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LABORATORY TESTS OF COMPRESSIVE CREEP IN CONCRETE SAMPLES: DEVELOPMENT OF SOLUTIONS FOR PROBLEMS OF ACTUATION, MEASUREMENT, DATA ACQUISITION AND LOAD BALANCING

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ABSTRACT

This paper reports a study carried out to develop an automatic facility for compressive creep testing of concrete specimens in laboratory. The solutions for actuation, measurement and data acquisition were developed after the identification of the main metrological requirements and operational constraints. The whole transduction chains, from the sensors to the data storage, was be analysed in detail. In addition a software tool was developed as an aid to the delicate process of force application and load balancing. The system has been tested and some results are presented.

INTRODUCTION

The Concrete Division of the Materials Department of LNEC carries out laboratory compressive creep tests of concrete specimens of 600×150×150 mm by submitting them to constant axial compression, over periods ranging from a few months to several years.

During a test, deformation measurements are made on two opposite sides of the specimen, along with load measurements. Given that the deformations are typically in the order of several tens of microns in 400 mm length, its measurement needs highly sensitive measurement devices that should also be easy to calibrate and require a detailed analysis of the metrological chain from the sensors to the data storage. Furthermore, load as well as ambient temperature and relative humidity may be measured with moderate cost instrumentation.

Test conditions are of particular importance with regard to the temporal and spatial uniformity of the load applied to the specimen in the long run, as well as to uniformity of environmental conditions (temperature and relative humidity). The ease of the devices placement for measuring the deformation, alongside with the means for load application and balancing, require substantially demanding operational conditions. All these requirements were taken into account in the selection of instrumentation, in the design of the machines and in the monitoring and data acquisition tools (Palma et al, 2010; Gustavo Coelho et al, 2010), as described next.

EQUIPMENT FOR ACTUATION, MEASUREMENT AND DATA ACQUISITION

Each prismatic specimen is compressed in a high stiffness reaction structure (see Fig. 1) by means of an oil filled flat jack, the pressure being maintained by an hydraulic accumulator; the load (up to 15 MPa) is measured with a pressure transmitter inserted in the hydraulic circuit.

The reaction structure is constructed from press-braked steel plates in order to obtain optimized profiles regarding to permissible loads and deformations. The profiles are welded