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## Reliability analysis of geo-structures

The stability of the geo-structures, and the natural slopes need to be analyzed against the severe natural disasters, namely, the earthquakes and heavy rains. Based on the analytical results, the appropriate counter measures can be determined. The concept of the reliability -based design can be conveniently used for the decision making for the optimum alternative of the counter measures. The phenomena of the earthquakes and the rains are probabilistic, and the soil parameters have great variability. The reliability-based design can include the uncertainties into the designs. The reliability-based design method is mainly applied to the earth-fill dams here. In Japan, about 160,000 of earth-fill dams exist, and many of them are deteriorated, and the countermeasures are rushed. The reliability based-design method can determine the priority of the earth-fill dams for the countermeasures.



Breached earth-fill dam by earthquake

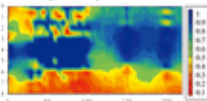


3-D model of earth-fill dam site for stability analysis

## Subsurface survey inside and under geo-structures



In-situ investigation of subsurface layer by CPTu



Visualized strength distribution of subsurface layer

-Probability for strength of soil to be low-

To evaluate the stability of the geo-structures, the subsurface survey inside or under the geo-structures are important. The geophysical survey and the sounding tests are convenient. In our research, the electric Cone Penetration Test (CPTu) is employed, and spatially long and short-interval tests are mixed to efficiently evaluate the stability of an embankment. The geostatistical method is used to simulate the N value (strength value) distribution and to predict the weak locations inside the embankments. The synthesized approach of the CPTu and the Surface Wave Method (SWM), which is one of the geophysical methods, is proposed to compensate for the shortcoming of each approach with use of the geostatistical approach. Consequently, the insides of the embankments can be identified accurately, the high resolution of the spatial distribution of the strength can be visualized.