PHD THESIS ABSTRACT

"NUMERICAL AND EXPERIMENTAL MODELING OF CONCRETE BEHAVIOR AT EXPLOSION AND IMPACT "

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This PhD thesis belongs to the civil engineering field by it's subject that treats the behavior of concrete under actions characterized by high rates loading such as explosion or impact.

In the research program related to the PhD thesis mechanical properties of concrete and mortar samples have been studied by numerical simulation, experimental calibration as well with the experimental Split Hopkinson Pressure Bar, aiming at the validation of existing material laws in the literature.

The purpose of the study was to provide an accurate method for determining the concrete response to the high rates loading, a method that consider the phenomena of spraying, cracking and fragmentation that occur in the structure of the material.

The paper is progressively developed in 8 chapters, starting with a complex synthesis of the specialized literature, continuing with the experimental study and validation of the optained results, ending with the final conclusions.

In Chapter 1 are presented the scope of the thesis, as well as a short history of the problem that is to be researched and the current state of knowledge in this field. At the end of the chapter are briefly presented the theoretical aspects of the interaction between the explosion and the structural elements.

Chapter 2 is dedicated to the mathematical formulation of wave propagation through dense materials. The main defining aspects of wave propagation, their typology and the mathematical elements defining dispersion and attenuation phenomena are presented.

Chapter 3 describes the failure criteria for concrete subject to short-term actions. Particular attention is paid in this chapter to the definition of efforts and effort invariants, the properties of the failure surfaces as well as the detailing of the main failure criteria of concrete proposed in the literature.

Chapter 4 is intended to present the main aspects of the behavior of concrete under high rate loadings, with particular attentions being accorded to the changing of material properties in dynamic conditions.

Chapter 5 describes the theoretical principles of organization and operation of the experimental Split Hopkinsson Bar Pressure installation as well as the conditions for validating the obtained results. Particular attention has been accorded to the compression test configuration principle.

Chapter 6 contains the experimental program for studying the behavior of concrete at explosion and impact using numerical simulation and also the Split Hopkinsson Bar Pressure system. It been described the FEM model, the test methodology, the data acquisition and correction process as well.

Chapter 7 presents the conclusions and the main contributions regarding numerical and experimental modeling of concrete under high rate loadings. In the end is highlighted the dissemination of research results by publishing some articles during the PhD studies, the 8th chapter has been reserved to the bibliography.