Numerical calculations for the pre-dimensioning of the support lining in a ventilation shaft

CIVIL • ENVIRONMENTAL • MANUFACTURING • **MINING** • OIL & GAS • POWER GENERATION

PROJECT DESCRIPTION

Confidential Client

Germany

FLAC3D™ 7.0

A ventilation shaft in Germany is part of a former colliery and was put into operation in the late 19th century with a depth of approx. 600 m. Since the colliery was closed down, it has been part of the central water drainage system at the site, together with further shafts in the near distance. In the course of technical reconstruction measures, the shaft is to be converted from a ventilation shaft to a well shaft. For this purpose, the current diameter has to be expanded to a clearance of 3.3 m. The shaft, which was previously constructed with approx. 50 cm thick brick masonry, will be secured with a concrete shell after expansion. To evaluate the pre-dimensioning of the shell, a numerical modeling of the secondary stress field is necessary.

ITASCA'S ROLE

The 3D simulation of the secondary stress field is performed with *FLAC3D* Version 7.0. The rock behaviour is represented by a linear-elastic ideal-plastic material model with fracture condition according to Mohr-Coulomb and non-associated flow rule. The existing shaft masonry is represented by the Ubiquitious-Joints material model implemented in *FLAC3D*. The concrete lining of the widened shaft is simulated by shell elements with specific tensile and bending stiffness. The design relevant internal forces can be read out directly from the isotropic, linear elastic shell elements.

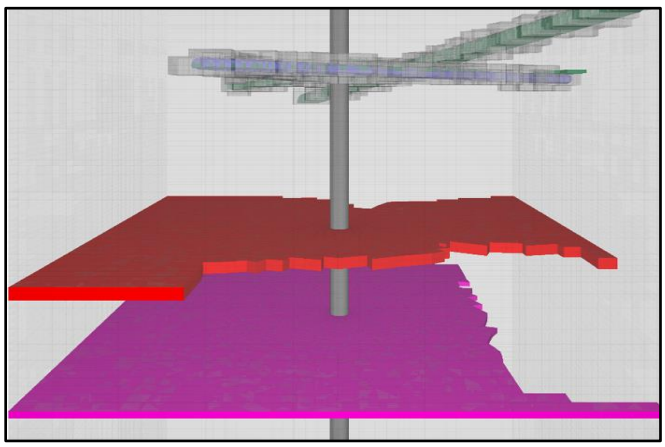

Figure 1. Mining situation in the area of two coal seams and two drifts. The red- and purple-colored zones correspond to goafs.

PROJECT RESULTS

The numerical simulation of the secondary stress field around the ventilation shaft indicates that the mining activities in the area close to the shaft have led to a stress concentration in the rock mass. The ventilation shaft at a depth of approx. 350 m runs exactly through this area. In addition, high compressive and tensile stresses can build up in the comparatively stiff geologies.

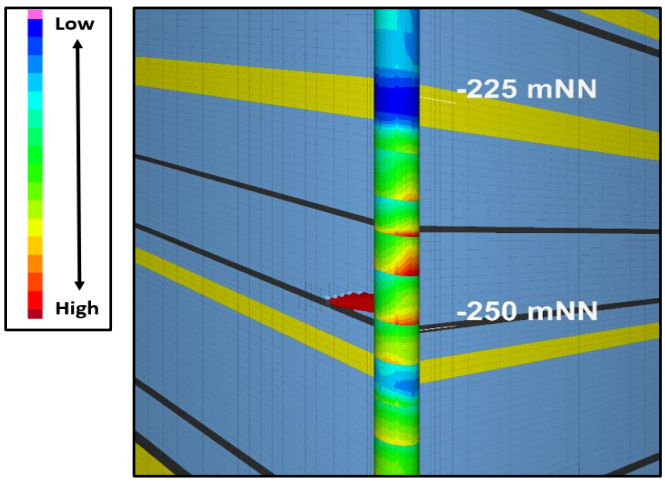

Figure 2. Normal force in the area of the ventilation shaft.

Itasca Consultants GmbH
Leithestraße 111a
D-45886 Gelsenkirchen I +49 (209) 1475630 I info@itasca.de

www.itascainternational.com
www.itasca.de