en couverture
Troquet, Quesnoy-sur-Deûle, atelier Hart Berteloot (HBAAT).
Photo Victor Cornu LOCI Tournai (novembre 2023)

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Preserving suspended structures with light façades (1960-1980)

Architectural study and retrofitting proposals

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PhD thesis co-supervised UCLouvain and EPFLausanne, 2020-2023

Abstract. *The present PhD research follows two objectives. Firstly, it aims to meticulously retrace the historical development of suspended buildings, from their rise to fall, starting to fill a recognized gap in the fields of architectural and construction history. The design features and construction challenges that characterize this distinctive architectural type are widely analyzed and critically discussed. Secondly, adopting suspended buildings as practical case studies, the research aims to test alternative retrofitting approaches, exploring and comparing different intervention scenarios. The effective possibility of improving the energy performance of existing buildings, while preserving their most distinctive architectural qualities is finally demonstrated. By recognizing suspended structures as technologically complex objects, the developed framework is intended to be extended, by analogy, to the more conventional building stock.*[1]

Keywords. *suspended buildings · architectural retrofitting · modern architecture · heritage · dynamic thermal modeling*

Résumé. *La présente recherche doctorale poursuit un double objectif. Premièrement, elle vise à retracer minutieusement l'évolution des bâtiments suspendus, de leur émergence à leur déclin, afin de combler une lacune reconnue dans les domaines de l'histoire de l'architecture et de la construction. Les caractéristiques et les défis constructifs de ce type architectural particulier sont ainsi analysés et critiquement examinés. Deuxièmement, la recherche vise à tester des approches alternatives de retrofitting, en explorant et en comparant différents scénarios d'intervention. La possibilité d'améliorer la performance énergétique des bâtiments existants, tout en préservant leurs qualités architecturales, est enfin démontrée. En reconnaissant les structures suspendues comme des objets technologiquement complexes, le cadre méthodologique proposé est pensé pour être étendu, par analogie, à un parc bâti plus large et conventionnel.*

Mots-clés. *bâtiments suspendus · rénovation architecturale · architecture moderne · patrimoine · modélisation thermique dynamique*

The research context

In the light of the current climate crisis, the energy efficiency of the existing building stock is widely recognized as a highly relevant issue. Although the energy retrofitting is strongly promoted by several communitarian policies (EU Commission, 2019), the outcomes of this process remain sometimes questionable. If the thermal performances are generally improved, this is often achieved by permanently altering the historically layered heritage of our cities, frequently hidden behind uniform insulation claddings. It also observed that the diffuse trend is to primarily target 20th century architecture, generally considered energy-inefficient and often neglecting its unquestionable heritage value (Graf, Marino, 2015). This unbalanced situation demonstrates that a broad and transdisciplinary approach is urgently required (Sentissi, Marino, Galbiati, 2023).

1 - The thesis was co-supervised by Professors Giulia Marino (UCLouvain – LOCI, LAB, Super-Positions) and Franz Graf (EPFL Lausanne – TSAM). In 2023, it received the EDAR Doctoral EPFL Distinction for high-quality research and, in 2025, an honorable mention from the *Fondazione Ingegnere Lino Gentilini* in Trento, Italy. Together with Franz Graf and Giulia Marino, the author recently published the book *Olivetti Firenze. Alberto Galardi – Silvano Zorzi. 1968–1972* (Edizioni di Comunità, 2026), a monographic volume devoted to the construction and design history of the Olivetti headquarters in Florence.
This research has received funding from the FSR incoming postdoc grant and is being conducted at UCLouvain's LOCI+LAB under the direction of Professor Giulia Marino.

1 L. Stynen, P. De Meyer and J. Reusens, BP headquarters in Antwerp, 1961-1963. Photo of the construction site. Source: VAI, Antwerp.

Suspended architecture

Within this context, suspended architecture is among the most threatened – and rarely legally protected - building types. From a technological point of view, the construction of suspended buildings entails a sophisticated integration of hanging structures and lightweight curtain walls, resulting in a delicate and pioneering structural configuration (figure 1). This feature makes preservation an extremely challenging practice, especially when considering the constantly rising standards of energy efficiency and safety (Galbiati, 2023).

In historical terms, suspended architecture mainly developed in the decades 1960s-1970s. After the 1980s, cable-supported solutions for buildings were gradually abandoned, and hanging architecture was almost entirely forgotten, even by contemporary historiography.

Firstly, the present thesis addresses a recognized gap in the field of construction history, producing new historical knowledge. The evolution of suspended buildings is thus comprehensively traced, from their rise to subsequent decline, with a focus on engineering, technologies and building components. The acknowledgement of hanging architecture's qualities constitutes the scientific basis for assessing its effective heritage value (figure 2).

The method

The absence of shared retrofitting guidelines in modern preservation and the absence of intervention methods specifically intended for light façades, has in parallel underscored the need to develop cohesive intervention workflows, capable of integrating thermal improvement and architectural conservation. Assuming the 15-year research carried out by the TSAM laboratory of the EPFL

2 Alberto Galardi and engineer Silvano Zorzi, Olivetti headquarters in Florence, 1968-1972. Source: Archivio Alberto Galardi, Milan.

as a starting point (Marino, Graf, 2012; Graf, 2024), the second aim of the thesis is to outline a methodological approach to preserve the cultural values and materiality of modern buildings, while meeting the main energy standards. In this view, a multidisciplinary methodology is outlined, consisting in a step-by-step process, including historical and architectural research, heritage preservation, and dynamic thermal modelling (Galbiati et al., 2021) (figure 3). Additionally, this last phase allows to enlarge the discussion about the effective reliability of thermal modelling results, proposing a framework helping in reducing the gap between the software outputs and the actual building's behavior (Galbiati et al., 2023).

Case Studies

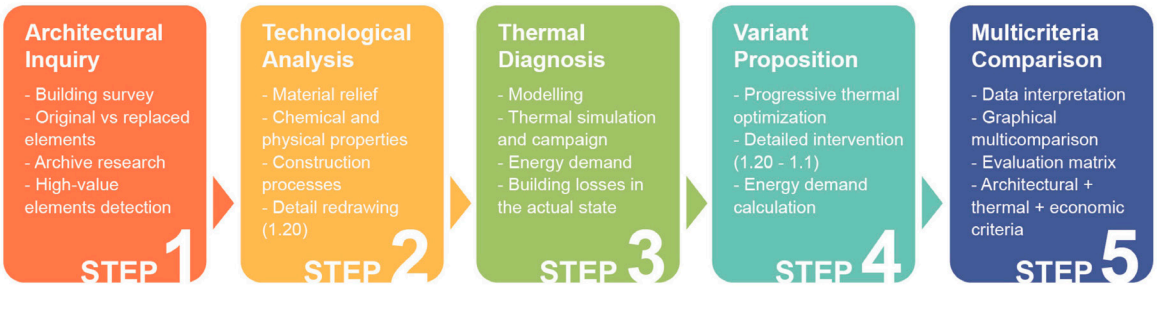
The proposed method is then tested on three suspended buildings: the BP tower in Antwerp by L. Stynen, P. De Meyer and J. Reusens (1961-1963); Chauderon administrative complex in Lausanne by Atelier AAA (1970-1974); and the Olivetti Corporate Building in Florence by A. Galardi (1968-1972). Starting from the deep study of the archival documentation and crossing multiple - and in many cases unpublished - sources, the construction history of each building is meticulously retraced. Different intervention scenarios are then proposed and compared. Detailed redrawing, intended as further research means, allows to understand specific architectural features, and adopted building technologies. In addition, dynamic modelling, preferred over static process, permits more precise energy consumptions' simulations, both in the current and proposed scenarios (figure 04).

Conclusions

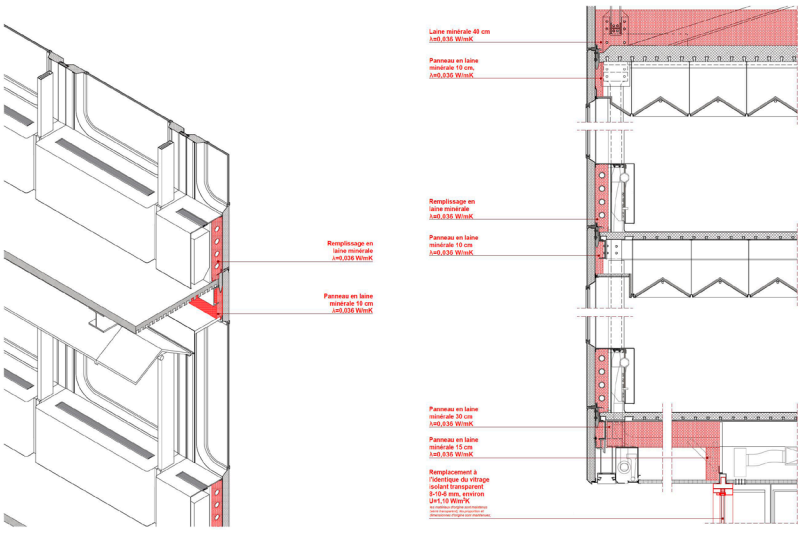
This PhD research retraces the history of suspended buildings' development from their affirmation to their decline. Three emblematic realizations are selected as practical case studies, retrofitting proposals are tested and critically discussed. The obtained results are encouraging, allowing reductions in heating energy consumption up to 70%[1], while respecting the original materiality. Thanks to the proposed framework, the two issues of architectural preservation and energy improvement - sometimes and unjustifiably *a priori* opposed - are finally reconciled. It is assumed that the technologically advanced suspended architecture can provide the basis for a wider-scale methodological application, encompassing more common and less challenging building stock. An alternative approach to the future architectural retrofitting is thus outlined, opening towards a stimulating debate about adaptive reuse and trying to better address the complex needs of contemporary society.
Moving beyond the obtained results, the research is today enlarged to explore solutions for the retrofit of European universities and Campuses, improving energy efficiency, users' experience and heritage preservation (Galbiati, 2025) (figure 05). ■

AI has been used for rephrasing parts of the document.

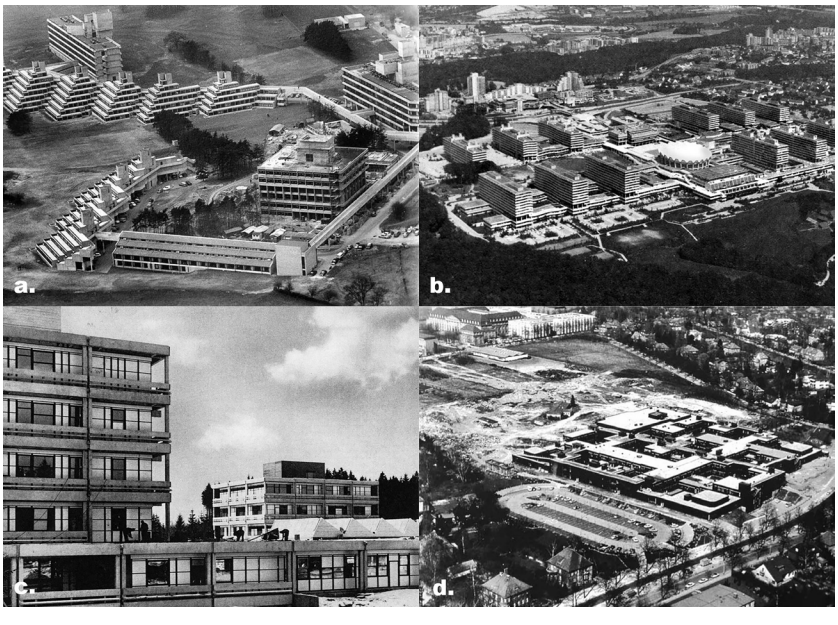
1 - Dynamic simulations are performed by means of WUFIPlus, while thermal bridges are calculated by means of WUFI2D and Flixo. The model inputs are defined starting from archival documentation and combining it with in-situ surveys.



3 The proposed methodological framework divided into five subsequent steps. Drawing by the author.



(4) Atelier AAA, Chauderon Administrative Complex in Lausanne, 1970-1974. Retrofitting proposal. Drawing by the author.



(5) University campuses in Europe. Collage by the author.

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