Toward a reliability framework for the observational method

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2016

Finansiärer

BeFo Report 163, 2016

The observational method

- Prepare a preliminary design:
  - Define in advance alarm limits toward unacceptable behaviour.
  - Plan in advance how to find out whether the behaviour is acceptable or not.
  - Plan what you will do, if the behaviour is found to be unacceptable.
  - Unacceptable behaviour may not occur too often, because contingency actions are usually expensive.
- Observe the behaviour during construction and put contingency actions into operation if they are needed.

Basis for research project

Contractual constraints?

Too general definition?

The observational method is rarely applied in practice.

Lack of guidelines?

Concerns about safety reported.

Overall aim of the research project:

- To identify, highlight, and solve the aspects of the observational method that limit its wider application in rock engineering.

Research approach:

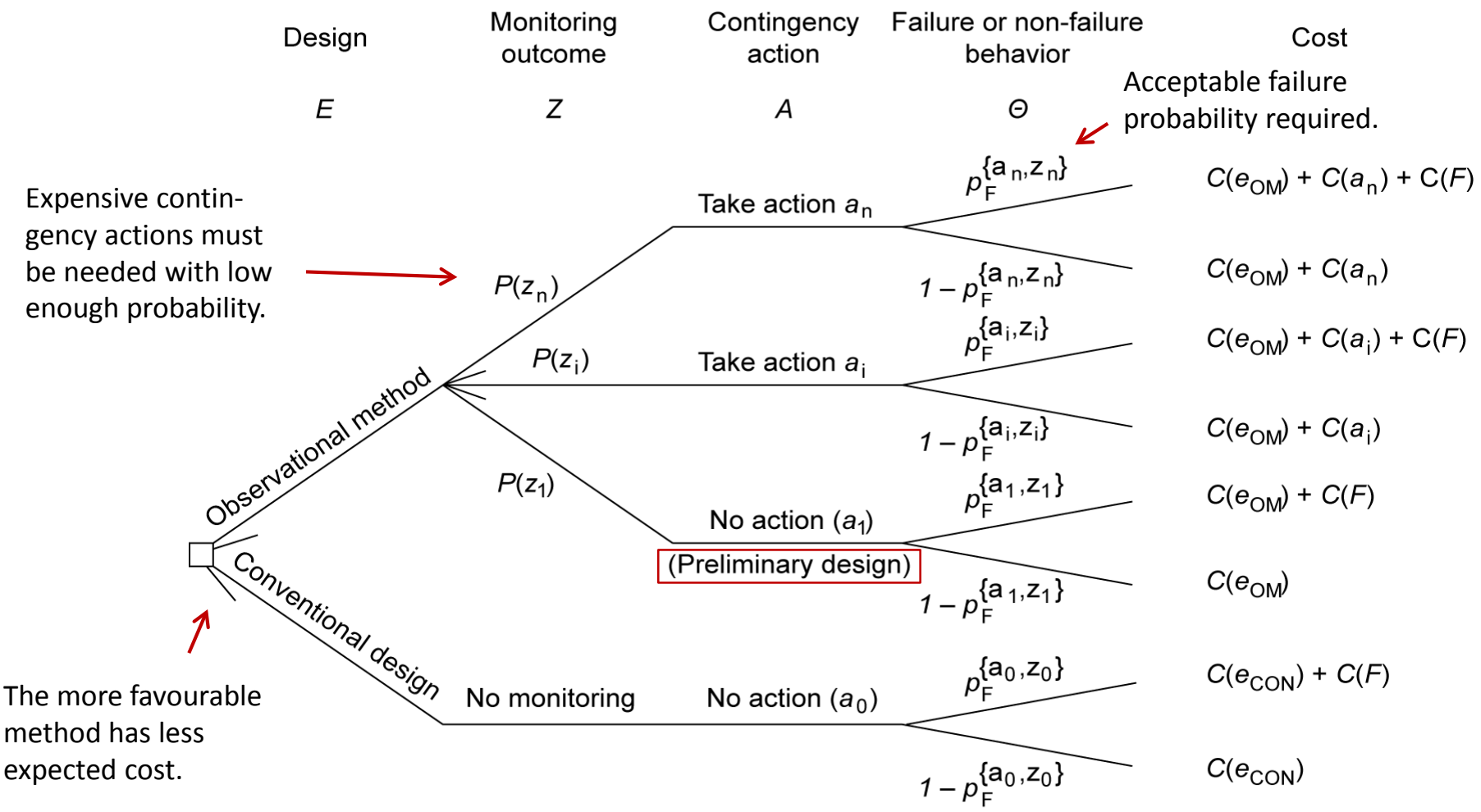
- To combine the observational method with reliability-based design and statistical decision theory into a unified framework.

Why isn't the observational method used today?

Limitations and practical difficulties with the current definition in EC7 were identified:

- The literature reports associations between the observational method and low safety margins.
- No safety margin is required for the observational method in EC7.
- Difficulties in establishing alarm limits toward unacceptable behaviour.
- Difficulties in assessing the probability of exceeding these limits and the need for contingency actions.

Combining reliability-based method with decision theory finds favourable method



Summary of main contributions and conclusions

- A reliability framework for the observational method that combines reliability-based design with Bayesian statistical decision theory is presented.
  - Compares the merits of the observational method with that of conventional design.
  - Ensures structural safety for all design options.

- It is shown how alarm limits for unacceptable behaviour may be established to ensure acceptable structural safety.

$$P(G < 0 | \boldsymbol{x} \leq \boldsymbol{x}_{\text{alarm}}) \leq p_{\text{FT}}$$