



Failures of external Tendons in Prestressed Concrete Bridges: Causes, Investigations, Remediation and Prevention.

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Abstract

In the the early 1980's, an evolution in the grouting operations took place with the use of increasingly fluid grouts to facilitate the injection of the prestress ducts. During a gammagraphy campaign carried out on a box girder bridge under construction in 1994, anomalies were detected at the upper point of the ducts of the external prestressing tendons. Observations carried out after opening of some ducts highlighted a lack of filling and the presence of a product having the consistency of a wet and soft white paste. After presenting several cases of external tendon failures that occurred in the past years in France, the article describes the mechanism leading to severe grouting defects resulting in failures of tendons by a rather rapid corrosion. Then it presents the development of an investigation device based on dielectric capacity measurement that was applied during the campaign of investigations launched on all box girder bridges of the French national road network.

Keywords: Post-tensioning; bridges; tendons; grouting; rupture; causes; investigations; capacitive probe; repair; replacement.

1 Introduction

From the mid-70s, a change was made with the use of more and more fluid grout to facilitate the injection of prestressing longer ducts. From the 80s, the search for a greater fluidity was accompanied with the widespread use of superplasticizers. This change in the grout formulation and the grouting methods prevailed without checking the actual filling of the ducts on the sites. This leads to the occurrence of failures in external prestressing tendons, and it was observed in various countries, especially United States [1], but also France.

2 Cases of external tendon failures

Between 1994 and 2005, 5 cases of rupture of external prestressing tendon protected by cement grout in direct contact with steel strands were observed in France. When they broke, the tendons were respectively 8, 10, 18, 19 and 21 years old, with a mean age of 15 years. In this article, three cases of rupture of prestressing tendons are presented; they occurred chronologically in the following box girder bridges: the Val-Durance bridge, the Saint Cloud viaduct and a bridge in La Réunion island.