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BIM & PROTOTIPAZIONE RAPIDA PER IL PATRIMONIO ARCHITETTONICO D'ARCHIVIO
BIM & RAPID PROTOTYPING FOR ARCHITECTURAL ARCHIVE HERITAGE

Giulia Bertola[1]
ModLab Arch/ DAD - Department of Architecture and Design / Polytechnic of Turin, Italy [1]

INTRODUCTION

Archives of 20th century architecture represent today an important source for scholars to gain a profound understanding of architectural designs.
The interpretation, use and sharing of archive materials are activities aimed at deepening the knowledge of contemporary masters and the different architectural movements.

OBJECTIVES

The present proposal intends to continue a study previously carried out on the project for the "Due case a Capri" by Aldo Morbelli in 1942, through the use of traditional tools and techniques proposing digital reconstruction using the BIM Revit® software.
BIM is applied here as a tool to rediscover, analyse, interpret and highlight architectural design, thus contributing to the recognition of architectural archives as Cultural Heritage.

"DUE CASE A CAPRI", ARCHIVAL DRAWING AND 3D REAL MODEL, AND INTERPRETATIVE DRAWING

METHODS

The BIM model for digital Manufacturing

For this case study, we started with the creation of a BIM digital model generated from the import of archival documents into Revit 2021®. The BIM model provides a complete representation of both geometric and semantic data.
By connecting these data, it is possible to reach a more complete knowledge of the project, inserting inside a single file and 3D model information about the quantities, the geometric and volumetric characteristics and the construction characteristics of the architectural artefact. Being a 3D model aimed at the realization of a full-scale object, it was necessary, before the modelling operations, to define: the printing scale, the levels of detail, the most suitable materials and rapid prototyping techniques.

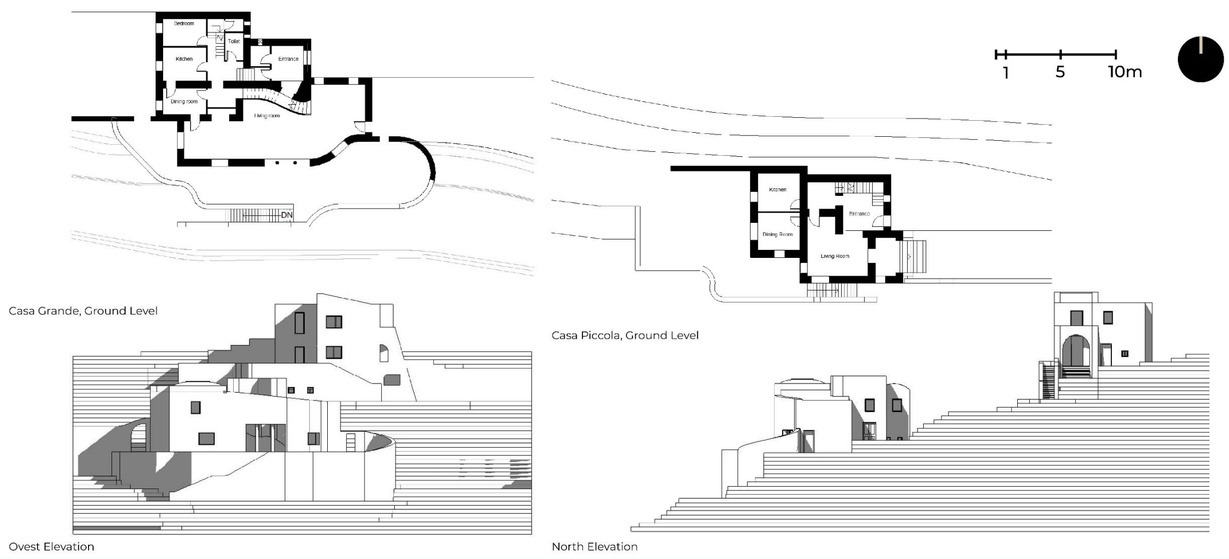
Dimensional choices and file preparation for the printing phases

Depending on the scale of reproduction, real or reduced it is necessary to enrich or simplify the model depending on how it is to be made. Usually the more complex is the shape, the more complex will be the production process.
This case study, being referred to a project not realized, having only drawings in scale 1:100 and not being possible to have additional information about the internal structures and stratigraphies, for the BIM model and the subsequent production of the physical model, it was initially decided to keep the same scale 1:100.
Later, how-ever, it was decided to work at scale 1:200, both for the export of plans, elevations and sections and for the processing of the real model.
The choice was mainly dictated by the dimensional requirements of the printing machines.

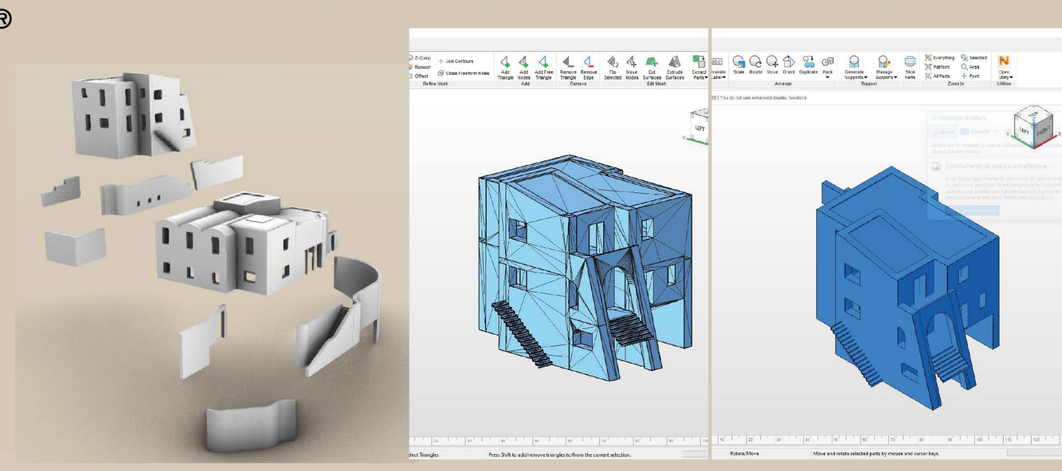
Exporting and editing the file in STL format

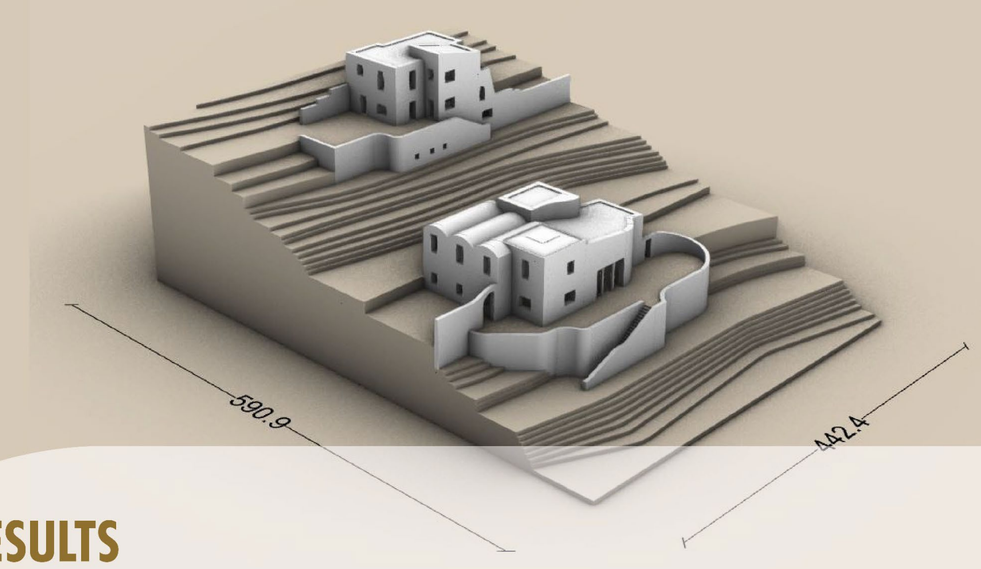
To proceed with the 3D printing, since an STL Exporter for Revit 2021® is not yet available, the file was exported in 1:100 scale in FBX format, imported into Rhinoceros® and then exported into STL. For dimensional issues related to the printing size of the machine, the models has been divided into parts: building blocks and exterior walls.
Sometimes it can happen that during the conversion of the Revit file to STL file, critical issues arise and the exported file may contain errors. These errors can be of various types: holes or gaps, inverted or intersected triangles and they can be solved by Netfabb®, an excellent software for editing STL files that offers a rich set of tools that optimizes workflows and minimizes building errors. At this point was possible to export the correct STL file, open it with Cura® and print it.

"DUE CASE A CAPRI", PLANS, SECTIONS AND ELEVATION FROM REVIT 2021®



THE ORGANIZATION OF THE MODEL BEFORE PRINTING AND STL FILE BEFORE AND AFTER REPAIR OPERATION ON NETFABB®



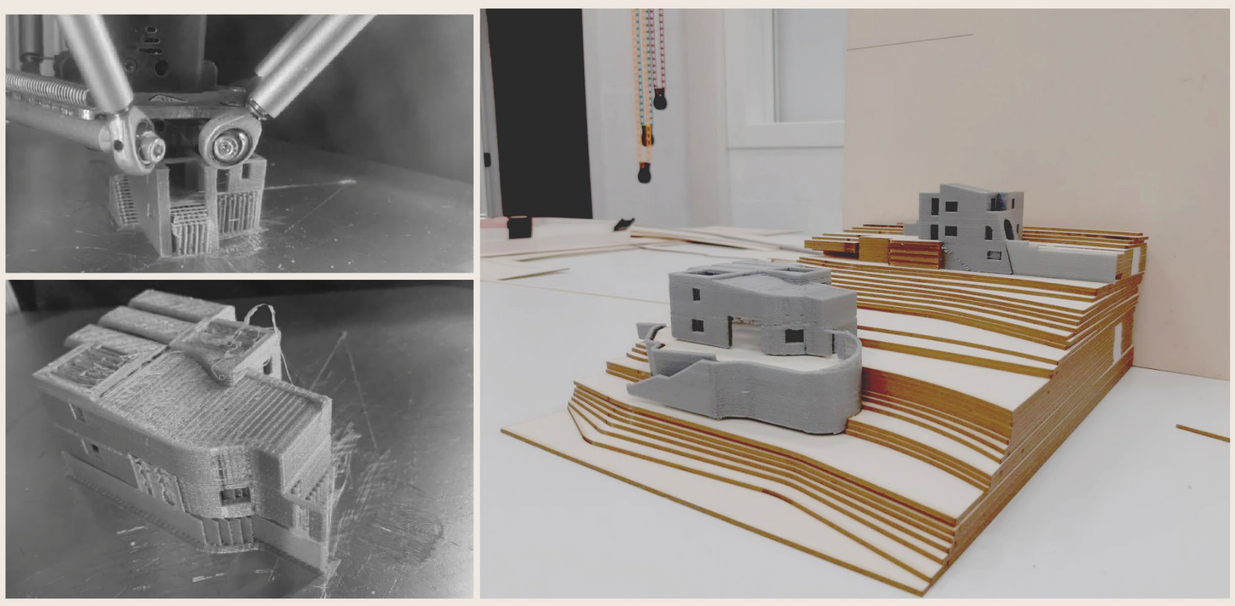


RESULTS

Digital manufacturing techniques: FDM e LBM

The result of this work has been the realization of a full-scale model of the two villas through the use of two digital fabrication techniques: Fused Deposition Modeling (FDM) for buildings and built parts and Laser Beam Machining (LBM) for the ground.

3D PRINTING PROCESS AND FINAL MODEL



CONCLUSION

The present work has shown the methodology of how it is possible to obtain a real model from a BIM project, having within a single file all the information necessary for an in-depth knowledge of an architectural project.
In the scenario of the digitization of archives, the 3D modeling phase allows ex-tending the consultation of archival material, placing drawings and photographs alongside three-dimensional models that can be explored through virtual reality and augmented reality experiences, with the application of different digital interfaces and machine learning techniques, and computer supports.