



POLITECNICO
DI TORINO

Honors thesis

DEGREE IN SUSTAINABILITY DESIGN

Abstract

**Energetic retrofit of cultural heritage, the case study:
the “Monasterio de Santa Maria de Monfero”, in Galicia,
Spain**

Tutor

Valentina Serra
Carla Bartolozzi

by

Deborah Laggiard
Ivana Mattea Lisitano

Stefano Fantucci
Enrique M. Blanco Lorenzo
Patricia Sabín Díaz

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This is the result of a two-man project, born from common interest and passion, during a training experience carried out abroad, taking part in the Erasmus + program, at ETSAC of La Coruña.

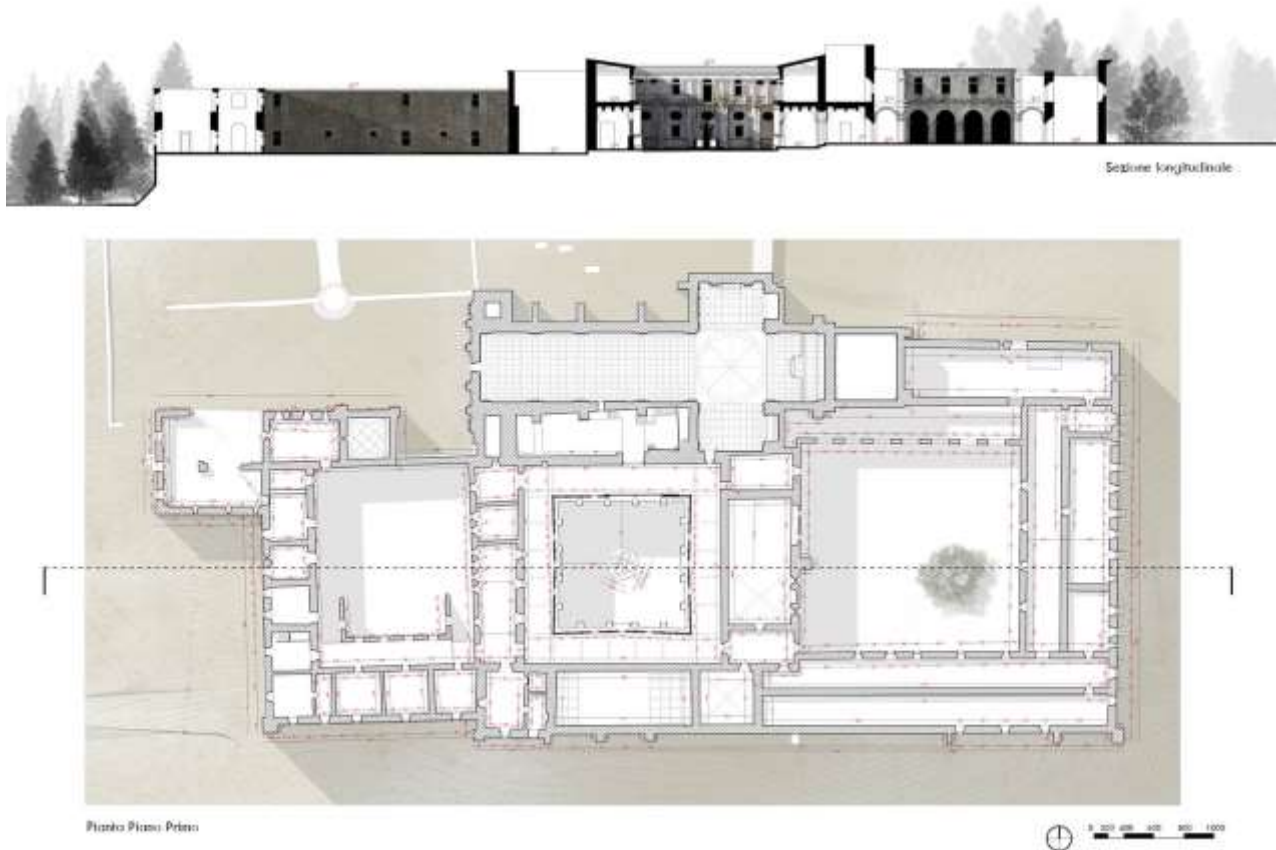
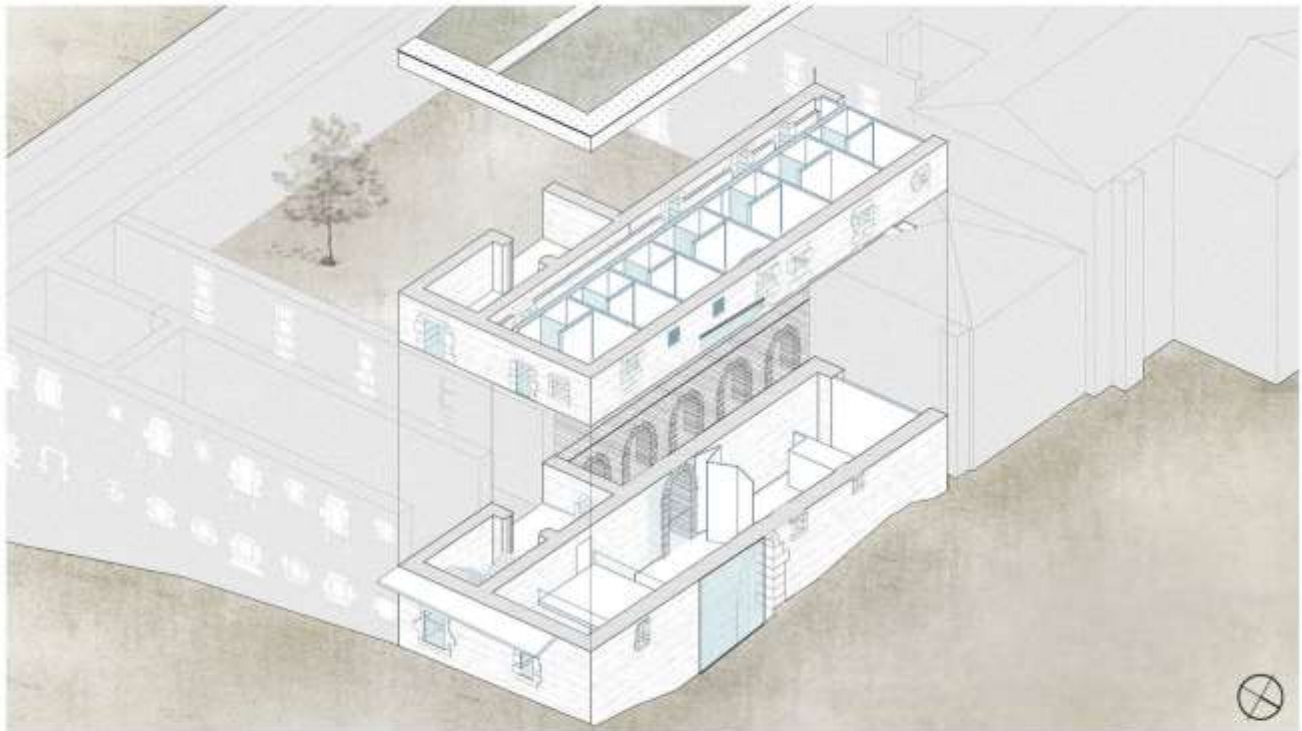


Fig.1 Plan and longitudinal section of the state of the Monasterio de Santa Maria de Monfero

Much of the European cultural heritage has spread throughout the territory and constitutes a network that defines the specificity and the historical memory of a particular place. The retraining in historic building represent, in themselves, an operational declination own concept of sustainability. The current need to integrate energy efficiency requirements with the operating principles of architectural restoration requires a multitude of skills. The intervention of retrofit assumes a higher level of complexity in the case where it deals with restoration of buildings with particular historical and cultural value. In these cases the limits and the quality of the interventions are measured with certain constraints imposed by the protection of architectural values: the possibility of referring to consolidated schemes that support each design phase of a redevelopment intervention becomes crucial.

The work aims to give priority to energy improvement and old building comfort compared with no intervention or adjustment interventions of, to investigate the characteristics of the historical built and how this might relate with the new materials and finally to study the phenomena related to thermo-hygrometric behavior. In particular these goals are analysed in a case study on the Monasterio de Santa Maria de Monfero, Spain.



Legenda delle convenzioni grafiche

Area oggetto di analisi	Coronamento con lastre in pietra granitica	Proiezione della copertura per il nuovo blocco	Nuova copertura verde	Sezione delle nuove partizioni orizzontali	Elementi di nuova costruzione
Area esclusa dall'analisi	Muratura irregolare in pietra calcarea	Muratura in pietra sezionata	Aperture di nuova costruzione	Infilzo a chiusura delle esistenti aperture	

Fig.2 Exploded isometric view of the winning project of the announcement of the Monastery rehabilitation competition, the analyzed portion

The thesis has been developed in two parts: the first, theoretical from the impression, it is processed as a collection of intervention guidelines in historic buildings from the artistic and cultural value and will develop from the practical point of view in the second, with the analysis case study: the Monasterio de Santa Maria de Monfero.

The research questions have been studied related to the compatibility between the permanence of existing and new values that could increase the energy performance of the historic building. Interventions on an existing building requires the knowledge of the its history, size, structure and materials.

They are presented: constructive solutions, steps during the realization and, through energy simulations are defined performance, fuel economy and comfort levels going to investigate the issues related to the presence of moisture.

The study was focused on the intervention of insulation from inside the existing masonry. Different simulation scenarios are compared through both steady state and dynamic regime simulations. The use of dynamic software (WUFI PRO, WUFI PLUS) and in static regime software (EDILCLIMA) were compared different simulation scenarios, both in scale component that environment. In order to assess the most appropriate solution for our case study, Several variables have been taken into account: climate, materials, employment and ventilation profiles.

The study shows the importance of thermo-hygrometric effects and not with the classic thermal behavior of the building as in most on the Normatives. It has also been shown the unsuitability of some building materials, due to their synthetic nature and poor/absent ability breathable interacting improperly with the historic building. What emerges is the need to proceed through the intervention guidelines, which are subsequently applied according to the criterion "case by case" with the collaboration and the comparison between the different experts in the field of science and conservation. In conclusion it is necessary to consider the energy retrofit as part of conservation and protection action and not as a mere intervention directed to reduction of energy consumption.

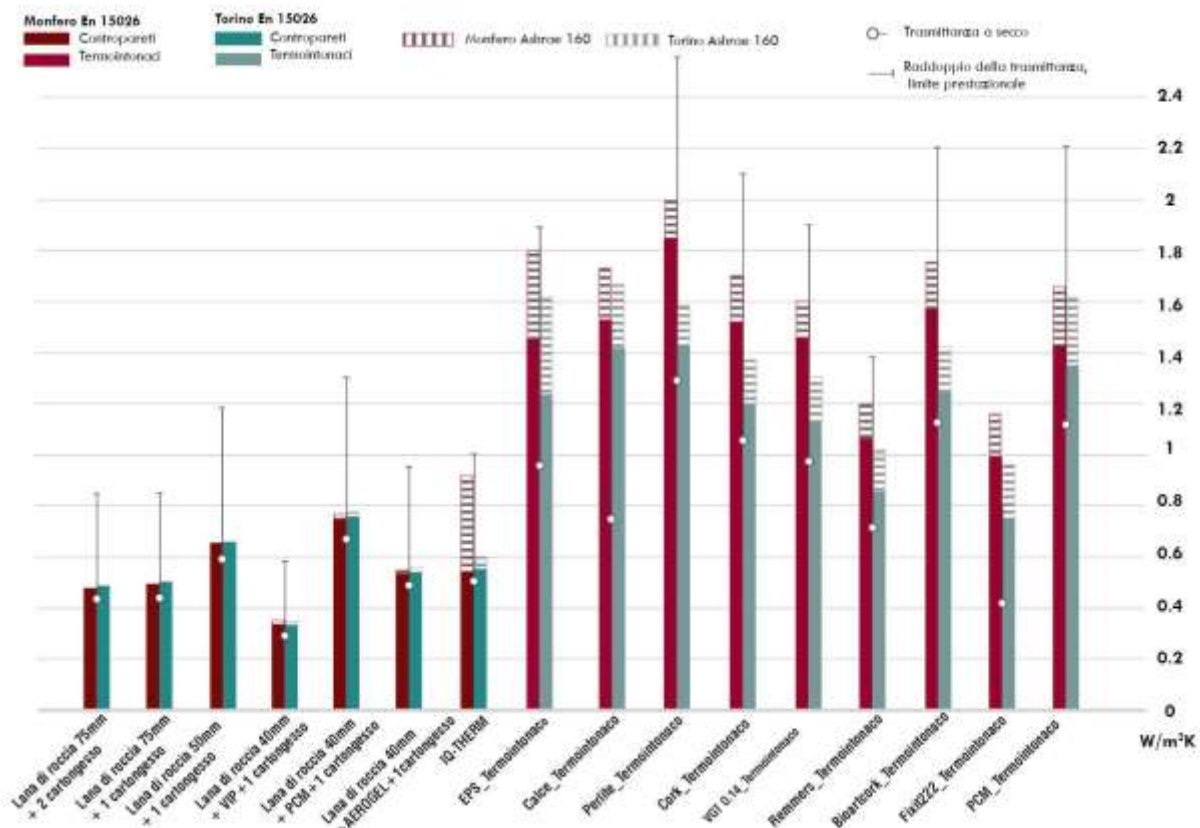


Fig.3 Change in transmittance of the tested configurations

For further information please contact:

Deborah Laggiard s218783@studenti.polito.it

Ivana Mattea Lisitano s214641@studenti.polito.it