

Report for ISSMGE Global Survey on SOA versus SOP TC304 (Engineering Practice of Risk Assessment and Management)

Background

We identified the following 'hot topics' in the practice –

1. Value of reliability- and risk-informed decision making in practice
2. Geotechnical databases and probability models
3. Practical methods to manage geotechnical risk for real-world problems (semi-probabilistic, reliability-based, risk-informed)

Three questions related to the hot subjects are asked during the survey. The survey has received 192 responses, accounting for 14.83% of the total responses that ISSMEGE received during this survey. The three questions are as follows.

Q1: Have you adopted a reliability- or risk-informed method for design, assessment, and/or management of a geotechnical project?

Q1a: If YES to the first question, provide some project details and highlight how your method complements the factor of safety approach?

Q1b: If NO to the first question, what are your reservations or concerns?

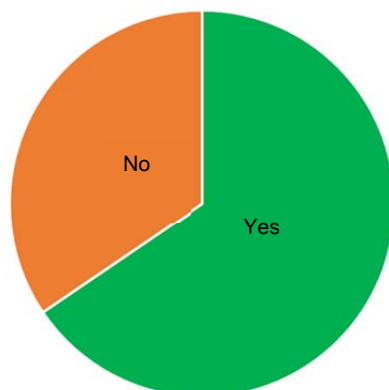
Q2: In relation to bridging state-of-the-art and state-of-the-practice, which aspect(s) of reliability- or risk-informed decision making deserve the most attention (e.g. role of engineering judgment, selection of characteristic value, statistical interpretation of site data and other geotechnical data, target reliability/risk level, Bayesian observational approach, codification versus site-specific needs)?

Q3: What are the top three items in your 'wish list' that you feel would facilitate adoption of reliability or risk-informed decision making in geotechnical practice (e.g. statistical guidelines, databases, software, short courses, clearer design standards/codes, case studies, bibliography)

Q1 is used to identify whether the participants have experiences on reliability and risk informed methods. Q1a and Q1b are follow-up questions for Q1. Q1b is important, because it may identify possible causes for the gap between SOA and SOP. Q2 and Q3 are used to further identify possible solutions that can bridge the gap.

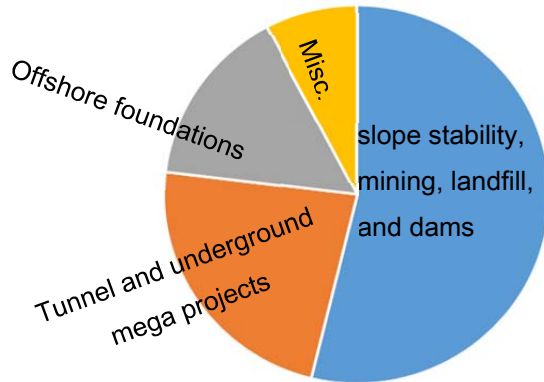
Summary of survey results

Q1 is about whether the participants have used reliability- and risk-informed methods in practice. 29 participants responded and about 65% are positive.



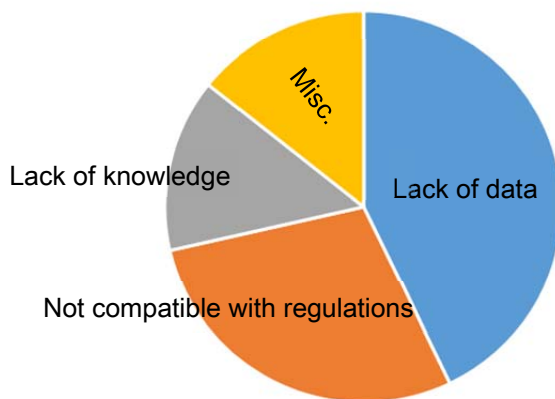
Q1: Have you adopted a reliability- or risk-informed method for design, assessment, and/or management of a geotechnical project?

Q1a received 15 replies. The following areas/subjects are among the most frequent ones where reliability- and risk-informed methods are applied: (a) slope stability, mining, landfill, and dams (7 replies); (b) tunnel and underground mega projects (3 replies); (c) offshore foundations (2 replies).



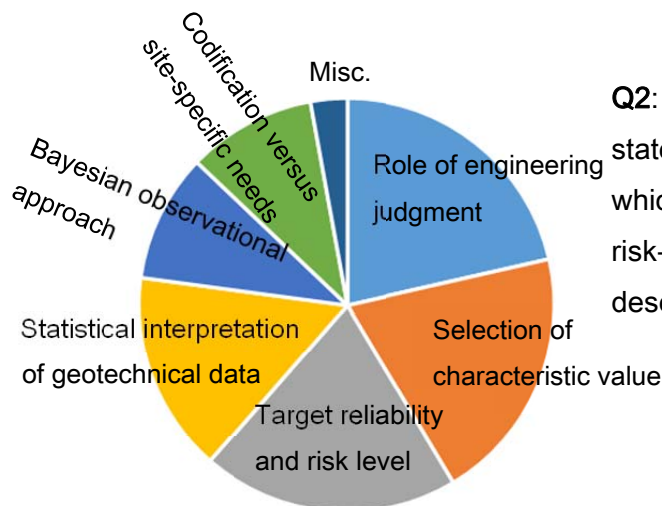
Q1a: If Yes, provide details and highlight how your method complements the FOS method?

Q1b is about the possible causes for the gap between SOA and SOP. It received 7 replies. The following causes are among the most frequent ones: (a) lack of data (3 replies); (b) not compatible with regulations (2 replies); and (c) lack of knowledge (1 reply).



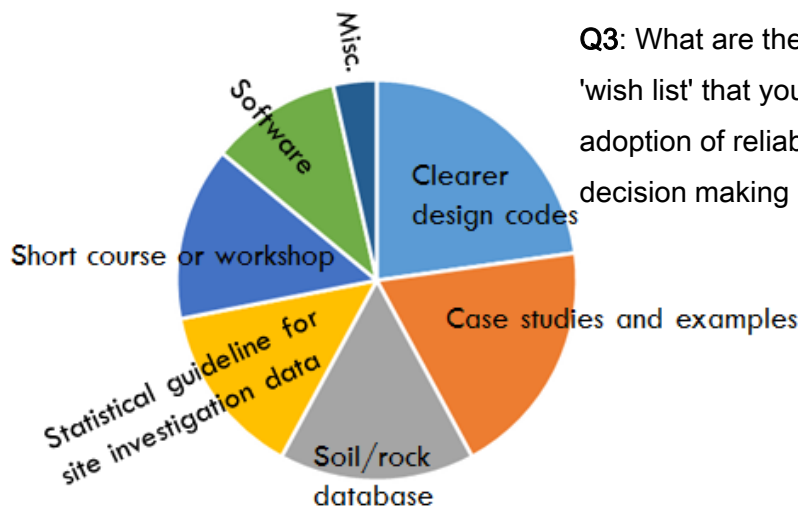
Q1b: If No, what are your reservations or concerns?

Q2 is about the aspect of reliability- or risk-informed methods that deserves the most attention, in order to bridge SOA and SOP. These aspects can be viewed as actions that can improve SOA. 70 participants responded. The following aspects are among the most frequent ones: (a) role of engineering judgement (15 replies); (b) selection of characteristic value (14 replies); (c) target reliability/risk level (14 replies); (d) statistical interpretation of geotechnical data (11 replies); (e) Bayesian observational approach (7 replies); and (f) codification versus site-specific needs (7 replies).



Q2: In relation to bridging state-of-the-art and state-of-practice, which aspect(s) of reliability or risk-informed decision making deserve the most attention?

Q3 is about the top three items in wish list to facilitate adoption of reliability- or risk-informed methods. These items can be viewed as actions that can improve SOP. The following items are among the most frequent ones: (a) clearer design codes (13 replies); (b) case studies and examples (11 replies); (c) soil/rock database (9 replies); (d) statistical guideline for site investigation data (8 replies); (e) short course or workshop (8 replies); and (f) software (6 replies).



Q3: What are the top three items in your 'wish list' that you feel would facilitate adoption of reliability or risk-informed decision making in geotechnical practice

Analysis of survey results

Q1: use of reliability- and risk-informed methods in practice

There are about 65% of participants have actually applied reliability- and risk-informed methods. This may not represent the actual condition for two reasons. First, the percentage for participants with academic background in the survey may be higher than normal. Second, participants for the survey may be already interested in the reliability- and risk-informed methods.

Q1a: areas with most application

The survey results are largely consistent with existing practice: reliability- and risk-informed methods have been implemented to areas such as slope stability, mining, landfill, embankments, dams, and tunnels. These are areas that traditionally welcome reliability- and

risk-informed methods. Areas where reliability-based design codes are available, e.g., foundation design, are not in the list probably because practitioners only need to follow the codes. It is interesting to see emerging areas such as offshore engineering and mega city engineering also welcome reliability- and risk-informed methods.

Q1b: causes for the gap between SOA and SOP

It is very interesting to see that the lack of data is a main cause for the gap. This raises a red flag to the recent research trend that focuses on models and methodologies. Indeed, reliability- and risk-informed methods heavily rely on data. Without real data, models and methods have no use. Insufficient background knowledge is another cause for the gap. This indicates that education is important.

Q2: bridging SOA and SOP – actions to improve SOA

Engineering judgment is an important element for geotechnical engineering, no matter reliability methods are adopted or not. The participants for the survey acknowledge this importance. Selection of characteristic value and determination of reliability level are examples of exercising engineering judgment. However, researchers (SOA) tend to focus more on developing new models and methods but less on the role of engineering judgment. There seem to be needs to provide clearer guidelines to facilitate engineering judgment, such as clearer guidelines for selecting characteristic value and target reliability level. There also seem to be needs to develop guidelines for statistical interpretation of geotechnical data.

Q3: wish list – actions to improve SOP

Geotechnical engineering practice is deeply connected with design codes. The participants express the sentiment that current design codes are not clear enough. One possible factor is that the principle and steps for the selection of characteristic value are unclear. Another one is that the statistical guidelines for analyzing geotechnical data are unclear. Soil and rock databases are essential for reliability- and risk-informed methods. The participants express the sentiment that such databases may not be available. Education (in terms of application examples, short courses, workshops, etc.) is another item that needs more attention. Finally, there seem to be needs for software.

Lessons learned from survey results

The survey results are stimulating. Based on the results, TC304 plans to focus on the following activities during the next term (from 2017 to 2021):

1. Design codes. TC304 has been interacting with TC205 in the discussion of possible use of statistical methods in future Eurocode 7 in a series of activities. TC304 will continue this line of activities. The selection of characteristic value and statistical guideline for site investigation data will be possible subjects.
2. Soil/rock databases and softwares. Task forces will be established within TC304 to develop soil/rock databases. These databases will be made available to the public through web-based or app-based softwares. These softwares will also be able to conduct statistical analysis for the soil/rock data.
3. Education. TC034 will organize short courses and workshops to educate engineers about the following aspects: (a) reliability and risk methods; (b) statistical methods for site investigation data; (c) case studies and application examples.