



Automated structural assessment of existing reinforced concrete underpasses

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Abstract

Due to the large number of underpasses in the Netherlands that have to be assessed, a project at the Delft University of Technology in cooperation with Royal HaskoningDHV was started. Research was conducted into the automation of the structural assessment of existing reinforced concrete underpasses in the Netherlands. The developed Automated Structural Assessment Tool (ASA Tool) consists of an analytical model and a 2.5D FEM model. The analytical model uses traffic load distribution following the Guyon-Massonnet-Bares method for bending and a method based on *fib* Model Code 2010 for shear. The script-based 2.5D FEM model uses 2D shell elements and performs a linear elastic analysis. The input and output can be linked to a database for assessment of large batches. Sensitivity analyses showed that in-plane load distribution following *fib* Model Code 2010 combined with vertical load distribution according to EN 1991-2:2003 results in underestimated shear forces.

Keywords: Existing concrete structures, automated assessment, reinforced concrete slabs, automated FEM.

1 Introduction

The Netherlands has about 55,000 engineering structures such as bridges and overpasses. This includes culverts, pedestrian or bicycle underpasses, and mixed traffic underpasses (Figure 1). Estimates for the number of these structures in the Netherlands vary between 8,000 and 11,000 [1]. More than half of the underpasses and culverts were built before 1976. Most structures were built during the wave of construction in the Netherlands

of the 1960s and 1970s, as shown in Figure 2. Based on an expected service life of 50 to 80 years, most of these structures will reach this age. Replacement of all these ageing structures in the short term is not feasible, both practically and financially. The Netherlands is on the eve of a major replacement task. However, the question is whether all these structures are really at the end of their lifespan or whether the service life can be extended with another 30 years. An extension of the service life could achieve a better distribution in the replacement task.