Impact of longwall mining of coal on highways in southwestern Pennsylvania

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Abstract Underground longwall mining is a widely used coal extraction method in southwestern Pennsylvania, USA. The extracted coal takes the form of rectangular panels whose length and width can reach up to 4000 m and 450 m, respectively, with a thickness of roughly 2.0 m; mine depths range from 180 m to 280 m. A number of longwall panels have been mined underneath interstate highway I-79 in Greene County, Pennsylvania, inducing subsidence that raises concern for traffic safety. The Pennsylvania Department of Transportation monitored the impact of mining on the highway and collected the data that formed the basis for this study. Field data obtained from eight longwall panels included time series of surveying measurements collected as each mine advanced underneath the highway. With the aid of a genetic algorithm, a three dimensional subsidence model was developed that described the data well. The model gives the spatial distribution of surface subsidence in terms of the depth of the coal, the width of panels, the thickness of extraction, and the location relative to the face of an advancing panel. Surface deformation features were analytically derived from the model.

Key words underground coal mining; longwall mining; mine subsidence; genetic algorithm; highway embankment