper face and the ventilation drift of the lower.

Present theory involves only the question of changes in rock pressure in a flat-lying coal seam in the neighborhood of an extraction working [1]. In view of the influence of a large number of factors (drivage of workings, time to start of working pillar, and leading abutment pressure), the theoretical problem of rock pressure phenomena in the zone of the ventilation drifts is difficult. On the basis of the method proposed by Gmoshinskii [1], in this article we attack this question with the aid of empirical relations obtained by processing field observations of rock pressure phenomena.

It is known that before mine workings are driven, the coal seam is under pressure from the superincumbent rock. In the abutment pressure zone created by an extraction working, the stress in the seam is \( P = \gamma H k \), where \( \gamma \) is the mean density of the superincumbent rock, \( H \) is the depth of the working, and \( k \) is a coefficient representing the effects of abutment pressure.

Figure 1 shows the stress distribution in a coal seam at the boundary of the extraction working in conditions where the coal behaves like a strong elastic body (curve 1). Owing to breakage of the coal, the maximum concentration of abutment pressure lies some distance from the boundary of the extraction working into the solid rock [1, 2]. The resulting rock pressure distribution in relation to the line of exposure takes the form of curve 2 with a characteristic maximum in the abutment pressure zone. The zone of fracture of the coal is favorable for the disposition of ventilation drifts. When the drift is driven, the zone of fracture of the coal increases, and the abutment pressure

![Fig. 1. State of stress of seam in zone of ventilation drifts.](image)
maximum moves from the worked-out area towards the solid rock. The zone of broken coal increases even further under the influence of the leading abutment pressure of the worked face.

In approximate calculations we can assume that the variation of the pressure is exponential on both sides of the maximum. The size of the zone of fracture of the coal can be defined by the point of intersection of the stress distribution curves both in the solid rock (Fig. 1, curve 3) and in the zone of fracture of the coal (curve 4).

With increasing distance from the point of maximum abutment pressure towards the solid rock, the seam increasingly approaches a condition of hydrostatic compression. In general form, the equation of curve 1 can be written as

\[ \sigma_1 = \gamma H (1 + k_0 e^{-ax}) \]

where \( \sigma_1 \) is the stress on the solid-rock side in tons per square meter, \( \gamma \) is the mean density of the superincumbent rock in tons per cubic meter, \( H \) is the depth of the working in meters, \( e \) is the base of natural logarithms, \( a \) is a coefficient determined by means of field observations, \( x \) is the distance from the boundary of the extraction operations towards the solid rock, and \( k_0 = k - 1 \), where \( k \) is the abutment pressure concentration coefficient.

The abutment pressure concentration coefficient \( k \) can be determined on the basis of the general laws of rock movement at the boundary of extraction operations [2, 3]:

\[ k = \frac{P_M}{\gamma H} \]

where \( P_M = \gamma H (1 + \frac{Q}{l_0} \gamma H) \) tons/m², \( Q = H^2/(2 \tan \Phi) \) tons/m, \( l_0 \) is the length of the abutment pressure zone in meters, and \( \Phi \) is the angle of total displacement of the rock strata at the boundary of the extraction operations, in degrees.

The empirical coefficient \( a \) represents the law of manifestation of rock pressure in relation to distance from the extraction operations. By statistical processing of the results of instrumental observations in ventilation drifts, a fairly close relation has been found between the rock displacements and the distance to the face. Since the ab-