

#### **4. Predicting Geological Conditions Ahead of a Tunnel Face Highly Accurately Using Blasting Vibration Data**

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In reflection seismic surveys such as the TSP and HSP methods for predicting geological conditions ahead of a tunnel face, measurements are made near the tunnel face and tunnel construction needs to be suspended. In the case where there was a wide fault fracture zone ahead of the tunnel face, the actual position of the reflection plane would be greatly different from the predicted reflection plane. In order to solve above problems, the authors developed a method for making three-dimensional prediction of the geological conditions ahead of a tunnel face that has little impact on construction and can improve the accuracy of prediction of the position of reflection plane using the seismic velocities of the ground that are obtained in refraction seismic survey or in tomographic analysis. Applying the developed method for predicting the geological conditions ahead of a tunnel face to a portal with known geological structure could enable highly accurate assessment of the position of reflection plane in the ground of complicated geological structure where prediction is difficult using a conventional method, or in the case where the tunnel crosses the reflection plane at a sharp angle.

**Key words:** seismic reflection, prediction of geological conditions ahead of the tunnel face, blasting vibrations, finite difference method