



POLITECNICO
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Honors thesis

COURSE OF ARCHITECTURE CONSTRUCTION CITY

Abstract

**Medieval Rocca San Silvestro: 3D modelling from UAV
survey and terrestrial laser scanning to study and analyze
the fortress.**

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This thesis has been realized using the researches developed by the partnership between the Politecnico of Turin and Parchi Val di Cornia Spa, Parchi e Musei Archeologici.

In particular, my thesis is linked with the internship I have done with the DIRECT Team (Disaster Recovery Team) from the 19th to the 23th of September 2016.

During this week, we focused on aerial and terrestrial photogrammetric researches, but also on some terrestrial laser scanning surveys applied to the whole surface of the Parco Archeominerario of San Silvestro, an area in which lots of mining activities had taken place.

In the specific we analyzed the medieval fortress inside the park.

In the first part of my thesis I show the historical and territorial background of the Park in general; and specifically, of the Fortress of San Silvestro.

I have used UAV and LIDAR survey techniques to examine the several parts of the Fortress: firstly I centered the researches on the whole building, but then I analyze the details, comparing the different types of masonry.

These surveys are verified by new instruments of 3D modelling, coming from reality-based technologies and based on articles and essays of Giovanna Bianchi, professor of Christian and medieval archeology at the University of Siena.

My purpose was showing how effective could be the use of modern survey methodologies in the archeological and architectural field. The Fortress seems a good subject, thanks to the fact it was deserted and unused for years, therefore it still preserves its original structure and composition.

The data analysis done in the laboratory has allowed to create a virtual model of the entire Fortress, built from the pictures taken by the drone, and also to work with the LIDAR survey data, used to create the west side of the model.

Finally, the new skills developed by some software up-to-date (as ContextCapture) have been tested: they collect data from different sources (aerial photogrammetric survey and terrestrial laser scanning) to elaborate extremely detailed works.

The results obtained by the combination of these different modern techniques show it is possible and extremely advantageous using UAV and terrestrial laser scanning to study and explain an archeological structure.

We were able to realize some digital models pretty similar to the real one, containing very detailed geometrical and colorimetric information, from which we have obtained some two-dimensional and tridimensional works and real scale models of the whole building.

These two technologies combined have showed how efficient is realizing an integrated model, able to give detailed information at different scales of representation.

Among the advantages of this technique there is the short amount of time we need to obtain data considered that the survey is precise, reliable and complete.

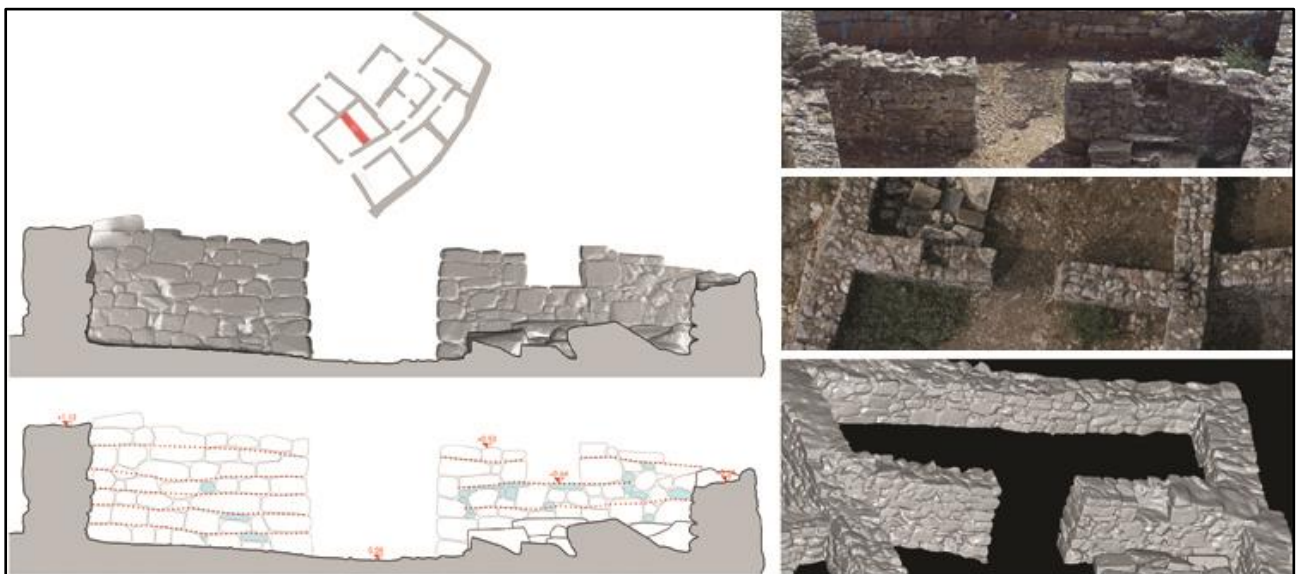
In conclusion, according to the results, the elaborates, obtained working on these researches, allow a detailed analysis of the building considered in the study, and in the specific, of the different masonry described by Giovanna Bianchini during her studies, re-elaborated in this thesis, using different tools.



Views of San Silvestro 3D aerial model.



Residential district map, based from the TLS model and superimposed to the 50 cm equidistance contours lines generated from UAV Digital Surface model (DSM).
Original scale 1:200



Sample tab for the analysis of masonry. A card was produced for each type of masonry, including images of the textured points cloud obtained from the union of UAV and LIDAR data, a mesh image and a vertical section (original scale 1:20). In blue are highlighted the stones that characterize the masonry and in red the laying planes.

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