Simulation of a tunnel excavation at shallow depth (Ohio River Bridge)

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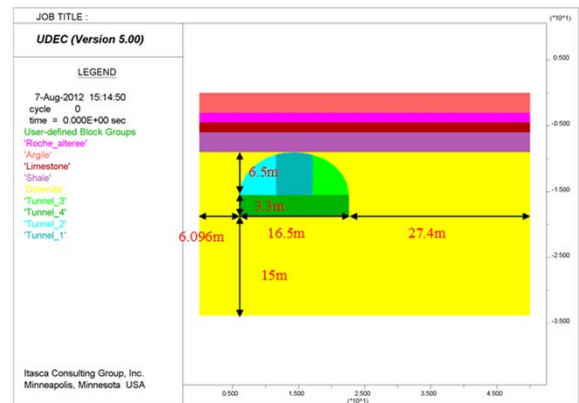
PROJECT DESCRIPTION

VINCI

Indiana, USA

The behavior, during excavation, of a shallow tunnel cutting densely fractured limestones and dolomites raised concerns.

The tunnel is called "Drumanar tunnel' and located in Louisville, in Southern Indiana.

The model geometry is shown on Figure 1.

Figure 1: Model geometry

ITASCA'S ROLE

- Analysis of in-situ geometry data, including block size distribution and fracture orientation. Building of an equivalent 2D DFN (Discrete Fracture Network) model.

- Numerical modeling using *UDEC*, accounting for the blocky nature of the medium using the 2D DFN (Figure 2) and simulating the excavation sequence, with structural support installation.

- Parametric analysis, accounting for variability, along the tunnel path, of the various rock layer thicknesses and the rock quality (good, moderate and poor).

PROJECT RESULTS

- Rock displacement is mainly dominated by rock quality: the case with poor joint properties shows noticeable rock displacement.

- Surface settlements remain in the same order as those measured at the crown, as expected for a shallow excavation (Figure 3).

- The maximum loads on the liner take place mostly in segments located near the intersection between the vertical wall and the raft. Additional reinforcement must be considered in these places.
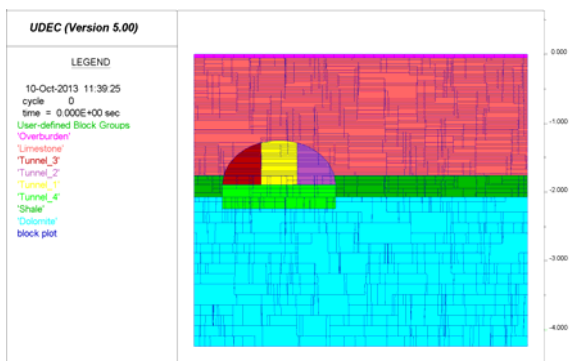
Figure 2: Geometry of the model, including the tunnel with excavation phases and surrounding rock layers cut by DFN.

Figure 3: Rock displacements at the end of the excavation (in meters).