POLYTECHNIC OF TORINO
FACULTY OF ARCHITECTURE 1
Degree in Architecture
***Honors theses***

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**Experimental tests to determine the parameters which are necessary to the masonry homogenization**

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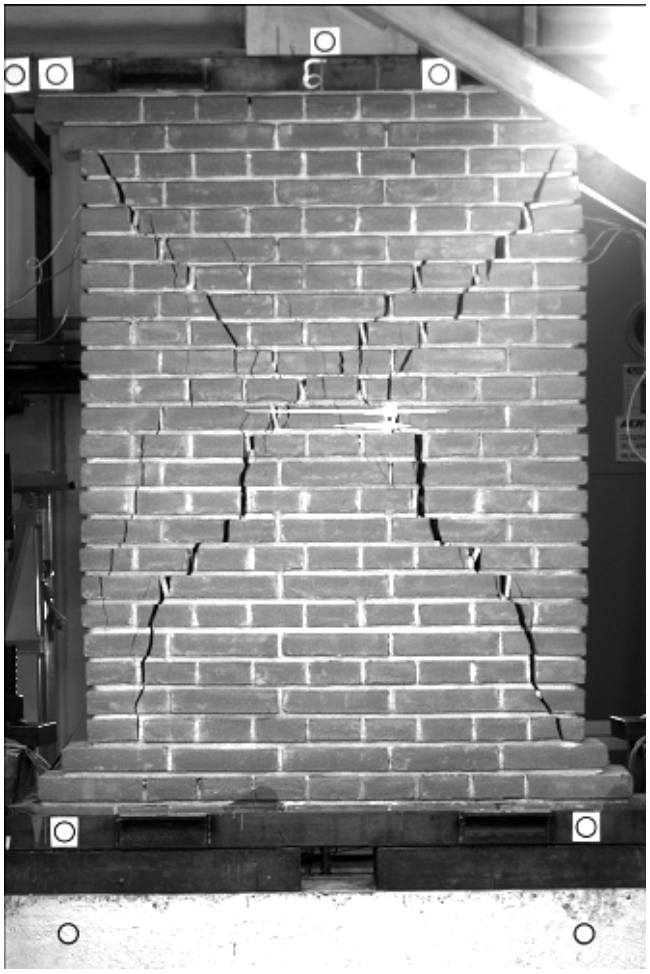
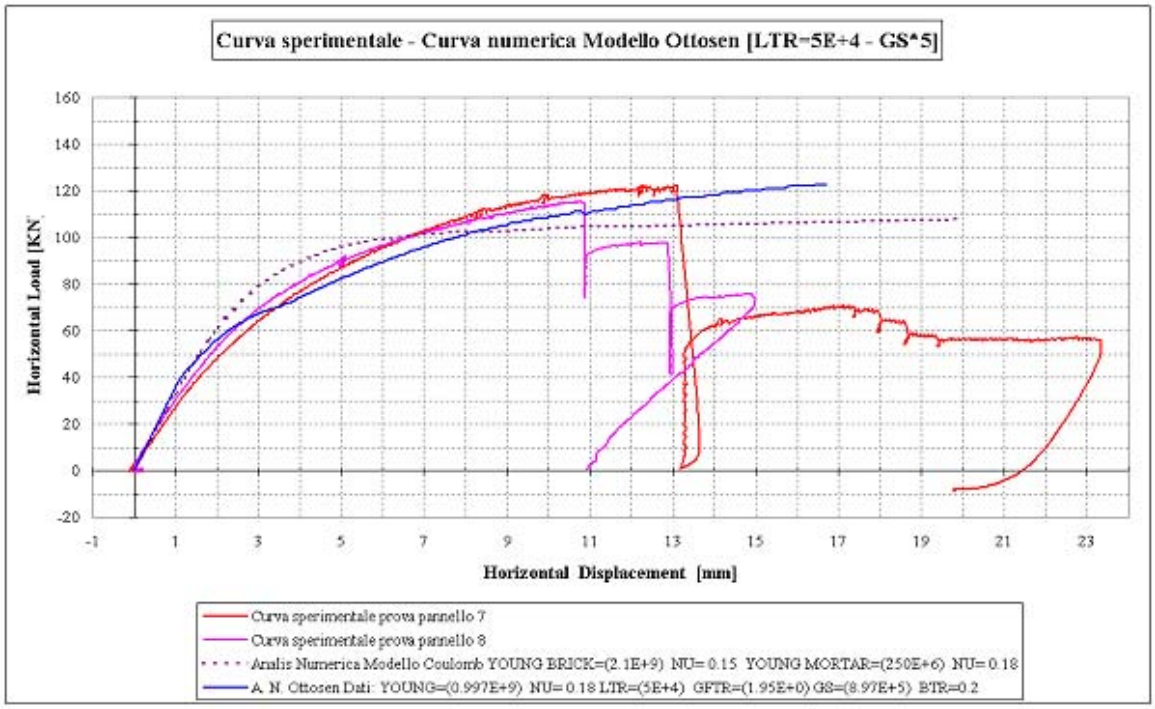
The present thesis is a part of a series of studies faced to the understanding of the structural behavior of the buildings in masonry in order to estimate the seismic vulnerability and it has been developed in the ELSA laboratory (European Laboratory for Structural Assessment) of the Joint Research Center (JRC) of the European Commission.


The activity is framed within a wide program of research based on experimental tests and numerical simulations which are inherent of the behavior of walls in masonry with a geometry representative of shear-resistant walls.



From a methodological point of view we started this work from a bibliographical study of the activities previously made in this field.
The thesis has contributed to the sharpening of the experimental campaign and it comprises the analysis of the results obtained, their interpretation and the comparison with numerical results. The study has also concurred to selection and use of constituent materials already defined from experimental campaigns conducted in other research institutes.
This thesis has been structured in 8 chapters for the complexity of the argument,.
The first chapter is about generality on the behavior of masonries. The main point has been put on the relations between architecture and seismic engineering. Everyone often believes, in fact, that seismic engineering is not among interest of architects but there is instead a complex connection between architectonic planning and seismic behavior of structures.
In the second chapter we find the results obtained from experimentals campaigns carried out on the constituent materials; the same materials have been used to build masonry walls and then they have been tried in laboratory. The experimental basic data are those used in the numerical simulation.
In the third chapter is about analys of test modalities generally used in seismic fields with particular attention to those carried out in the ELSA laboratory.
The fourth chapter is about how the experimental campaign was carried out, the description of the laboratory and the test development.

In the fifth chapter we introduce the models used for the numerical simulation. Two models were used: the Beton model and the Ottosen model, both available for the analysis of homogeneous materials like concrete.
The sixth chapter gives the results of the experimental campaign. The tests carried out have been analysed by data obtained as well as by pictures taken. The various tests have also been compared one another, and this comparison makes the results obtained reliable.
The seventh chapter gives the results of the campaign of numerical analysis. These were been compared to those of the experimental campaign carried out in laboratory. For about numerical analysis it has been used a finite element software, CASTEM-2000, developed by the CEA (Commissariat of Atomic Energies, France) with the collaboration of JRC.
Such analysis was obtained by using two models of damaging, Beton and Ottosen, developed for homogeneous structures, that have given interesting results.
It has been carried out an analysis by taking into account the stress-strain curve as well as the reading of the fissures. The fissures and the stress-strain curve are comparable with the data of the laboratory tests.
In the eighth chapter we find the conclusions: it was possible, especially for the Ottosen model, to gain a series of results which may lead to further surveys.
A scheme of reference of the results obtained is presented here below and this is a comparison between numerical analysis and experimental results.




The thesis has shown that it is possible to characterize, at least for the Ottosen model that has been inquired more thoroughly, a set of parameters which allow a coherent description, even if approximate, of the behavior observed experimentally. Such set of parameters has been identified "a posteriori" by knowing the results of the experimental campaign. However, a logical development has been shown by allowing their characterization also "a priori", based on the data of the materials. It is therefore possible to conclude that a homogeneous model like Ottosen can be used in a first approximation for geometries and complex load histories supplying a valid indication for deepening

critical parts of the structure with experimental tests or more refined, but much heavier, numerical models as those based on single blocks and dissipation joints.

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