



Bridges Piers' replacement due to alkali-silica reaction pathologies

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Abstract

The solution for the piers replacement of three bridges, integrated into the road network of Aguieira's dam in Portugal is presented. The piers' shafts and footings had severe pathologies due to concrete alkali-silica reactions, namely extensive longitudinal cracking, therefore making it necessary to repair or replace the piers.

The works were performed in very particular conditions. These constraints have been overcome with the construction of new hollow section pier shafts, jacketing the old ones. The use of prefabricated footings and pier shafts with a sliding technic allowed to avoid the construction of cofferdams. The new footings were supported on micropiles.

This construction method has proven to be an economical, low-intrusive and easy to implement solution, enabling the maintenance of traffic over the bridges during the construction period.

Keywords: Concrete, Bridges, Rehabilitation, Construction methods.

1. Introduction

The first two bridges, over Mondego and Mortágua's rivers are inside Raiva's dam lake and the third, over Dão river is inside Aguieira's dam lake. The three bridges are structurally similar and have the same kind of pathologies.

The rehabilitation was programmed in two phases, the first corresponding to the reinforcement of the deck, abutments and piles' heads and the second to the piers' rehabilitation / replacement. When we started the design of the pier's replacement, the first phase was already complete.

2. Bridges description

The three bridges are composed by slab on beams decks in prestressed reinforced concrete, 15.2 m wide, with four variable depth beams with 40 m

spans. The abutments are solid type and the hammer-type piers have solid 2,60 m diameter shafts with prestressed concrete pier heads. These elements are 0,60 m wide and have a variable depth from 0,80 m (at the edge) to 3,60 m (at pile axis). The piers' foundations are $\Phi 6,0$ m circular footings or 6,0 by 8,0 m elliptic ones.

The bridges were built between 1976 and 1979.

The decks' reinforcement and rehabilitation design included additional external prestressing and the reinforcement of the cross-beams and pier' heads. The upper zone of the piers' cap was thickened, transversal prestressed bars under the beams bearing were installed as well as six longitudinal prestressing cables in each cap. The installation of oil dampers and longitudinal bearings on abutments was also planned.