



## Bridge quality control using Bayesian net

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### Abstract

Bridge quality, as a measure of its compliance with the performance goals is tracked by the quality control plan. In other words, the quality could be understood as a comparison between performance indicators and performance goals. Reliability is widely recognized as the most important key performance indicator. This paper proposes a new approach to the mentioned comparison that provides valuable information and consequently improve decision-making regarding future course of action.

A current quality control plan is facing certain limitations. Defects are being detected in the inspection and documented in the inspection report. In the most cases, however the essential information for reliability assessment i.e. the extent and location of the defects is not recorded.

The proposed approach uses a Bayesian net for the prior analysis of the bridge. Afterwards, the net is updated after each inspection, allowing a posterior analysis of the bridge reliability. A damage free state of the bridge, so-called “virgin state” is adopted as a baseline, while inspectors are asked to estimate the severity of the defect and consider the vulnerability of the structural system for the locations of defects.

**Keywords:** bridge inspection; Bayesian network; reliability; key performance indicator, performance goal, vulnerable zone.

### 1 Introduction

Bridges are critical components of transportation infrastructure. Hence, an information on bridges' safety and serviceability is essential to trigger timely interventions for ensuring societal benefit from transportation infrastructure. To get an overall information on bridge reliability, investigative actions need to be performed. Based on this information, decision regarding

maintenance interventions are taken. The term “quality control” stands for both investigative actions and decision-making process mirroring the two meanings of the term control as “verify, check or inspect” and “command, direct or rule”. The term “quality control”, as well as the concept itself, comes from the mass production industry where it is well-established. Application of quality control to existing bridges is relatively new, given that the importance of systematic planning maintenance