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Numerical Study on Tunnel Collapse Modes by Using the 3-D Shear Band Finite Element Analysis

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Summary

The purpose of this study is aimed to estimate the patterns and scales of the potential tunnel collapses corresponding to the ground and tunnel geometrical conditions given. This study investigates the aspects by a number of parametric studies in which the 3-dimensional shear-band finite element analysis developed by KICT is involved.

In this paper, a mathematical formulation for the shear band analysis is presented, which is implemented into the in-house 3-D finite element code, SELINA3D. The SELINA3D is, then, plugged into a commercial FE program, MISAS-GTS by using its user-defined material model. Then, systematic verification of the implementation made in this study is carried out. A number of typical ground and tunnel conditions are set up. A strength reduction method, which is to reduce the shear strength of ground for appearing any shear-band type tunnel collapse, will be incorporated to identify the potential tunnel collapse corresponding to the conditions given. In fact, general FE codes couldn't be used for capturing the shear-band type failure consistently regardless to FE mesh generated.

Finally, an assessment chart or a tool for making a better understanding of possible tunnel collapse mechanism prior to going for tunnel construction is given through the parametric studies. It is expected that it will be valuable to minimize the possibility of tunnel collapse by verifying tunnel design once more based on the concept of tunnel collapse and considering proper supporting system *a-priori*.

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