Probabilistic assessment of tunnel construction time using dynamic Bayesian network

Abstract:

Construction time estimates are important parameters for decision-making in transport infrastructure projects. At present, the construction time is usually assessed deterministically by experts; probabilistic models are not commonly employed in practice. A main reason is that the existing models often do not provide a realistic estimate of the overall uncertainty. In this contribution, we present a Dynamic Bayesian Network (DBN) model, which aims to more realistically represent the uncertainties in tunnel construction time estimates and which provides an understandable graphical representation of the model assumptions. The model considers the geotechnical uncertainties as well as uncertainties associated with human and other external factors. It includes the common variability of the construction performance and the occurrence of extraordinary events (failures) such as tunnel collapses. Analyses of construction performance data from tunnels constructed in the past provide a basis for estimation of failure rate and for determination of unit time distribution, which are the essential inputs of the probabilistic model. A case study demonstrates the applicability of the DBN model and the possibility of updating predictions.
with new information obtained during the construction process.

Stichworte: Construction time, risk analysis, Dynamic Bayesian Networks, construction performance, failure rate, probabilistic model

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