HERITAGE 2025

INTERNATIONAL CONFERENCE ON EARTHEN AND VERNACULAR HERITAGE
CONSERVATION, ADAPTIVE REUSE AND URBAN REGENERATION

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September 10th, 11th and 12th, 2025 - Valencia, Spain

Passive Thermal Performance Of Glazed Balconies from Northern Portugal vernacular architecture and contribution to a regenerative built environment

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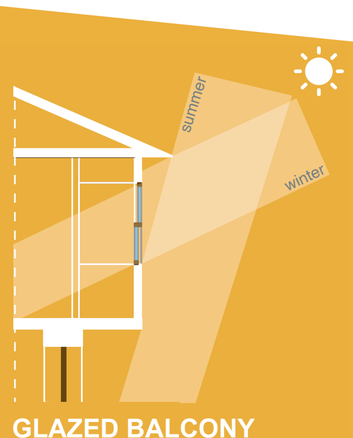


GLAZED BALCONY
Passive Heating Strategy

METHODS

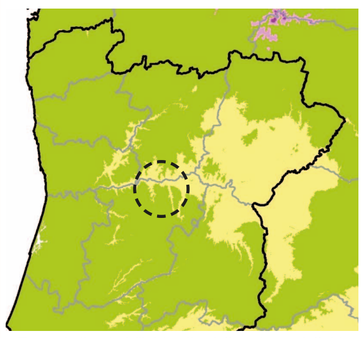
IEQ monitoring + Survey occupants

OCCUPANTS' THERMAL SENSATION

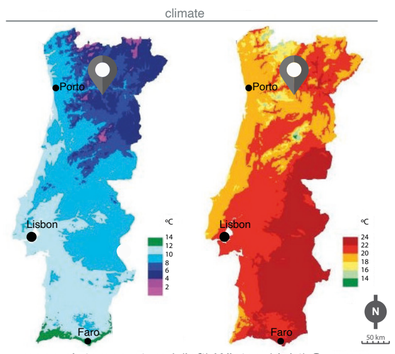
I. SCOPE, SITE & CLIMATE

Features such as glazed balconies can dramatically lower energy consumption and carbon emissions. This research investigates the impact of glazed balconies through a case study of vernacular architecture in Northern Portugal, emphasising their function as passive heating systems that capture solar energy while minimising heat loss. Unfortunately, a lack of awareness about the benefits of this passive approach is leading to the decline of this vernacular technique, which is a key aspect of Northern Portugal's architectural identity. Consequently, this research seeks to raise awareness about the need to preserve this climate-responsive vernacular strategy and explore how the associated knowledge and benefits can be integrated into modern buildings to foster a regenerative built environment.

The case study is located in Salzedas, in the Douro Valley, municipality of Tarouca. The region has a temperate climate (Type C in the Köppen-Geiger Classification), with subtypes Csa (hot, dry summer) in the valley and Csb (dry or mild summer) in higher areas. The annual average temperature is 15 °C, with winter averaging 7.5 °C and summer ranging from 22.5 °C to 25.0 °C. Winters are harsh, with 10 to 20 days reaching 0 °C or below.



Type of climate | (light yellow) Csa; (green) Csb)



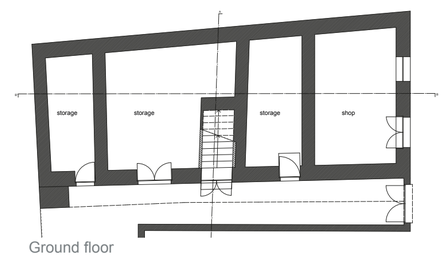
mean air temperature | (left) Winter; (right) Summer.

II. CASE STUDY

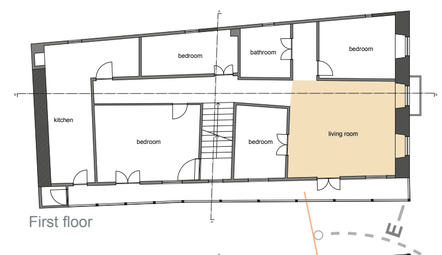
The case study presents an outstanding example of a glazed balcony building, built to enhance heat gains and minimise heat losses. It is a single-family home and spans ≈350 m² over three storeys. Traditionally, the ground floor was used for storage and housing cattle to benefit from their body heat, while the upper floors served as living spaces. Southern façades have bigger openings, an open balcony and a glazed balcony to maximise solar heat gains, while Northern façades have small openings to reduce heat loss. Construction materials include thick granite walls on the lower floors and *tabique* (wattle and daub) on other external and internal partitions. The building allows for cross-ventilation and features a large, well-oriented glazed balcony facing SE and SW, ensuring extended solar exposure. Unique operable wooden shutters below the windows support ventilation during the summer season. The building does not have HVAC system. The findings show glazed balconies reduce indoor discomfort during sunny heating season days. Overheating risks in the cooling season highlight the need for shading and ventilation. The study confirms glazed balconies as effective passive heating in regions with cold seasons and emphasises user behaviour's role in building performance.

Southeast and southwest façades

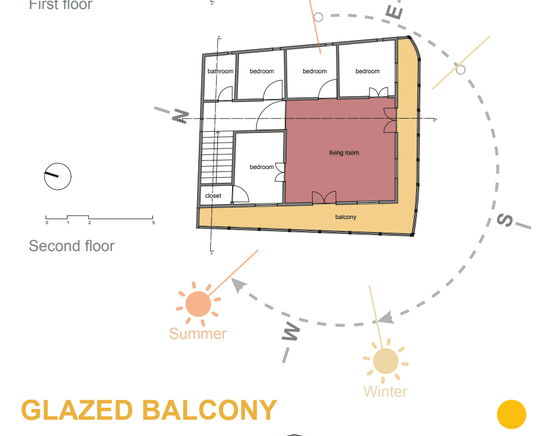
Northern façade



Ground floor

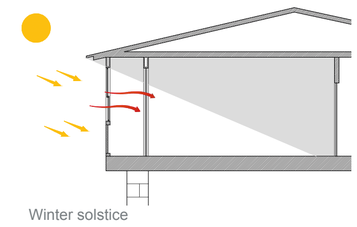


First floor

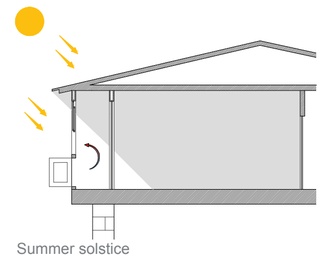


Second floor

GLAZED BALCONY



Winter solstice

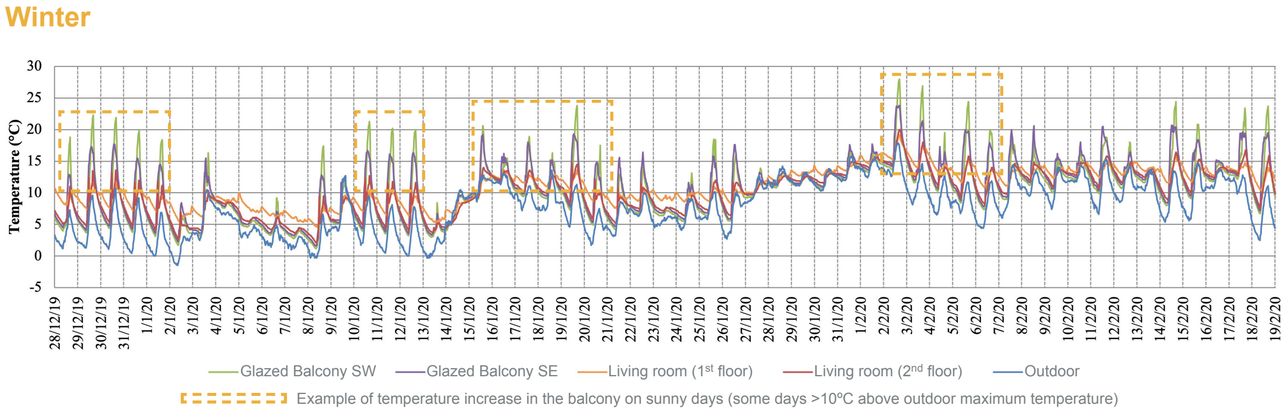


Summer solstice

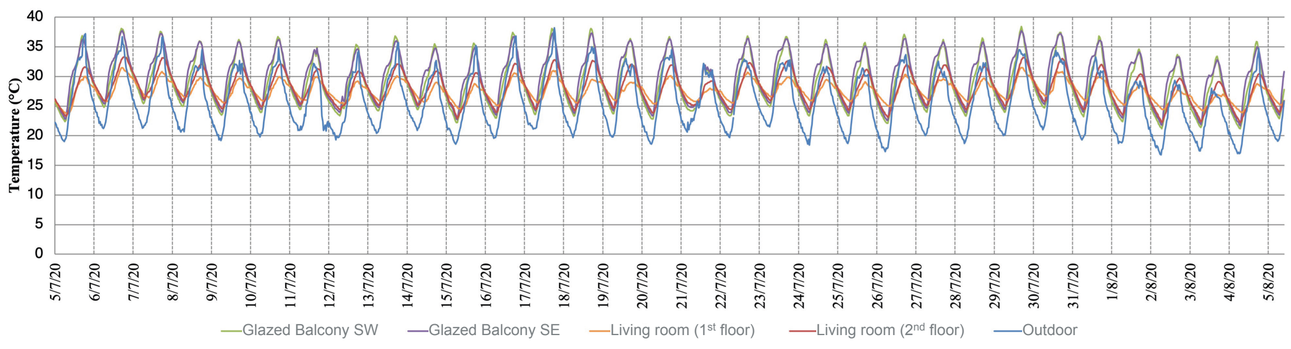
III. THERMAL PERFORMANCE AND COMFORT CONDITIONS

AIR TEMPERATURE MONITORING

Winter



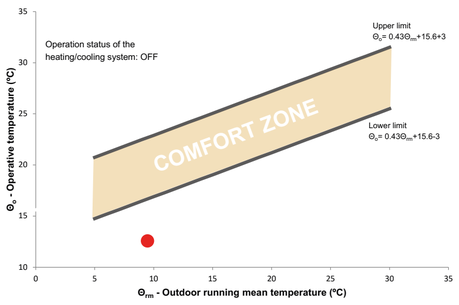
Summer



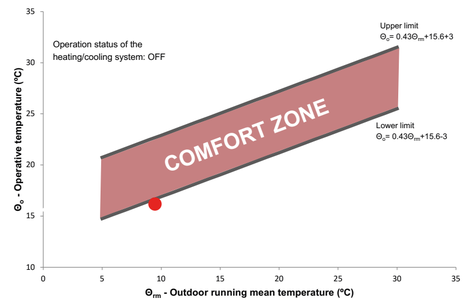
THERMAL COMFORT ASSESSMENT

Winter | adaptive comfort

Living room (1st floor)



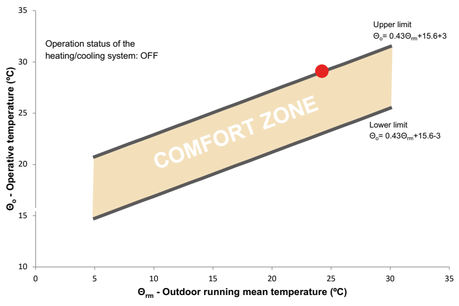
Living room (2nd floor) adjacent to the balcony



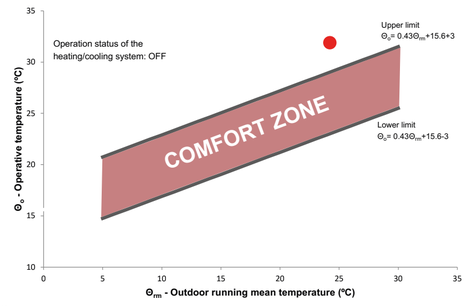
Thermal sensation

Summer | adaptive comfort

Living room (1st floor)



Living room (2nd floor) adjacent to the balcony



Thermal sensation

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Research projects

EARTH FUTURE · re HABITAT · ENACT 15 mC

Support of

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