

CHARACTERIZATION OF DELETERIOUS EXPANSIVE REACTIONS IN FAGILDE DAM

Isabel Fernandes^{1,*}, António Santos Silva², José Piteira Gomes²,
António Tavares de Castro², Fernando Noronha¹, Maria dos Anjos Ribeiro¹

¹ University of Porto, DGAOT/Centre of Geology, Rua do Campo Alegre,
4169-007 PORTO, Portugal

² National Laboratory of Civil Engineering, Av. do Brasil 101,
1700-066 LISBON, Portugal

Abstract

A monitoring system has been detecting progressive displacements in Fagilde dam, completed in 1984. Site inspection revealed the existence of random cracking, surface discoloration, and superficial dissolution of cement in the spillway surfaces and in the upstream face of the dam. The macroscopic signs of deterioration, which could be due to different mechanisms, showed an uneven distribution in the exposed surfaces of the structure. Crushed limestone and alluvial siliceous sand were used as aggregates. Alkali–aggregate reaction was considered to be the likely cause of concrete distress. In order to investigate the causes of cracking and of the movements registered in the wall, drill core sampling was performed and the concrete investigated for the occurrence of expansive reactions.

Concrete petrography was complemented by other tests in order to assess the probable evolution of the reactions in the structure in the near future. Residual expansion tests, soluble alkalis evaluation, and unconfined compression tests were carried out. Alkali–aggregate reactions and internal sulfate reaction were considered to be the main causes of damage in the concrete. In this study, microscopy showed to be an essential tool in the identification of the main causes of deterioration.

KEYWORDS: displacement, microscopy, laboratory tests, internal sulfate reaction, alkali-aggregate reaction
