ABSTRACT

In Polish coal mining, the dominant extraction system is the longwall system. In this system, gateroads adjacent to the coal face in a given section for successive panels are typically developed, leaving what are known as coal pillars, often several meters wide. Designing these coal pillars is crucial to ensure both safe operating conditions, due to the possibility of gateroad deformations, and fire hazards. It is worth emphasizing that in Polish coal mining, there is a lack of commonly used methods to determine the width of coal pillars during the design phase of panels based on geological and mining conditions. A properly designed coal pillar allows for isolating the gateroad, thereby limiting the migration of methane from collapsed workings of the previous face into the ventilation air and reducing the fire hazard in the gob. The geometric parameters of the pillar also significantly affect the deformation of the adjacent gateroad. It should also be noted that leaving a coal pillar creates the possibility of endogenous (fissure) fire occurrence.

The above observations, insights, and practical experiences have led to formulating the scientific aim of this dissertation, which is to determine the influence of selected geological-mining factors and geometric parameters of coal pillars on the deformation of gateroads adjacent to the exploitation face. The utilitarian goal of the work, on the other hand, is to develop a method for assessing the combined risk of loss of functionality of gateroads, considering their deformation and the threat of endogenous (fissure) fires.

Achieving these goals of the doctoral dissertation required conducting field research in ten gateroads under varied geological and mining conditions, which included determining the deformation of gateroads ahead of the longwall face and endoscopic examinations of coal pillars to assess their fracturing.

The obtained research results allowed for the development of prognostic tools in the form of an empirical formula for predicting the intensity of coal pillar fracturing, expressed by linear fracturing density, and a method utilizing numerical modeling algorithms to forecast the deformation of gateroads neighboring coal pillars. This method involves modifying the Geological Strength Index (GSI) of the coal seam

constituting the pillar based on its fracturing, calculating the height of the goaf zone, parameters of gobs, and selecting the calculation procedure.

The summary of the work was the development of a method for assessing combined risk, considering gateroad deformation, coal pillar fracturing, and coal's propensity for spontaneous combustion.

The methods presented in the work for determining the extent of coal pillar fracturing zones ahead of the longwall face have utilitarian significance as they can be applied in the exploitation design process, especially in the design of development work, selection of roadway support, and fire prevention planning.