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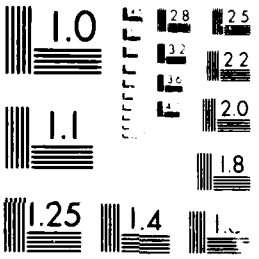
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REPAIR WORKS FOR UPLIFT AND SEEPAGE CONTROL

IN EXISTING CONCRETE DAMS

by

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United States Army

RESEARCH, DEVELOPMENT & STANDARDIZATION GROUP U.K.

CONTRAT NUMBER DAJA45-87-C-0022

Second Interim Report

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This report is intended only for the internal management use of the Contractor and the U.S.Government.

LABORATORIO NACIONAL DE ENGENHARIA CIVIL,LNEC

Lisbon, December, 1987

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REPAIR WORKS FOR UPLIFT AND SEEPAGE CONTROL

IN EXISTING CONCRETE DAM

1 - Introduction

This second interim report presents a summary of the work done and of the admnistrative actions carried out in the period concerned, under the terms of the contract, as well as some comments on future work.

The report will refer to each of the four main steps that were planned for the development of the work, namely:

- Case histories on rock mass foundation deteriorations of some Portuguese arch dams (R1);
- Case histories on the hydromechanical behaviour of some Portuguese concrete gravity dam foundations (R2);
- Modelling of the hydromechanical behaviour of concrete dam foundations (R3); and
- Tests for deterioration evaluation and for analysis of repair works in concrete dam foundations (R4).

2 - Development of the work

Concerning steps R1 and R2, the case histories analysis has been started by the cases of Varosa, Bouçã and Venda Nova, some Portuguese arch dams in which foundation deteriorations were detected; and by the cases of Alto Rabagão, Raiva and Torrão, the Portuguese gravity dams chosen to examplify the foundation treatment and the monitoring and observation of the works.

For each one of the above indicated dams, the following aspects related to the design, construction and operation are under consideration:

- a general description of the works, with particular reference to the foundation, to the watertightening and drainage

systems and to the deteriorations observed and the corresponding repair works in the cases of deterioration;

- the hydromechanical behaviour of the rock mass foundation based on geological studies, on the Rock Mass Rating geomechanical classification (RMR) and on the hydraulic and mechanical, field and laboratory, tests; and

- the observation of the behaviour along the periods of the first filling and of the operation of the reservoirs, before and after the repairing works, in the cases of deterioration.

Concerning step R3 work is in progress in order to:

- improve and adjust the computational systems already developed at LNEC, by finite element and boundary element methods, for analysing hydraulic,thermal and mechanical models;

- apply the above mathematical models to the cases of Bouçã and Torrão dams; and

- develop methods for the quantitative interpretation analysis of the results observed in the dams under consideration, making an evaluation of the mathematical models possible.

Concerning step R4 the main work to be reported is:

- the geophysical and the permeability tests performed in the foundation of Bouçã dam; and

- the inventory drawn on the field and laboratory tests, associated with the deterioration cases of Varosa and Venda Nova dams.

3 - Future work

According to the plan of the work, steps R1 and R2 will be completed until the next interim report; it is planned to present technical reports on these steps.

Concerning R3 and R4 it is planned:

- to complete the development of the mathematical models and of the quantitative interpretation analysis of the results observed at Bouçã and Torrão dams; and

- to start with i) the development of models for Venda Nova and Raiva dams; ii) numerical analysis on the usual design solutions

for repairing works; and iii) the development of the methods for detection of deteriorations and their application to Venda Nova and Varosa cases.

It also seems of interest to present a paper at the ISRM Symposium on " Rock Mechanics and Power Plants ", to be held next year in Madrid; this paper entitled " Hydromechanical characterization and modelling of the behaviour of concrete dam foundations " would clearly refer to the present work, supported by the ERO of U.S. Army.

4 - Other actions developed

We should mention other actions related to the project, namely :

- the participation in technical meetings of the Mr. José O. Pedro and Mr. Luis Ribeiro e Sousa, in China (Guangzhou) and in Portugal;

- the association to the present project of two Research Assistants of LNEC, Mr. Henrique Silva (steps R1 and R4) and Mr. Tavares de Castro (steps R2 and R3), as well as Technicians of LNEC Mr. Adelino Bastos, Mr. Daniel Vicente, Mr João Pereira and Mr. Tiago de Almeida; and

- the contacts with " Electricidade de Portugal - EDP ", owner of the dams selected in this project, to ensure the colaboration of Engineers of this firm.

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