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Mariella Diaferio, Marilena Venerito, Michele Vitti

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Experimental testing and numerical analysis of a barrel vault

Mariella Diaferio[a]*, Marilena Venerito[b] and Michele Vitti[b]

[a] *Department of Sciences of Civil Engineering & Architecture, Politecnico di Bari, via Orabona 4, 70125 Bari, (Italy); e-mail: mariella.diaferio@poliba.it;*

[b] *Intuit Structure, via Camillo Rosalba 47/z, 70100 Bari, Italy*

* *Corresponding author*

The barrel vault is a widespread typology in the cultural heritage buildings; consequently, the study of its structural response is a crucial goal as necessary for the design of interventions on such structures which have a high social interest. However, these vaults are characterized by a complex structural behavior due to several uncertainties which could significantly influence their response. To overcome these problems, the experimental campaign is the most reliable procedure which may characterize both the static and the dynamic behavior of such structures. Thus, as the knowledge of the behavior of the vault is a fundamental aspect to guarantee its preservation and the stability of the whole building, here experimental and numerical analyses are performed on a barrel vault with the aim of showing possible routine. In detail, as the main applications will be on cultural heritage buildings, only non-destructive or moderately destructive experimental tests have been considered, both under static and dynamic actions, and have been carried out on a barrel vault realized in accordance with the "rules of art". The adopted techniques are discussed with reference to their advantages and limits. Moreover, the acquired data have been utilized to check and validate a numerical model.

Keywords: Barrel vault, Experimental investigation, Finite element model, laser scanner, flat jack, sonic test, geophone.

Introduction

In the last decades the topic of evaluating the mechanical behavior of masonry structures has become of crucial importance due to the existence of a wide and valuable historical building patrimony. These structures, in fact, are characterized by a complex

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