Abstract

The dissertation deals with the problem of designing and evaluating solutions for underground transport of materials in coal mines taking into account the guarantee of the coal mining process continuity while keeping the operation cost of the transport system as low as possible.

The study analyzes technical solutions of modern mine transport systems and the operation of transport systems in the mines of a mining company in the Upper Silesian Coal Basin. The material transport system connection with the coal mining process in difficult mining and geological conditions was also analyzed.

The dissertation presents a detailed method of designing the underground transport subsystem for newly designed mining areas. This includes, among other things: transported amount of cargo determination, transport routes delineation, type and amount of transport means selection. As a result of such design, several or more variants of the transport subsystem are obtained.

In the next stage, based on mathematical multicriterial decision support methods, the optimal variant of multi-faceted selection of the transportation subsystem is made according to the established multiple criteria. Among others, used the weighting method, which determines the level of significance of a given criterion in the designer's evaluation. One of the utility criteria is operation of the transport subsystem evaluation in the so-called over-planned states, i.e. in the case of emergency random events that threaten the production continuity, it is an increase in the number of receiving points or the failure of the machines.

In the final stage of the evaluation, utility-maximizing and cost-minimizing objective functions were applied. With their help, the variants are presented in a two-dimensional criterion space, and the selection of the optimal solution is made, among other things, by using reference points and also a distance function. This is supplemented by the variants reference to the total costs in the period of transport subsystem assumed operation. In addition to the theoretical description, the work includes a detailed example of the developed method practical application, where the optimal variant was selected from among ten transportation subsystem possible variants.

The presented method is fully functional, it can be applied to modern rail underground transport systems and it is also possible to implement it partially or comprehensively in the form of IT tools. The dissertation indicates the systemic dependence of the mining process on transportation systems and also the quality factors defining these system dependencies.