Development of a 3D GIS Based Tunnel Design Support System for Rock Mass Classification and Fault Zone Analysis in Tunneling

**Hyeong-Dong Park, Department of Energy Systems Engineering, Seoul National University, Korea**

In this study, a 3D GIS based tunnel design support system, named Tunneling Analyst (TA) extension, has been developed in ArcScene 3D GIS software, part of the ArcGIS software package. TA is efficient in bringing the following advantages: (1) boreholes and geophysical exploration data can be used complementarily to estimate a 3D distribution of RMR values in the subsurface by multiple indicator kriging. This can decrease the uncertainty of estimated RMR values, especially at the undrilled tunnel sections that occupy the major portion of proposed tunnel alignments in a tunnel design project. (2) True 3D intersection and buffer functions can be used to analyze the fault zone, which is a critical part in tunneling. They can improve the reliability of interpretation about complex spatial relationships between a tunnel alignment and discontinuity in the subsurface. Because they have been implemented in TA based on simple mathematical equations, a complex 3D topological data structure is not required in GIS for their utilization. (3) TA allows users to complete entire procedures (i.e., data preprocessing, volumetric modeling, geometric modeling, 3D spatial query, visualization, etc.) in a single framework; therefore tedious tasks for data conversion among various software can be significantly reduced or are not required. The case studies at the Daecheong and the Soyanggang tunneling sites in Korea show that TA could present a rational solution to evaluating the rock mass classes along a proposed tunnel alignment and can also provide specific 3D spatial query tools to support the tunnel design work. This presentation describes the concept and details of the development and implementation of TA and the case studies from two tunneling sites.