
Subject: Requalification of static and dynamic behavior of curved masonry structures. Experimental, analytical and numerical study

Themes: materials – structures

Keywords: Requalification, Arch, Masonry structures, Failure, Damage, Modelling

Laboratories:

- Laboratory of Mechanics and Materials of Civil Engineering (L2MGC - EA 4114), University of Cergy-Pontoise – France
- Construction group, gCons, University of A Coruña – Spain

Description:

Masonry structures represent an important part of the cultural and architectural heritage in Europe. The majority of these structures is characterized by the presence of arches that have both bearing and aesthetic functions. They are aging and suffer the increase of applied static and dynamic loads. Their preservation, therefore, requires the establishment of effective intervention methods for the maintenance and the eventual reinforcement.

The proposed joint thesis project aims to study the static and dynamic behavior of brick arches designed and tested up to failure in the laboratory under several types of loading. For the analysis and the interpretation of obtained results, an experimental campaign on the mechanical properties of masonry is envisaged. Compressive tests on masonry specimens will be carried out in order to characterize the stress-strain relationship as well as the compression failure mode. Direct tensile tests on the brick alone will be performed to determine the tensile strength and the post-peak softening behavior. In addition, 3-point bending tests are envisaged to obtain the tensile behavior of the brick-mortar interface. From these tests, the necessary parameters for the material behavior constitutive laws are determined. An experimental program will be also conducted on reduced arcs models with the same geometric characteristics and made with the same materials.

For the analysis at the structural scale, several approaches will be adopted under both static and dynamic loading conditions. The objective is to achieve analysis tool using analytical

models and finite element method to simulate the behavior of curved structures. The proposed tools would allow to simulate the mechanical behavior as well as the failure modes of reduced structures models. The knowledge of the masonry behavior constitutive laws would allow to determine stresses and strains states inducing the failure of critical sections and to perform a reliability analysis of the influence of elementary material behavior laws on the overall behavior.

Profile and requested skills:

- Master of Science in Mechanics of Materials and Structures
- Master in civil engineering or equivalent.
- Skills in the use of finite element tools and programming
- English level B2 TOEIC or equivalent level

Thesis supervisors:

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Thesis duration: 36 months from October 1st 2019. The duration will be divided into 18 months in France and 18 months in Spain. The selected candidate will be contracted by both universities during all the period of the thesis.

Application: the applicant should send the following documents, in English, before May 31 2019 by e-mail to Dr. Fonteboa and Dr. Wardeh:

- A Curriculum Vitae and a motivation letter
- A copy of obtained diplomas or a certificate of success for the students registered in MSc degree during the scholar year 2018-2019
- A letter of recommendation from the MSc advisor
- Extended abstract of the MSc thesis (maximum 4 pages)