Geophysical Survey in Engineering Geology and Integrated Geophysical Survey

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In The Integrated Geophysical Survey proposed by Inazaki and Levee Consortium, the process of safety assessment of levees based on geophysical surveys from the planning to the evaluations have been organized. It also have presented the semi-qualitative interpretations by means of the combination of S-wave velocity and resistivity. The idea of integrated geophysical survey is expected to improve the applications of geophysical surveys in engineering geology.
Various geophysical surveys have been applied to many engineering geology projects. However, reliability of geophysical surveys is questionable in some cases, and this situation have brought the feelings of mistrust to many geologic engineers although geophysical surveys have been expected as a powerful method. The Society of Exploration Geophysicist of Japan has worked toward standardization of the method of geophysical surveys to improve the reliability of surveys. However, it could be considered that viewpoint of using survey results to geotechnical interpretation was weak. From this background, The Integrated Geophysical Survey Committee has been organized.
The Integrated Geophysical Survey Committee has established 3 working groups, and the following activities have been carried out. In the working group 1, the documentary searches and case studies have been made to investigate applications and development of the integrated geophysical survey. According to the documentary searches, the combination of S-wave velocity and resistivity is utilized for evaluation of ground condition in the field of levees survey, and integrated geophysical survey are conducted. However, in the field of tunnel survey, ground conditions are evaluated by seismic refraction survey in many cases. The electric or electromagnetic survey, together with seismic refraction survey, have been usually adopted for detecting weak zone, where these results have been interpreted qualitatively. In the field of landslide and slope survey, the combination of P-wave velocity and resistivity have been also used for the evaluation of ground conditions. However, its usage also have been a qualitative manner in many cases.
In the working group 2, the research on the interpreting methods have been made to improve performance of the evaluation of ground conditions. According to the case studies on combined interpretation using plural geophysical surveys data, interpretation methods are divided to 3 categories, which are the cross plot method, the method based on empirical relationship and the method based on Rock Physics. The cross plot method are simple and effective when a large amount of surveys data and physical property testing results on the site is available. The method based on empirical relationship, which is the extension of the cross plot method, is more general, and many relational expressions have been proposed. However, these empirical relationship could not apply to the interpretation beyond based geological conditions, limitations of the relationship, and so on. The method based on Rock Physics is sophisticated and is expected to apply to various geological conditions. However, a large amount of surveys data and physical property testing results is demanded to construct constitutive law, and a lot of work is also demanded to validate the constitutive model. A selection of the interpreting methods is depended on quality and quantity of the available data.
The working group 3 have dealt with the digital standard formats and electronic delivery of geophysical survey results. The purpose of the working group is to improve performance of geophysical surveys, and it is considered that the improvement contribute to the growth of the

geophysical survey utilization in engineering geology.
In this report, the present situation of geophysical surveys and applications of integrated geophysical surveys will present.

Keywords: geophysical survey, integrated geophysical survey, engineering geology

