Analysis of the Sites of Slope Collapse by Earthquake

(Study period: FY2018-)

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1. Introduction

The influence of ground structure is considered at the site of a slope collapse caused by an earthquake. However, the impact of ground structure on the occurrence of slope collapse in the event of an earthquake cannot be verified since wide-area three-dimensional information on the ground structure in mountainous areas has not been sufficiently obtained. Accordingly, if a risk assessment technique that reflects the impact of ground structure in more detail were developed, the accuracy of risk assessment would be expected to increase. Therefore, we analyzed the characteristics of ground structure in slope collapse caused by earthquake by overlapping the specific resistance obtained by aerial electromagnetic survey, including the depth direction of the ground across a wide area encompassing the slope collapse caused by the 2016 Kumamoto Earthquake (Fig. 1).

2. Research contents

First, we calculated the specific resistance variation in a section 20 m deep ("depth section") by deducting, from the specific resistance at a certain depth, the specific resistance at a point 20 m deep from there for each 10 m mesh. Next, meshes were set with a center of gravity within in the collapsed site as a collapse grid. Then, we calculated the ratio of collapsed meshes according to each class of specific resistance variation (Fig. 2). As a result, the ratio of collapsed meshes was found to increase as the class of specific resistance variation became larger in the positive direction. Particularly, in relatively shallow sections, such as in the depth section of 10-30 m, the ratio of collapsed meshes sharply increased at the class where the specific resistance variation shifted from a negative value to a positive value.

In the meshes representing a positive value of specific resistance variation, specific resistance was high at shallow depths and low at deep depths, which is considered to show that the site has a ground structure similar to the cap rock structure, in which the upper layer of soft rock is covered with hard rock. In past earthquake events, many cases of collapse in a slope with the cap rock structure were reported. It is considered from the above that ground structure similar to cap rock structure exists in the site where the specific resistance variation shifts to a positive value and that a relatively larger number of slope collapses might have occurred in the earthquake event.

3. Conclusion

We intend to continue the analysis of slope collapse caused by earthquake and develop a method for predicting the occurrence of slope collapses including large scale slope collapse in the event of an imaginable earthquake.

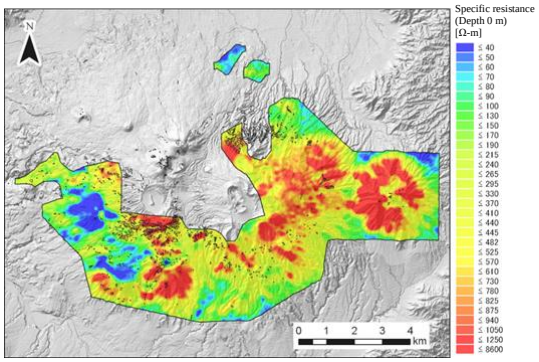

Fig. 1 Specific resistance and distribution of slope collapses caused by the 2016 Kumamoto Earthquake

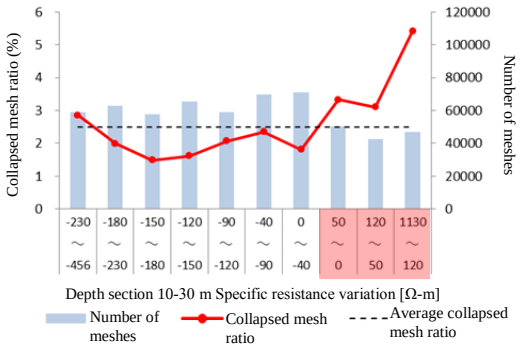

Fig. 2 Ratio of collapsed meshes by class of specific resistance variation

☞See the following for details.

1) Civil Engineering Journal, Vol.61, No.12, 2019, pp. 12-15