Brief Notes

AMAS Course on Reliability-Based Design and Optimisation
RBO'03 - (pp.409–410) - Warsaw, September 15-18, 2003

Risk management of Södra Länken SL24. Reliability analysis of a sheet pile wall

S. HINTZE [1] and Z.-E. MEROUANI [2]

[1] *Skanska AB/Royal Institute of Technology*
Sweden

[2] *Royal Institute of Technology*
Sweden

The Southern Link of Stockholm (Södra Länken) is a major project concerned with the building of a number of earth structures, links, bridges, roads, tunnels, canals and locks in the south of Stockholm. This project is divided into a number of subprojects spread over other different locations, SL 24 is a part of this large project and is located in Sickla. Skanska AB is the contracting company that is also responsible for the consultancy work. In this risk analysis will be considered solely from the contractor perspective.

The different earth structures and foundations designed and constructed in this project are piles, retaining walls, and calcium-cement columns.

Identification and evaluation of risk should start at an early stage to allow for the good progress of the project and for realistic estimation in the tender documents. As a first step, hazards have been identified around and inside the project location. The parameters likely influencing SL24 are shown in an interaction matrix. An observation system was also installed on the construction site.

A stochastic analysis can give more information about the safety situation of a slope or a retaining wall without being influenced by the design method, or at a much lesser degree than the safety factor. Among the large number of earth structures designed and constructed at Södra Länken SL24, one sheet pile wall was retained for the determination of the safety factor and the reliability index using the two procedures presented below.

Procedure 1:

1. Define $Y = f(X_i, C_i)$ where X_i are random variables and C_i are constants.
2. Set an initial value for β.
3. Compute $f_i = \frac{\partial Y}{\partial Xi}$ for all i.
4. Compute α_i (for all i): $\alpha_i = f_i \frac{\sigma_i}{\sigma_Y}$ and $\sigma_Y = \left[\sum_{i=1}^{n} (f_i \, x_i \, \sigma_i)^2 \right]^{\frac{1}{2}}$.
5. Compute new x_i values from: $x_i = m_i - \alpha_i \, \beta \, \sigma_i$.
6. Repeat steps 4 and 5 until stable values of x_i are achieved.
7. Evaluate Y.
8. Modify β and repeat the procedure to achieve $Y = 0$.

Procedure 2:

1. Define $Y = f(X_i, C_i)$ where X_i are random variables and C_i are constants.
2. Monte-Carlo simulation.
3. Compute $\beta = \frac{\overline{Y}}{\sigma_Y}$.