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# HBIM Applied in Structural Project in the Refurbishing of an Antique Building

**Alcinia Zita Sampaio\*, A Mendes Pinto and Augusto M Gomes**

University of Lisbon, Portugal

**\*Corresponding author:** Alcinia Zita Sampaio, Department of Civil Engineering, University of Lisbon, Lisbon, Portugal.

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## Abstract

The Building Information Modelling (BIM) methodology have been applied in distinct domain of the construction activity. A recent perspective concerning Heritage Building Information Modelling (HBIM) supports of the conservation, rehabilitation or refurbishing of buildings of patrimonial value. As the main fundament of BIM is the generation of virtual parametric models, representing the building project or the existing building with the required accuracy in configuration and mechanical properties, to generate a HBIM model it is necessary to create a library with specific parametric objects. A selected study case, a 19th century house, was analysed. The proposed remodelling design involves an architectural study that leads to the establishment of a solution were wooden floors are replaced by a composite slab. The main objective of the present study is to develop the new structural solution, using BIM platforms. However, the process requires a sequence of steps: modelling the antique building and the new slab elements with accuracy, requiring the generation of new objects; the transference of the analytical model to a software in order to perform the structural analyses; the archive of documentation antique and post-analyses. The project aims to drive the implementation of BIM methodology in construction projects of heritage buildings in Portugal, both through the development of libraries for families of specific parametric objects, and strategies to overcome the inherent limitations of the degree of interoperability found in the case of study.

**Keywords:** BIM; HBIM; New parametric objects; BIM interoperability; Composite slab; Structural project

## HBIM Concept and Application

Currently, one of the most relevant topics among professionals in the field of Architecture, Engineering and Construction (AEC) is the evolution of tools for the development of projects that incorporate greater automation, reducing time consuming and errors. The concept of Building Information Modelling (BIM) has been introduced in the sector, as a methodology that allows the elaboration of projects in a more integrated and optimized way, than the traditional one based in drawings, leading to more efficiency, and encouraging the collaboration within the team of professionals. The methodology is based on the development of a three-dimensional (3D) model, fully parameterized in BIM platforms, containing all the information concerning the project development, allowing all participants to take advantage of the integration of

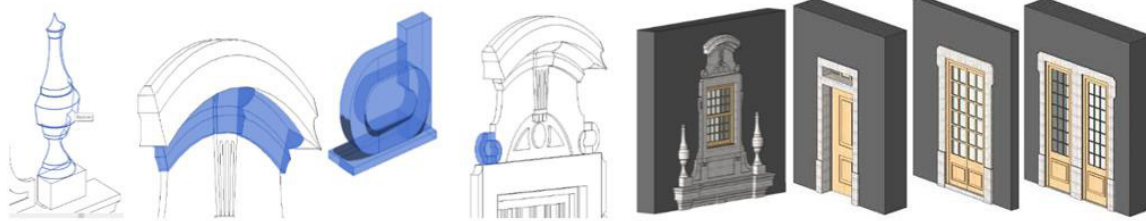
steps throughout the life cycle of a building. In structural project, a frequent limitation concerns the interoperability capacity of the software [1].

A recent implementation perspective, the Historic or Heritage Building Information Modelling (HBIM), is oriented towards buildings of historical value or heritage relevance. Recent research related to HBIM addresses: The standardization of architectural configurations and creation parametric objects representative of applicable and reusable forms in the old construction; The analysis of constructive techniques used in order to identify the materials used and the solutions applied; The definition of alternative structural solutions applied over antique building, focused on the preservation of the patrimonial value of the building; The



archive of registration documents, studies carried out or previous interventions and their availability for consultation by experts involved in the project. In order to represent with accuracy, the geometry and the traditional constructive techniques, it is required to understand geometric rules and antique construction

procedures, retrieved from books of architectural patterns and antique construction guides. Sets of specific parametric object must be generated to allow the generation of old buildings with accuracy (Figure 1).



**Figure 1:** Sequence of the modelling process of a window and modes of distinct doors.

The registered documentary information provides data concerning the characterization of the construction (historical epoch and traditional construction systems), the registration of refurbishing interventions and local inspection reports. In addition, the documentary collection, along with municipal archives, composed of drawings of plants, elevations and cut, referring to different dates and with yellows and reds, bring a complete description of the old building. A practical case of reconversion

of a building of heritage value was presented [2]. A proposal for the adaptation of an old building, located in Lisbon, requiring the reorganization of internal compartmentalization, but preserving their architectural characteristics, illustrated an application of HBIM (Figure 2). As a basis for modelling, it was requested to collect the existing documentation in the Municipal Archive of Lisbon, to obtain photographs from outside and inside of the building and the registration of detailed sketches (Figure 2).



**Figure 2:** Old drawing, BIM model of the building, model of the structural mixed slab element and results of the analytical analyses.

The proposed rehabilitation project maintains the identity of the building, with the preservation of the main part of the building and facades but requires the replacement of the wooden floor of the side wings, in order to accommodate the new reorganization of the wall's location. A mixed slab solution with collaborating sheet metal was selected. The modelling process of the composed slab, realized in of Revit software, begin with the definition of the orthogonal alinements to allow a correct position the metal beams, HE260B (main) and HE160B (secondary). To model the steel waved slices, the options, Component and Steel Deck were selected. The CAD drawing of the steel cross-section of the new element was imported to Revit and an Extrusion function was applied (Figure 2). For the security check, the Robot Structural Analysis program was initially used, but this system does not allow the analysis of a mixed solution. Alternatively, the ETABS software was adopted, which admits the import of BIM models in IFC (Industry Foundation Classes) format. The dimensioning was performed using the BIM model to present the current solution and the proposal solution.

The process of replacing the wooden floor for a composite slab was performed using a set of BIM based software. As a conclusion, the study brings a positive contribution in a HBIM context, even when an alternative structural solution take place.

### Acknowledgment

None.

### Conflict of Interest

No conflict of interest.

### References

1. Sampaio AZ, Gomes Augusto M, Farinha T (2021) BIM methodology applied in structural design: Analysis of interoperability in ArchiCAD/ETABS process, JSEA - Journal of Software Engineering and Applications.
2. Pinto AM (2021) The design of structures in BIM: reconversion of building of patrimonial value. Master thesis in Structures, University of Lisbon, Lisbon, Portugal.