

RTRI Develops New Risk Evaluation System for Falling Rocks with Laser Beam and Drone

RTRI developed a new risk evaluation system for falling rocks in order to prevent the damage by falling rocks from trackside slopes. This system is capable of detecting unstable rocks safely and efficiently by using laser vibration measurement technology and drone survey technologies.

It is necessary to detect in advance unstable rocks on slopes along railway tracks and take measures in order to prevent falling rock accidents. However, as such unstable rocks are likely to be located on the slopes which are difficult to access, only visual surveys have been conducted from remote places so far. In order to conduct the surveys more safely and efficiently, RTRI has developed a system to enable quantitative evaluation of the shapes and stability of rocks at remote locations or at higher elevations with safe and efficient methods. This system consists of three subsystems:

- (a) Non-contact vibration measurement system
- (b) Aerial survey system
- (c) Risk evaluation system with numerical analysis

With the (a) non-contact vibration measurement system, imperceptible rock vibrations dozens or hundreds of meters away can be measured by irradiating the targeted rock slope with a laser.

In the (b) aerial survey system, a drone equipped with a stereo camera takes aerial photos of the rock and can obtain important information such as cracks around the rock, and with the data, we can measure its three dimensional form and estimate its weight. In the (c) risk evaluation system with numerical analysis, a numerical analysis model has been built to estimate the vibration properties of the rock from the 3D-form data obtained in the above mentioned aerial survey system (b). By comparing the results of the numerical analysis and the measurement data of actual rock vibrations obtained by the system (a), the progress of cracks behind the rock is estimated and the rock falling risks under both normal and disaster conditions are evaluated.

Part of this development project was implemented with the MLIT* subsidy for railway technical development. * Ministry of Land, Infrastructure, Transport and Tourism.

