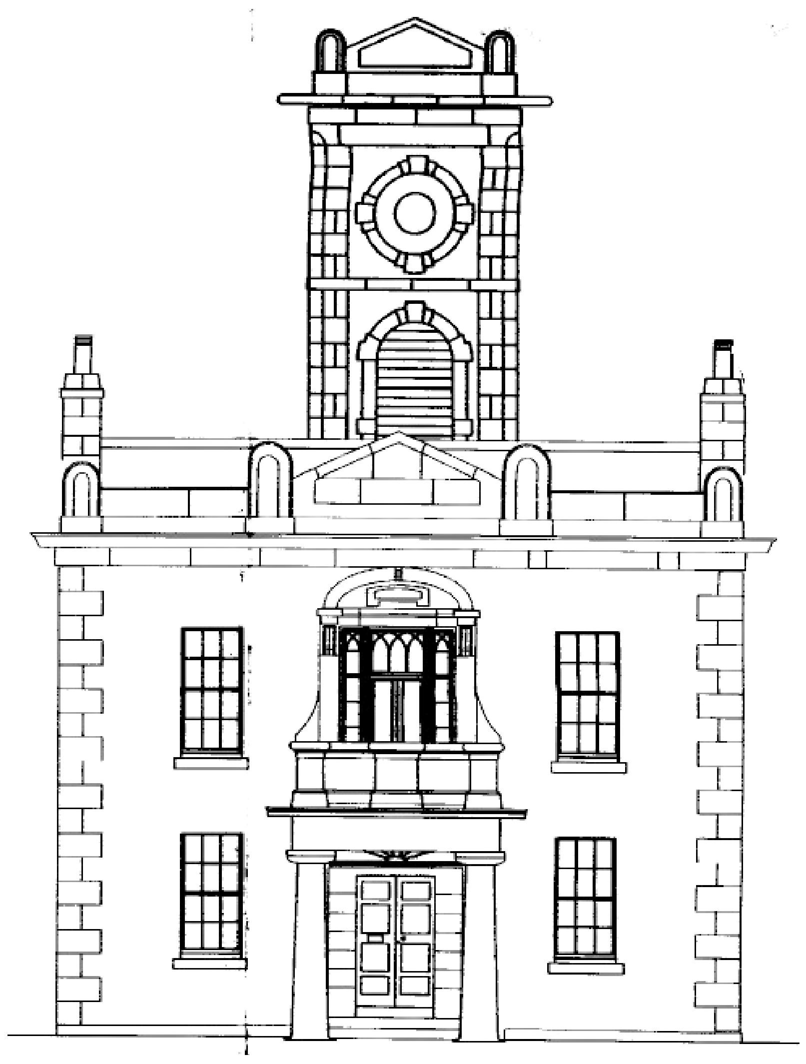
Open House Dublin

# Harbour Master's Lodge
# Dún Laoghaire

## A case study on retrofitting historic fabric while preserving architectural heritage

## Introduction

The Harbour Masters Lodge, originally known as the Harbour Commissioners House, was constructed by George Smith in 1820 at a cost of £330. It features neoclassical architecture, built from Dalkey granite, and is topped with a clock tower and signalling turret.

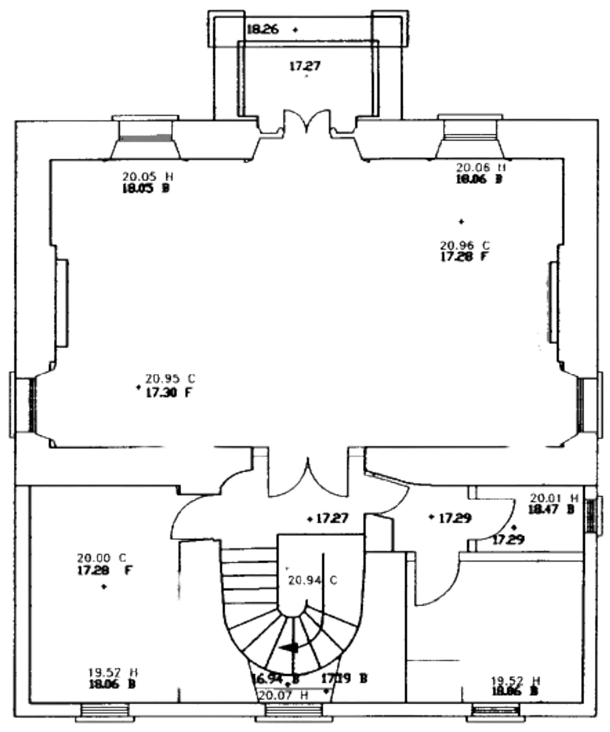


## Architectural overview

The front and side elevations feature a roughcast render, while the rear elevation has a smooth render. Granite quoins are present on the front and sides, with a granite frieze, cornice, and parapet. The parapet's center is adorned with a stylized granite pediment, flanked by round-headed acroteria, which also mark the corners. The clock tower extends two stories above the stair hall, with walls made of handmade brown brick. Some areas retain the original lime mortar with tuck pointing. Granite elements on the tower include canted quoins, a string course, cornice, pediment, and roundels.

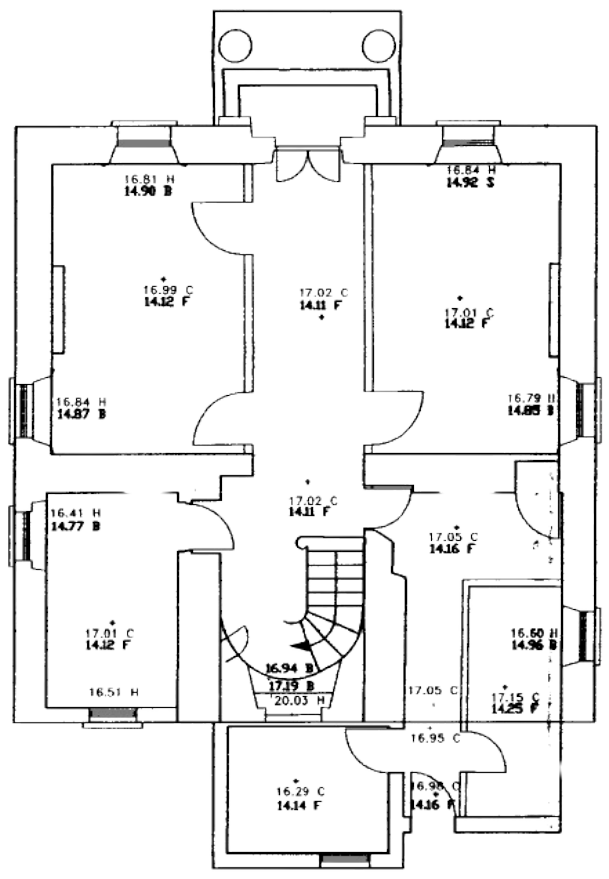
The building features square-headed window openings with rendered reveals and granite sills. Original sash windows remain on the front and sides, including a hubbed six-over-six pane sash window in the stair hall. A granite balcony above the portico includes glazed double doors with Gothic detailing on the side lights and overlight, set in a finely detailed granite surround with modillion accents. An original window is located in the western bay on the ground floor. The first floor rear elevation has late 19th-century sash windows. The clock tower has two openings per side: round-headed timber louvered windows with granite surrounds, and upper blind roundels. The entrance door features a segmental-headed fanlight, granite jambs, and a panelled timber leaf. The rear scullery door has been blocked, and a new timber-sheeted door has been added to the east.

The lodge, once the Harbour Company's head office, was vacated during the Harbour Yard development. This allowed for interior renovations and the addition of a modern two-storey extension at the rear, covering the original garden space.



First floor

*Images of windows pre-retrofit*



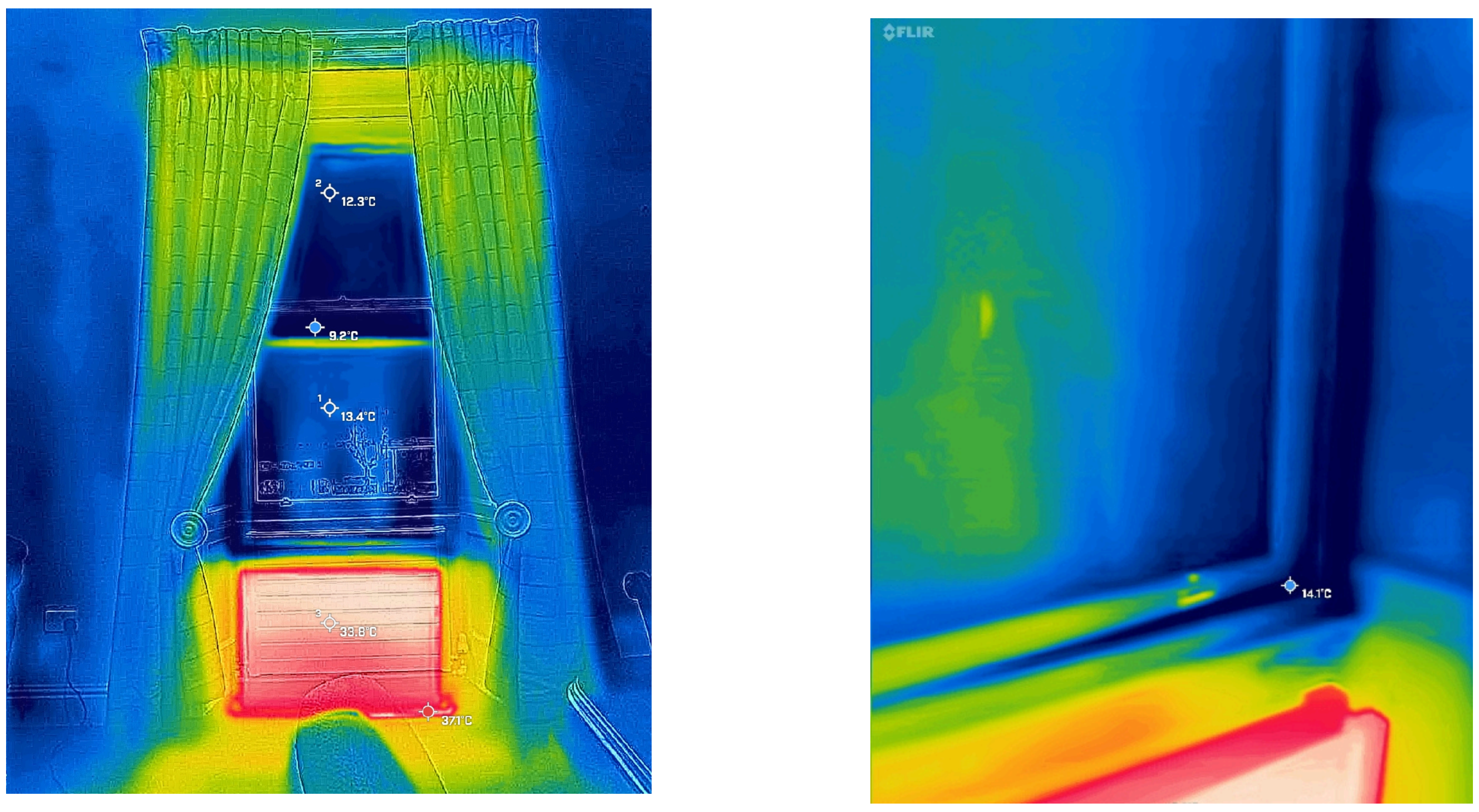
Ground floor

**Open House Dublin**

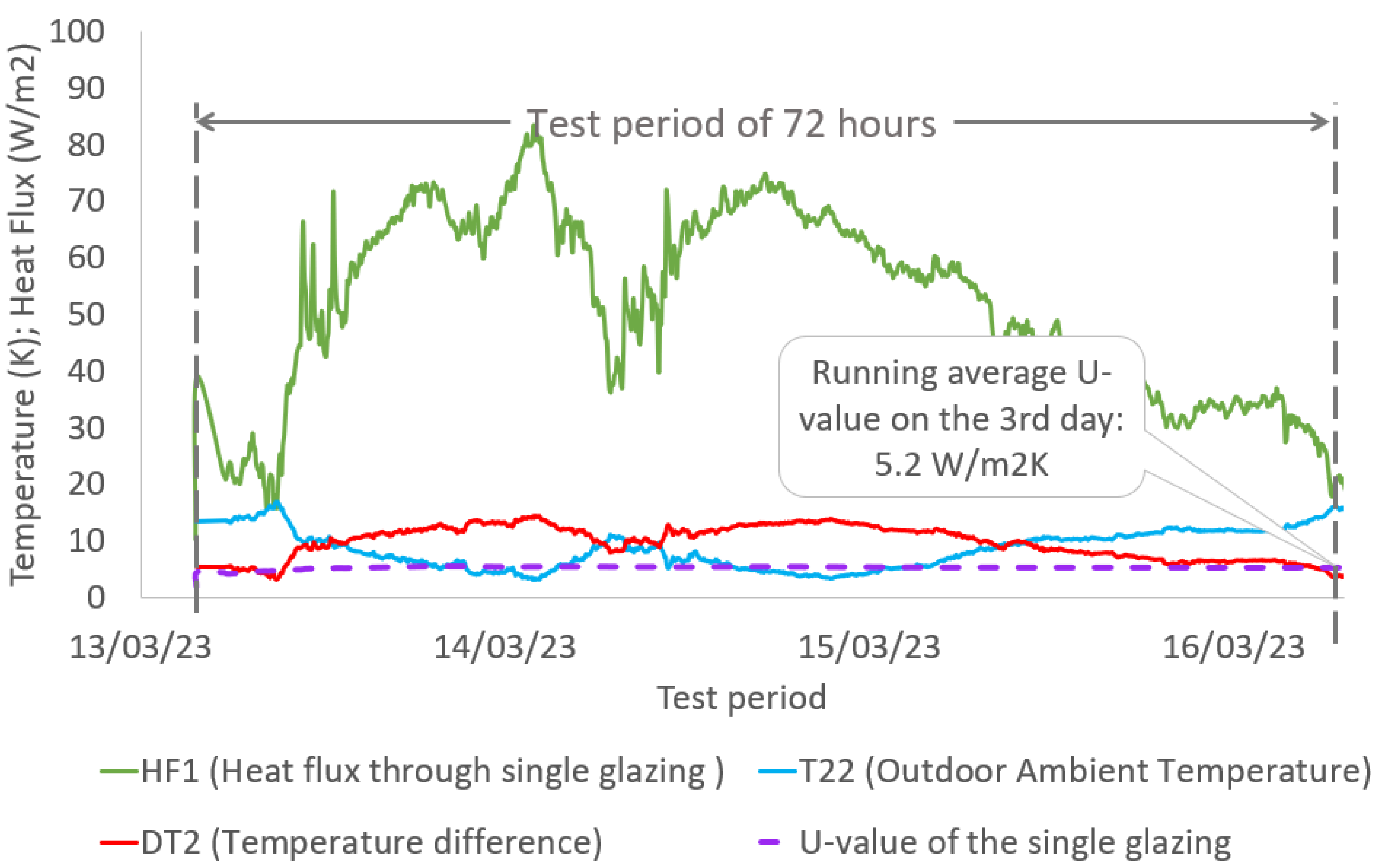
# Pre-retrofit monitoring

**Heat flux sensors** measure energy flux onto or through a surface in [W/m²]. The in-situ heat flux monitoring (HFM) can accurately measure the heat flux through existing building walls and windows using indoor air temperature, outdoor air temperature, indoor wall surface temperature, and temperature difference between indoor and outdoor air.

Thermal transmittance and surface temperature monitoring sensors attached to the single glazing and wainscot panels behind the radiators.



a) Thermal image illustrating surface temperature of single glazing as low as 9 °C at junctions. b) Thermal bridges observed at the corners suggesting heat loss through gaps.




Effective u-value of single glazed windows: **5.2 W/m2K**

Effective u-value of wainscot panels: **1.2 W/m2K**

# Methods

The **u-value**, also known as **thermal transmittance**, measures how well a building element (such as a wall, window, roof, or floor) conducts heat. It indicates how much heat is lost through a material, making it an essential factor in determining the energy efficiency of buildings. The lower the u-value, the better the material is at insulating and preventing heat loss.

This in-situ testing is non-invasive: two small sensors are taped to a window, two small sensors are taped to the exterior and interior of the building and are connected to the others.

The smaller the u-value, the lower the heat flow through the building component.

High u-value

Low u-value

# Retrofit challenges

- Preservation of Historical Integrity
- Regulatory Constraints
- Structural Limitations
- Material Compatibility
- Energy Efficiency Upgrades
- Cost and Expertise
- Unforeseen Issues

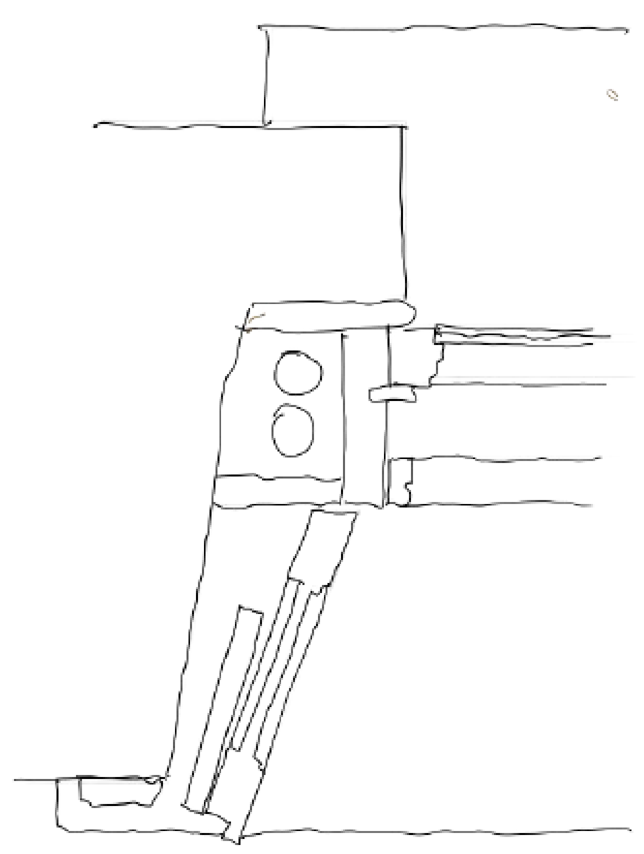
Retrofitting historic windows can be a delicate process, as it requires balancing modern performance improvements with the preservation of the building's original character.

Internal features in historic buildings reflect the craftsmanship and architectural styles of their time. These elements contribute to the building's character and heritage value and must be carefully preserved or restored during renovation or retrofitting.

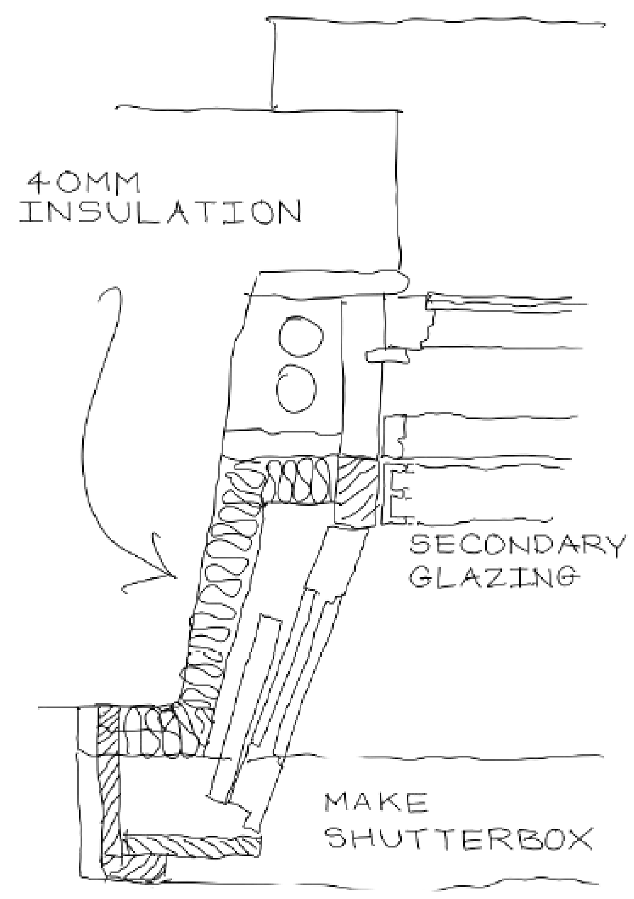
Open House Dublin

# Retrofitting works

During the retrofitting process, the existing windows were removed and refurbished by a skilled team of fitters. New single-glazed panes were installed in the original historic frames to maintain their aesthetic and historical significance. Secondary glazing was added on the internal side of the window frame.



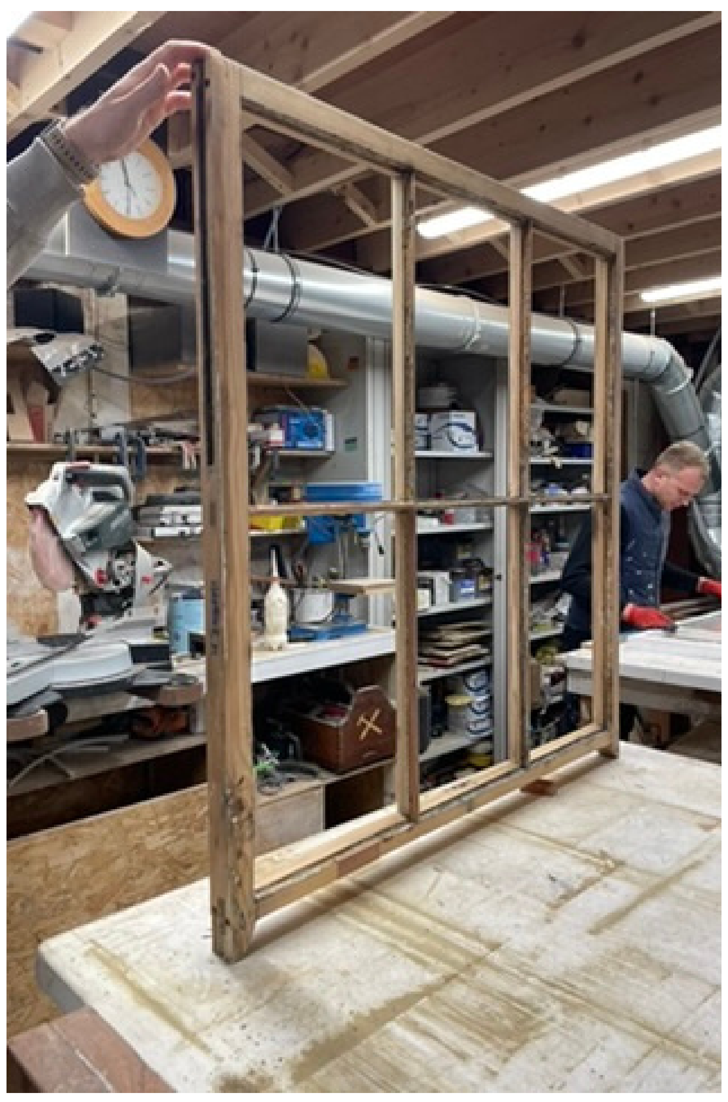
WINDOW 1 EXISTING




WINDOW 1 PROPOSED

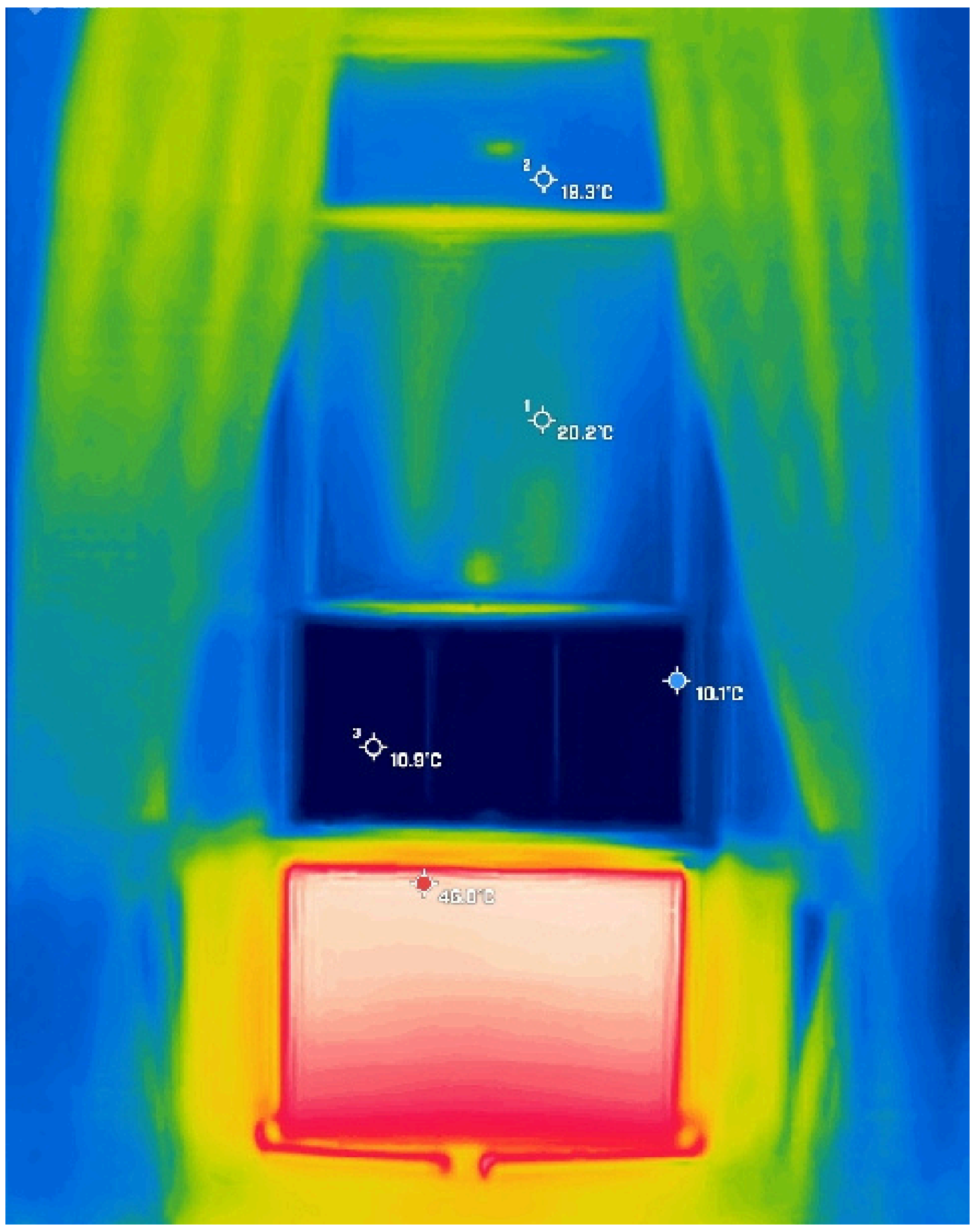
The wainscot panels beneath the windows were removed to allow for insulation to be applied underneath. The shutter were also taken out to allow for insulation. Each window on the north elevation was fitted with a different insulation system, enabling the evaluation of the best solution based on post-retrofit in-situ heat flux monitoring data.

*Images of the retrofitting works undertaken by Mac's Joinery and DLR County Council*



# Open House Dublin

# Post-retrofit monitoring

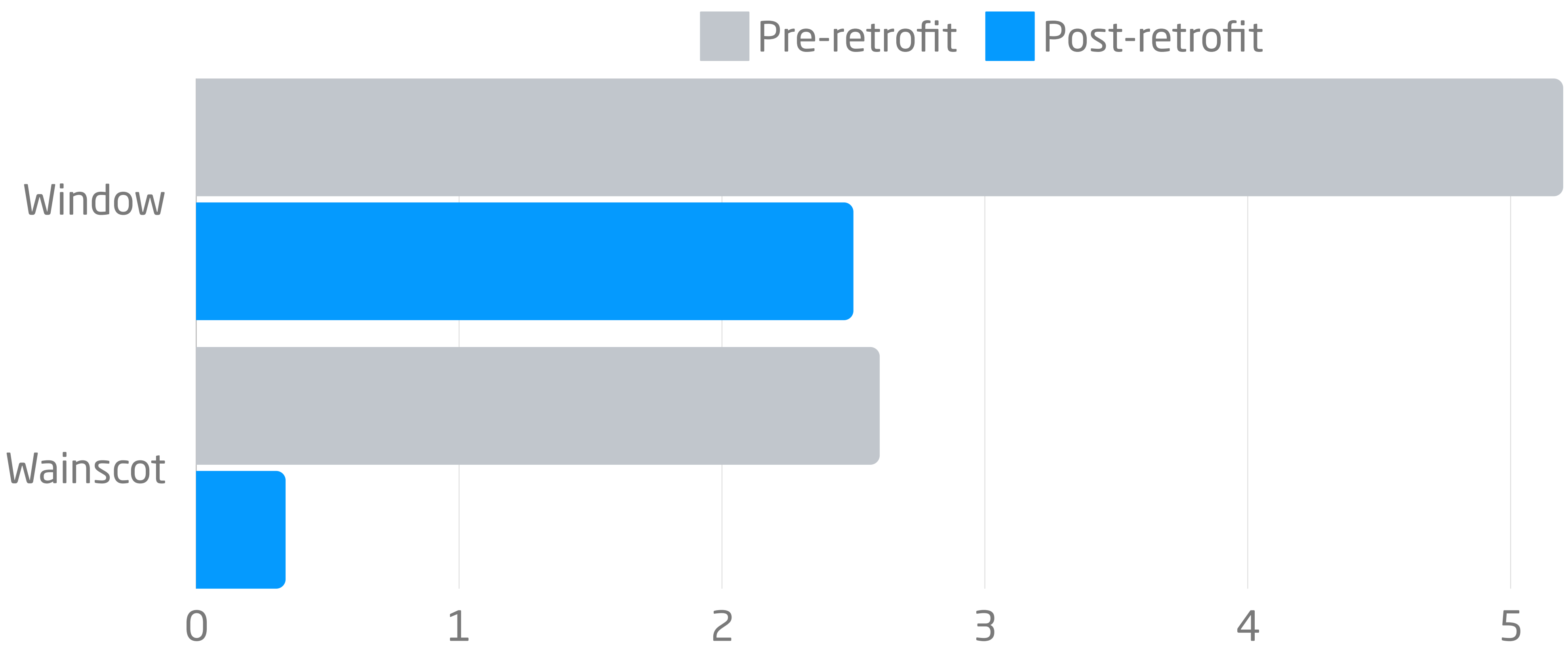



Thermal image of the window post-retrofit illustrating nearly 10 °C between (half opened) secondary glazing and single glazing behind it.

Upon completion of the retrofit works, which included:

- **Window reconstruction**
- **Secondary glazing**
- **Insulation behind wainscot**
- **Insulation behind shutters**

new tests were completed with the same method.




Effective u-value results pre- and post retrofit

**The results show a ~50% reduction in the effective u-value of windows and 77%-87% reduction in the case of the wainscots.**

**Pre-retrofit**

**Post-retrofit**

MAC JOINERY & CONSTRUCTION LTD

dlr Comhairle Contae County Council

Irish Architecture Foundation

UCD DUBLIN

PROBONO