



POLITECNICO  
DI TORINO

# Honors thesis

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COURSE OF  
ARCHITECTURE FOR SUSTAINABLE DESIGN

*Abstract*

**BIM (Building Information Modeling) approach for cultural  
Heritage documentation. A proposed application in the  
Valentino Castle**

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The aim of this work is to provide a contribution to the critical metric documentation for an historical and architectural interest asset using next-generation technologies, and thus to evaluate the potential of the same in a land of such high interest to the whole community of specialists dealing with the conservation of cultural heritage.

The methodology used is called BIM (Building Information Modeling), which involves the construction of a three-dimensional model of analysed asset which go to accompany different kinds of information.

BIM technology, although born to support with a computer system the entire building process, from design to construction control until the realization of the artifact, was used in order to document and analyse an existing building: in this case it is therefore more appropriate to mention HBIM (Historical Building Information Modeling).

The asset taken into account is the Castle of Valentino in Turin, one of the symbols of the city and seat of the architecture of the Polytechnic University; more precisely, we were occupied with the study of local places in the first basement, currently destined for stores and depots, but that in the past were the reception rooms of the palace.

With this work we wanted to experience the integration between a survey carried out by using tools and more advanced techniques in the field of architectural survey and the virtual reconstruction of the product made by a parametric modeling program that works in BIM and allowing therefore to manage within a single database the 3D model and the information associated with it.

Given the complexity of the elements making up the premises to detect and above all their current condition of partition and the presence of plant and countertops, to return the data in the most realistic way possible, it was necessary to perform scans using a Laser Scanner, tool that it allows to obtain a point cloud, of which it is possible to know the 3D coordinates, so as to obtain spatial data of the rooms.

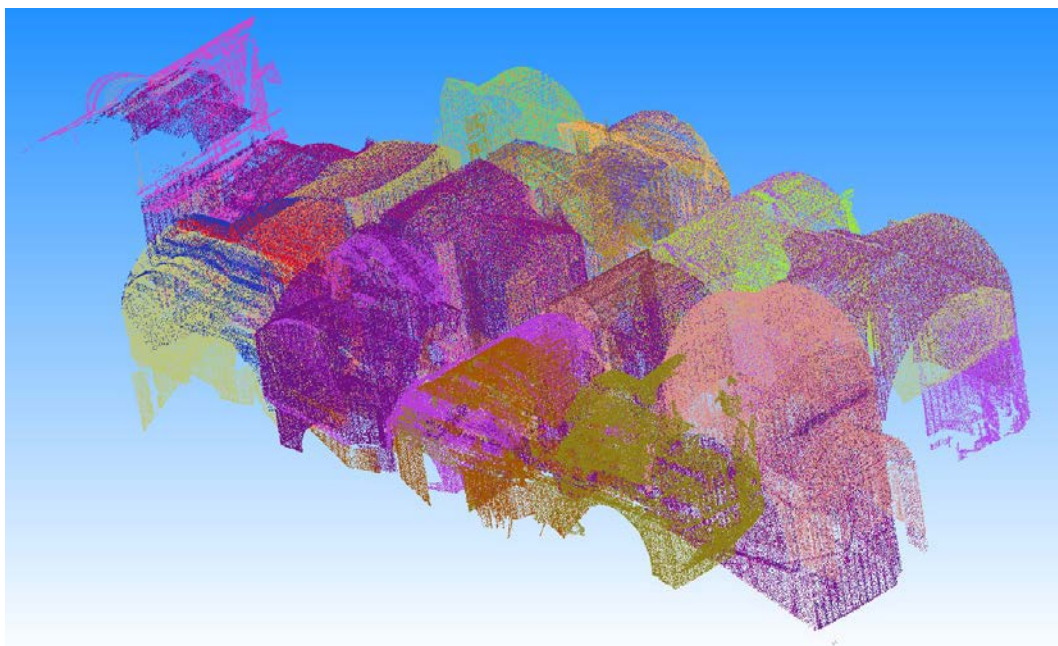


Figure 1: Point cloud of detected locals

As for three-dimensional modeling, used software was Autodesk Revit Architecture, which is mainly used for the design of new buildings, therefore allows modeling of the building elements derived from today's mass production of housing, so managed by well-defined rules and parameters. Since Revit doesn't allow recreating elements directly acting on a point cloud, it has opted for a traditional modeling.

Through software specifically designed to support the processing stage of 2D data from point clouds (Pointcab), from point cloud obtained by survey it was possible to extract the projections on cloud from any direction, for use as graphic support to get classic architectural designs, plant and section, in AutoCAD.

Using these two-dimensional elaborate, to rebuild with Revit elements of the detected environments were adopted modeling techniques making simplifications to created objects, taking into account the limitations in the program in terms of modeling of complex elements and looking for solutions that make it possible to obtain a result closer to the original shape of the elements; these simplifications have not however compromise the conformation of the premises or of individual items, but simply allowed to be as realistic as possible.



Figure 2: Locals modeled with Revit Architecture

The feature that allows to differentiate a BIM from any 3D model concerns the possibility to associate information to created elements: these may relate to any aspect which affects the life cycle of a structure. In our case, we focused on information about the alleged period of realization of the elements and information on the state of preservation. Given its

nature of BIM software, Revit allows you to treat in a timely manner any shaped object inside and it also allows the creation of additional parameters to be used when the needs require to accompany modeling to particularly specific information.

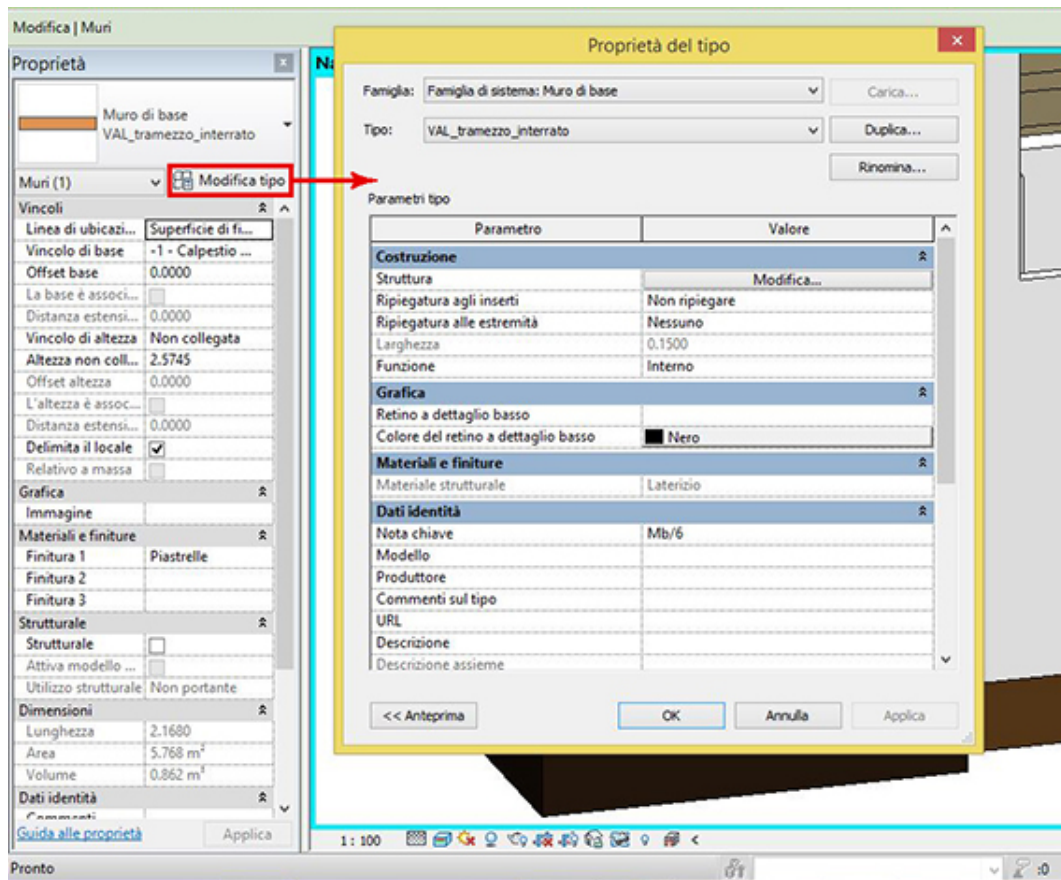


Figure 3: Tables for insertion and control of information

Despite the limitations of the software, the results are regarded as positive, and since the advanced surveys methods are increasingly required in case of maintenance or documentation of historical and architectural interest assets, it would be interesting to see if using other modeling programs, or with the integration of different software, it can achieve an higher degree of accuracy than achieved with this work.

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