

Diagnosis of Risk on structural failure for deteriorated bridge beams

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Summary

In this paper the risk on structural failure of some heavily deteriorated bridges constructed with post-tensioned prefabricated T-girders is described. The bridges have undergone three detailed inspections with an interval of approximately five years. All visual deterioration was recorded and classified. To check the actual state of corrosion, at four viaducts with severe deterioration, the risk of corrosion of the prestressing bars has been thoroughly assessed. With high pressure water-jetting the anchorages of the prestressing bars were carefully partly uncovered. Parallel to this for two of these viaducts thorough structural assessments have been carried out. For the other viaducts the risk on structural failure is determined by a specifically developed quick-scan-model. With this model the bridges are ranked with respect to the risk on structural failure. Depending on this risk, a solution for conserving these structures was proposed and a Design and Construct contractor was chosen to repair and conserve the structures.

Keywords: Chloride induced corrosion, concrete deterioration, structural assessment, structural failure, prefabricated post-tensioned beams, conservation of structures.

1. Introduction

During a regular inspection in 2001 of some 40 year old viaducts, constructed with post-tensioned prefabricated T-girders (see Figure 1), severe deterioration due to cracking and spalling was discovered. The deterioration was situated at the beam-heads near the supports, where rubber (watertight) joints are present. Due to the leakage of these joints, the concrete around these joints

has been contaminated with chlorides from de-icing salts. High levels of chloride ingress have been found. All viaducts constructed with similar prefabricated beams have been detailed inspected three times with an interval of five years and all deterioration was reported. For a few viaducts as a result of the first detailed inspection an emergency measure was implemented to ensure the structural safety by adding an alternative bearing. At each site of a heavily deteriorated girder a concrete block (with extra bearing below it) was placed in the free space between the webs of the T-girders. The bottom of the blocks and the bottom of the T-girder was coupled by a FRP-strip (see Figure 2) as external reinforcement.

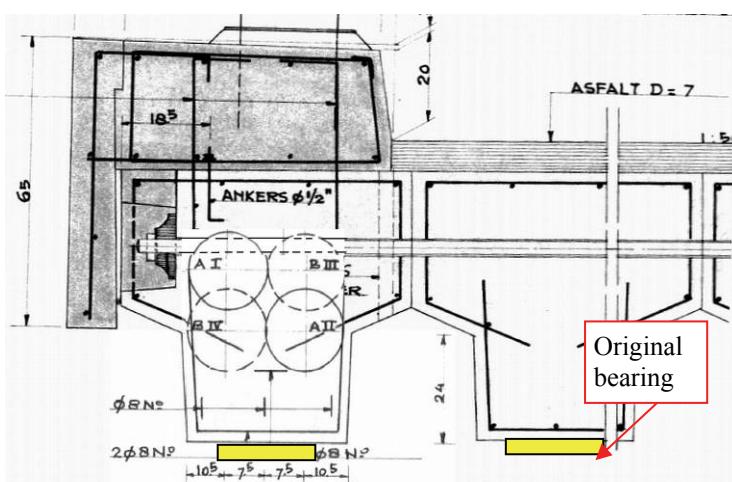


Fig. 1: Cross-section of viaduct with T-girders