Accuracy of topographical feature measurement from a radio-controlled helicopter

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Introduction

When a slope failure disaster occurs, it is important to identify the falling rate and the topographical features of the falling section immediately to enable prompt recovery measures.

In this study, the accuracy of measurements taken from a radio-controlled helicopter (a technique that enables observation from a relatively unlimited range of positions when an overall picture of a falling section cannot be captured from the ground) was verified through comparison with the results of measurements taken from the ground.

Fig.1. Radio-controlled helicopter

Measurement methods

Laser scanning

This measurement method assesses the shape of the object as point group data with three-dimensional coordinates by repeating laser measurement at high speed.

3D photogrammetric technique

This is a measurement method that assesses the three-dimensional shape of the target object using the disparity between multiple photos of the object taken from different positions.

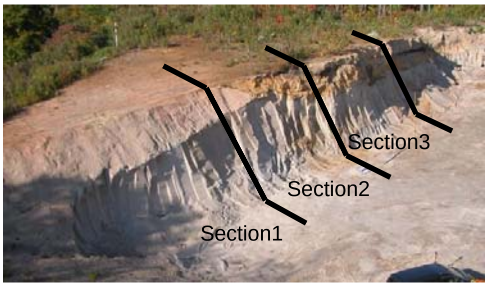

Fig. 2. Target slope for measurement

Comparison of measurement results

The target of measurement here was the slope shown in Fig. 2. Figure 3,4 show each measurement results.

While there were some sections without data in ground-based measurement (Fig. 3) due to their location in blind spots from the measurement point, hardly any such sections appeared in measurement from a radio-controlled helicopter (Fig. 4).

Figure 5 shows topographic data for the three cross sections in Fig. 2 obtained using different measurement methods. While the level of error in laser scanning from a radio-controlled helicopter was around 20 cm in some sections compared with ground-based measurement, the corresponding value was a maximum of around 10 cm in other sections. The three-dimensional photogrammetric method was sufficiently accurate to ascertain overall topographic features, although its level of error was up to around 50 cm.

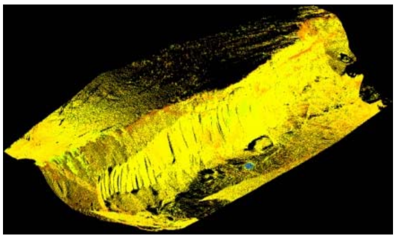

Fig. 3. Ground-based measurement results (This results is a combination of measurement outcomes from four positions.)

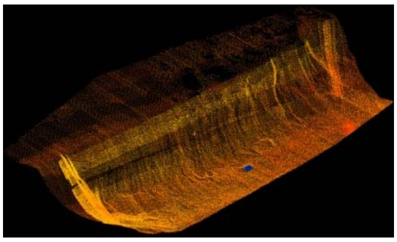

Fig. 4. Results of laser scanning from a RC Helicopter

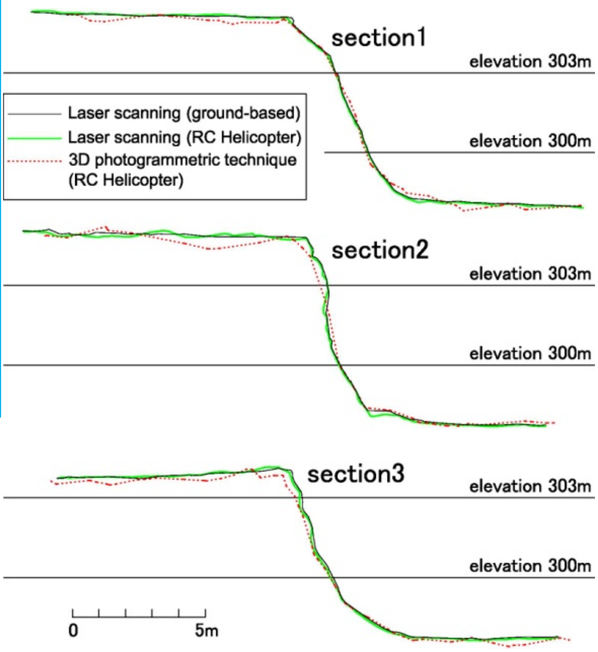

Fig. 5. Comparison of cross-sectional land shapes

Conclusion

The results indicated that a radio-controlled helicopter has the advantage of providing a choice of observation points with a minimal number of blind spots since it can move through a relatively unlimited range of positions, although laser scanning from the helicopter was not as accurate as ground-based measurement due to the accumulation of accuracy errors by GPS, IMU and other systems.