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Seismic and Geomechanical Monitoring of Transport Infrastructure on Undermined Territories

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Abstract

Development of deposits of water-soluble minerals is connected with the risk of the accidents caused by the destruction of the waterproof stratum, and, as a consequence, water breakthrough into the mines. Thereupon, besides the problem of the mine's loss the problem of stability of the massif uppermost part appears. This part includes the foundations of buildings and serves as the base for railways and highways, bridges, dams, pipelines and etc.

At the present stage of remote geophysical techniques of monitoring and prediction of such negative natural and technic origin, processes methods of high-resolution seismic survey on reflected waves have been developed most of all. In addition to prompt acquisition of physical and geological models of the section, the results of seismic observation's interpretation are proposed to be used as a part of parametric support for geomechanical calculations, which makes possible to predict rock mass stability in the range of transport facilities located above the mines.

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1. Introduction

In the European largest Verkhnekamsky deposit of potassium and magnesium salts (VKDPS) industrial and transport facilities are coincided with the worked mine fields in terms of location. Field development is connected

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with the risk of emergency situations (Fig.1) caused by the failure of waterproof stratum and further fresh and brackish water breakthrough into the mine working. Thereupon, besides the problem of the mine loss the problem of stability of the massif uppermost part appears. This part includes the foundations of buildings and serves as the base for railways and highways, bridges, dams, pipelines and etc.

At the present stage of remote geophysical techniques of monitoring and prediction of such negative natural and technogenic processes methods of high-resolution seismic survey on reflected waves have been developed most of all [2, 4, 9, 10, 11, 12, 13]. In addition to prompt acquisition of physical and geological models of the section, the results of seismic observation's interpretation are proposed to be used as a part of parametric support for geomechanical calculation of underground mining parameters and makes possible to correct predictions of massif stability in the area of transport facilities location.



Fig. 1. Emergency failure of transport facilities in the area of undermined territory.

2. Modern Shallow Seismic Techniques

At present the main bulk of seismic works in potential accident zones of mine fields is carried out by the areal networks of 2D seismic profiles, and occasionally by spatial 3D seismic survey [1, 3, 4]. Calculations of seismic

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