

# **Protection of historical buildings against catastrophic actions: case studies**

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## **ABSTRACT**

The historical buildings represent a great part of the Italian built heritage. Therefore, there is a pressing need to recognize, analyse and asses their different vulnerabilities. Catastrophic situations due to earthquake, impact and fire produce the most dangerous effects on these buildings, which are not designed for carrying them.

The research programme includes a wide experimental activity, in situ and in laboratory, which is directed to selected masonry elements and substructures, tested in static and dynamic conditions, in order to evaluate and codify their mechanical behaviour before, during and after the catastrophic actions occurring.

The analysed case studies are representative of historical buildings in central Italy:

- a) The gothic cathedral of Fossanova has been studied by means of a large scale model (1 : 5,5) tested on shaking table. The damage has been produced by a pick ground acceleration of 0,15g. Afterword, the model has been seismically upgraded by a tie system, by reaching an increase of capacity of about three times.
- b) The old Palace in Saint Peter square of L’Aquila city was strongly damaged by the 06<sup>th</sup> April 2009 earthquake and therefore destined to demolition. The carrying capacity of its masonry walls has been measured by means of in-plane and out-of-plane in situ tests.
- c) A zone of the Royal Palace in Naples was bombed during World War Two and a vault partially collapsed. Afterward, the damage was repaired and the effectiveness of the reparation intervention has been evaluated by means of loading tests.
- d) The Marqueses Vernasse of Akaia palace, built at the end of the sixteenth century, is located in the historical centre of Naples near the famous Saint Claire Monastery. The palace was devastated by a fire action. Preliminary to the analyses of the behaviour under fire conditions, a campaign of test has been done on the different types of materials, which are tuff masonry, brickwork and stones. The tests have been finalized the evaluate the material deterioration due to fire, by comparing the results of the damaged and undamaged parts.