



Forensic investigation of early age Alkali-Aggregate Reaction damaged concrete elements: causes and lessons

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Abstract

Precast L-shaped reinforced concrete of the platforms of a railway station showed excessive damage after only 8 years of service. Damage led to important deformation (outward bending towards the railway clearance outline) of these elements to such an extent that they had to be urgently replaced because of safety reasons. Forensic investigation revealed Alkali-Aggregate Reaction (AAR) to be the cause for the damage.

In view of establishing the responsibilities in this costly case, a major question was whether the contractor mandated for the fabrication of the elements could have been sufficiently knowledgeable of the AAR phenomenon at the time of execution of the construction works. Also, the role of standards and in general the notion of “state-of-knowledge” of the profession were important issues.

Keywords: Alkali Aggregate Reaction in concrete, advanced numerical simulation, precast concrete elements, fabrication process, state-of-knowledge.

1 Introduction

Precast L-shaped reinforced concrete elements of the platforms of a railway station showed excessive damage after only 8 years of service. This damage led to important deformation (outward bending towards the railway clearance outline) of these elements to such an extent that they had to be urgently replaced because of safety reasons. Intersection of the bent elements with the clearance outline of the railway vehicles was imminent. Replacement of the elements led to significant costs.

A team of three experts led by the author of this paper was formed in May 2010 and officially appointed in September 2010 by the related Magistrate, to establish an expertise concerning the disorders observed of the prefabricated concrete elements of the platforms of the railway station.

In the following, the disorders are described, and major technical topics and issues of liability handled within the framework of this expertise are outlined. They have been established as a report being part of the questionnaire to be answered on request by the Magistrate.

No names of involved persons, companies or locations are given as this is of no relevance to the technical facts and the lessons to be learnt from this forensic case.

2 Course of actions

In May 2010, the experts visited the railway station in presence of representatives of the owner, contractor and consulting engineering firm, responsible for the design and construction works of the platforms. Disorders of the prefabricated concrete elements of the platforms were identified, and a general overview was obtained.