The use of infrared thermography for the assessment of buildings’ insulation and energy performance

Professor Amin Al-Habaibeh
Professor of Intelligent Engineering Systems

iSBET- Innovative and Sustainable Built Environment Technologies
School of Architecture, Design and the Built Environment
Nottingham Trent University, UK

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Nottingham Playhouse

This presentation outlines key thermal performance characteristics of Nottingham Playhouse building. Infrared thermography has been used to qualitatively evaluate the thermal insulation of the building before and after building’s improvement.
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The Research Problem

Style

Energy

Architecture

Consumption using infrared thermography
Energy in buildings – some facts

➢ In the UK, buildings are responsible for almost 50% of the UK energy consumption.

➢ Major part of this consumption is for heating and air conditioning of buildings.

➢ Insulation in buildings could have significant effect on reducing energy consumption and improving efficiency.

➢ It is usually cheaper, at common energy prices, to save an extra unit of energy than to generate it.

➢ In most countries including UK, construction activity ranges from 1 to 3% of existing number of buildings per annum, efficiency gains in new buildings only marginally reduce future energy consumption.

➢ Modification of existing buildings could reduce energy consumption by an average of 25%.
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Heat losses

- The work has been done using FLIR E25 infrared camera on 3 December 2010 at about 6 PM with ambient temperature of approximately 0 °C.
- The single glazed windows have been found to be one of the major contributors to heat losses, there is about 8 to 10 °C difference which indicates a significant heat loss and poor insulation.
When examining the windows internally, it becomes evident that the frames act as a thermal bridge to the outside temperature and that the windows are at very low temperature in comparison to the panels.
Door problems, air leakage and poor insulation.
Nottingham Playhouse

The doors are major contributor to heat losses.
The Auditorium

The Auditorium thermal performance is much better than the rest of the building.
Heat loss in the Auditorium following switching the heating system off.
The results indicate that the following are key components that contribute to heat loss:
1. The doors of the building.
2. The single glazed windows.
3. Steel structures and frames that provide a thermal conductor between the internal and external sides of the building.

The Auditorium seems to have relatively good insulation performance.
Date of Survey before modifications: 3 December 2010 (PM)

Date of Survey after modifications: 12 December 2014 (PM)
In 2010 the single glazed windows have been found to be one of the major contributors to heat losses, there is about 8 to 10 degree C difference which indicates significant heat loss and poor insulation.

The external layer of glass of the windows is colder which indicates a much better insulation.
When examining the windows internally, it becomes evident that the frames act as a thermal bridge to the outside temperature and that the windows are at very low temperature in comparison to the panels.

The internal layer of the glass is much warmer now indicating a much better insulation. But frames still act as a thermal bridge.
The internal layer of the glass is much warmer now indicating a much better insulation. But frames still act as a thermal bridge.
Nottingham Playhouse

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Improved insulation due to the double door system (when door closed)
Nottingham Playhouse

2010

2014

Lights and reflections

Improved insulation due to the double door system (when door is closed)
Nottingham Playhouse
The main doors (internal view)

2010: The doors are single glazed with poor design

2014: The double doors show much better insulation
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Double doors have improved insulation
(and air infiltration particularly when doors are closed)
Nottingham Playhouse

Much improve insulation in the restaurant section
This report has outlined qualitative key thermal performance characteristics of Nottingham Playhouse building between December 2010 and December 2014.

Infrared thermography is used to evaluate the thermal insulation of the building.

The results indicate that key improvements have been done to the insulation of the building and this is evident in the infrared images; significant energy savings are expected.

Despite the improvement in the design of the doors, the doors design could still be improved further to reduce air infiltration when doors are in use (e.g. using revolving doors if possible particularly in the restaurant section of the building).

Further comprehensive study and analysis is needed to quantify the energy savings that could be achieved on the long term.
For any questions, please contact:

Professor Amin Al-Habaibeh
Nottingham Trent University,
Tel: 0115 848 2564. email: Amin.AL@ntu.ac.uk
www.ntu.ac.uk