Case Study

Brunel University | School of Engineering and Design

BRUNEL UNIVERSITY

School of Engineering and Design

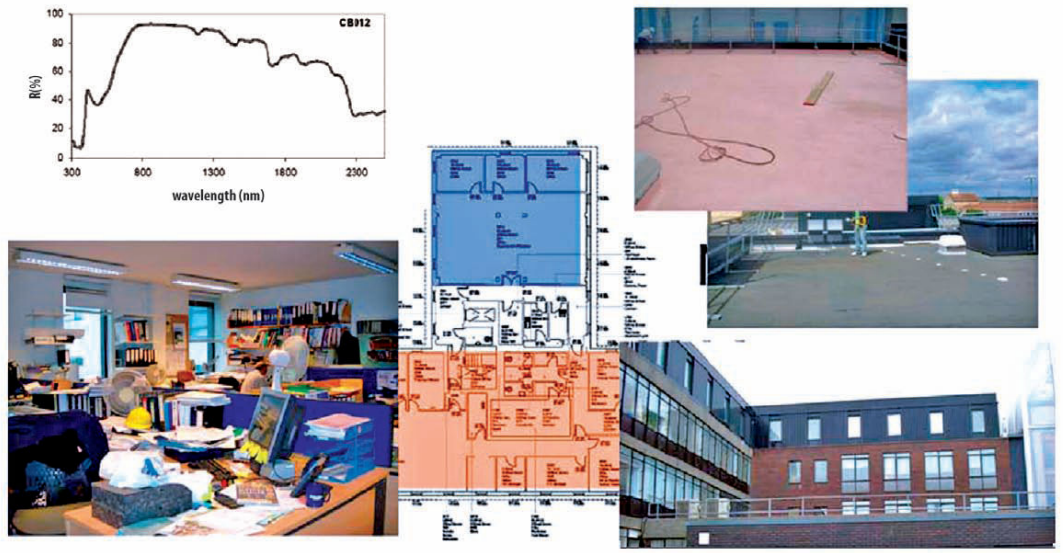
Cool roof technology in London:
An experimental and modelling study

This case study examines the impact from the application of the reflective COOL BARRIER paint on a flat roof in a naturally ventilated office building in the area of London, UK

"COOL BARRIER ROOF ARE A PROMINENT TECHNOLOGY BRINGING A RANGE OF SUSTAINABILITY BENEFITS TO THE BUILDING"

The building

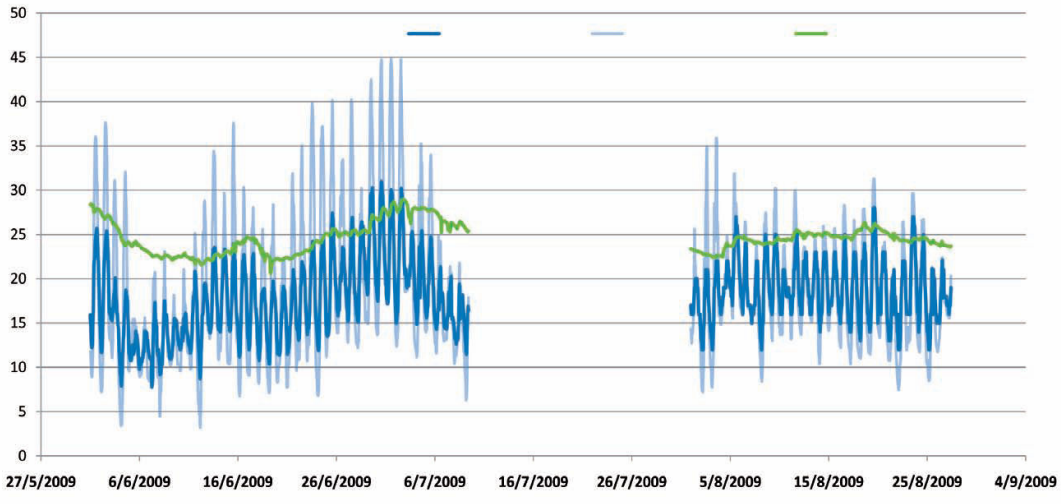
The Estate Office at Brunel University consists of an open office area and three separate office rooms and is located at the top floor (flat roof) of a four floor building constructed in 1995. The roof is made of a 0.15m thick concrete slab with a 0.04m insulation layer on top covered with a layer of water proofing material (asphalt). The external wall structure is made of concrete block work and is insulated externally.



Floor plan and photos of the office and roof including the solar reflectance of the cool material applied

The building

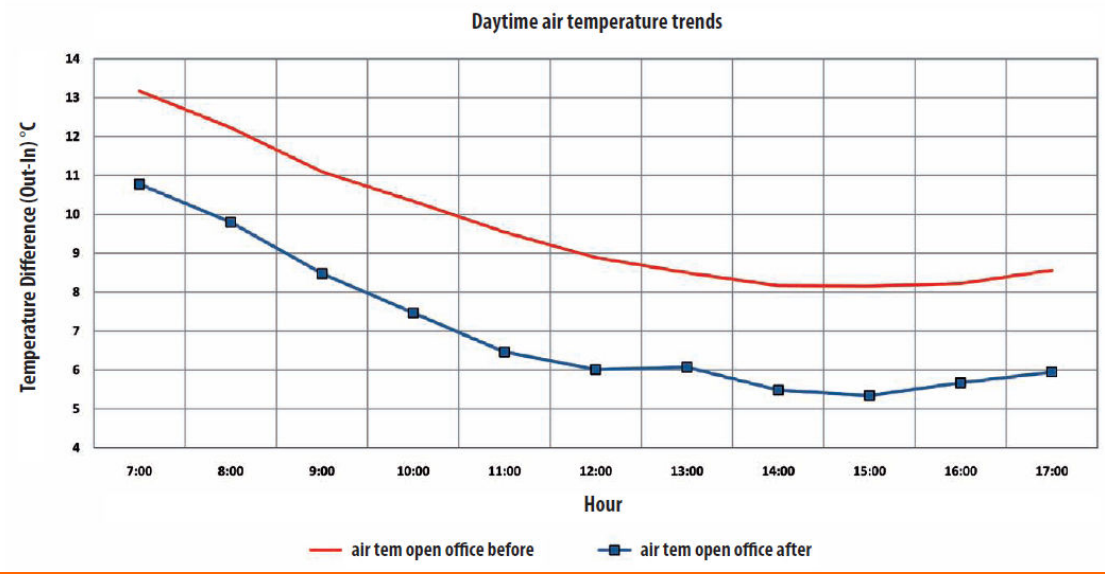
The environmental conditions (internal/external air and surface temperatures) of the building were monitored before and after the application of the cool roof during the summer. The building was modelled using TRNSYS and the model was calibrated successfully using the measurements. A parametric analysis was carried out by varying the reflectivity and insulation of the roof and ventilation rate; the heating and cooling demand for a year was calculated using the Summer Design Year for London as the weather file.



Measured surface and air temperature before and after the Cool Roof application

The Cool Barrier Roof Technology

Abolin's "Cool Barrier 012 (CB012- red colour)" was applied on the roof with an SR of 0.6 (measured on site after application) and an emissivity rating of 0.88.
The reflectivity of the original roof was 0.1. The building was monitored from April 2009. Cool roof materials were applied in July 2009 and monitoring continued until October 2009.



Measured daytime air temperature trends, before and after the application of cool roof materials

Evaluation results

The measurements have shown that the:
- External surface temperature was reduced
- Internal surface temperature was reduced by an average of 2°C in the middle of the day
- Internal air temperature was reduced by an average of 3-4°C in the middle of the day.

Modelling with a calibrated model has shown:
- Overheating hours during the summer are significantly reduced with the application of cool roof materials resulting in an increase of the surface Albedo (Last Fig.).
- Cooling load is decreased; although there is a heating penalty, the overall contribution is positive.
- Optimum surface Albedo is estimated between 0.6 and 0.7 with air exchange rate of 2 air exchanges per hour. This combination creates an overall heating and cooling load reduction of 3-6% depending on the set-point temperature for winter and summer.
- Increasing insulation levels would decrease the potential energy benefits in heating and cooling demand.

This case study analysis indicates that applying ABOLIN'S Cool Barrier technology could be beneficial for the moderate climate of suburban London, in terms of increased thermal comfort in the summer and could decrease overall energy use for heating and cooling. Should be considered as an effective solution for the refurbishment of existing offices and for the design of new offices, together with other passive energy efficient strategies.

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