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Non-destructive testing in civil engineering: A valuable source of information for reliability assessments

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Abstract

The reassessment of bridges is becoming increasingly important. The basic requirement for analyses of structural safety is reliable knowledge about individual structures. This paper introduces the new approach to evaluate the quality of measured data gained from non-destructive testing (NDT) to provide reliable, objective, and relevant information about existing bridges. The purpose is to relate this validated knowledge to probabilistic analyses. Bridging the gap between NDT and numerical reassessments indicates reduced numerical uncertainties and residual service time extensions. This paper deals with an application of this approach using measurement data collected by ultrasonic technique at a prestressed concrete bridge.

Keywords: NDT; non-destructive testing in civil engineering; measurement; reliability; structural safety; concrete bridges; existing structures; GUM; uncertainty

1. Introduction

The numerical assessment of structures has to be carried out generally by means of a model. This model is a more or less accurate approximation of reality. The structural engineer should try to solve an individual problem with a simple model at first. An overly simple model may be expanded by more precise details about the considered issue in various ways if necessary. We could exemplarily define nonlinear models and scientific assessment methods, adapt partial safety factors, or update prior assumed actions and material parameters.

The aim of this contribution is not to increase the level of approximation [1] (LoA) of calculation methods but to improve the LoA with regard to the qualitative and quantitative knowledge about an existing structure based on investigations onsite. These usually coincide with destructive interventions on the construction. Therefore, the amount of measurements is limited. The new approach is to use measured data gained from methods of non-destructive testing in civil

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