

## **2. Development of CIM and ICT Technologies for Tunnel Construction - A New CIM Software for Mountain Tunneling and Shield Tunneling with Satellite Data -**

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This report deals with examples of construction information modeling (CIM) and information and communication technology (ICT) applications in mountain tunneling and shield tunneling. The introduction of CIM for mountain tunneling was a tough challenge because complicated three-dimensional computer aided design processes including constructing the basic 3D ground model and registering measurement data concerning tunnel excavation and ground conditions were time-consuming. To solve this problem, mountain tunneling CIM software designed for easy data preparation and comfortable operation was developed and used to carry out on-site CIM tasks efficiently. In shield tunneling, it is important to stay informed of the ground surface conditions including the overlying roads and surrounding areas as the shield tunneling machine advances and minimize ground surface displacement to ensure safe tunnel excavation. It is often difficult, however, to conduct land surveys using conventional surveying instruments because of problems associated with road traffic conditions and privately owned land in surrounding areas, and such measurement is an onerous task. In this study, therefore, ground surface displacement was measured by using synthetic aperture radar (SAR) satellite data to verify that surface displacement can be measured with accuracy comparable to that attainable by conventional level surveying.

**Key words:** construction information modeling (CIM), information and communication technology (ICT), semi-three-dimensional ground model, visualization, synthetic aperture radar (SAR) satellite