

Random Sets-based estimation of soundings density for geotechnical site investigation

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Abstract

Geotechnical site investigation is a process conducted generally in two steps. One preliminary stage consisting in collecting available information and executing a limited number of soundings on site, and a second step of investigation based on the first stage using more soundings for soil testing. The optimal number of soundings is not known, it depends on number of factors such as geology of the site, soil variability and the type of project to build.

The idea underlying the use of random sets as a tool to estimate soundings density is supported by their ability to handle vague and uncertain information. The degree of belief an engineer could propose given preliminary information is used to construct the upper and lower probabilities to estimate the number of soundings for geotechnical investigation. The calibration is done upon minimal number of soundings per surface recommended by Eurocode7.

Intervals of values are proposed by number of experts (engineers) concerning the soundings density based on preliminary information from site (soil variability, geology, type of project). Each engineer can give an interval of values based on his degree of belief. He will support his judgment by available information.

As a first step we used only one parameter (soil variability) to construct the random sets. For certain soil variability degree between [1,10] the expert will give the corresponding number of soundings (with a degree of belief m_{ij}). Using Eurocode7 recommendations for site soundings, we constructed an "objective function" $f(X)$ to rely "soil variability" to the number of soundings. This function permits constructing the random set and obtain the number of soundings by unit area for each expert (engineer). The next step consists in aggregating information from other parameters (Geology, Project type...) and computing the random sets. The construction of upper and lower probabilities permits us optimizing the number of soundings to carry out on site.

References

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