The Challenge of Modelling Solar Shading Products and their Impact on the Built Environment

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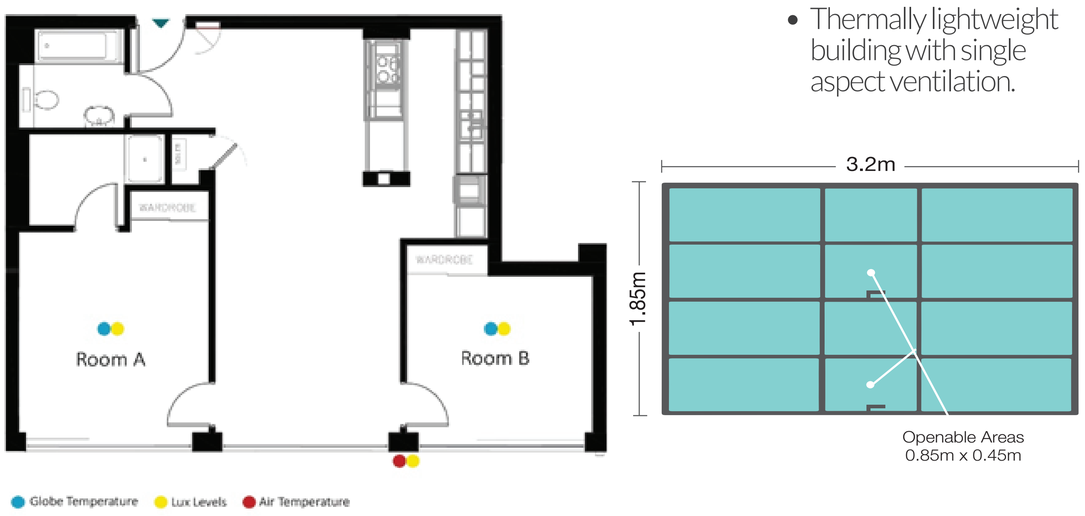
Improved insulation and glazing contribute to overheating in buildings, the incidence of which is rising. Blinds and shutters can reduce thermal gain if specified and used correctly and their value as passive / low energy products is now being acknowledged by construction professionals, who also recommend that building models include solar shading devices to reduce overheating in buildings. However, some software does not appear to generate accurate models of shading products and their impact as illustrated in a comparative study of recent real-time data from a refurbished residential building in London and the results of building simulations.

Aims

- Evaluate the accuracy of thermal modelling in energy simulations during extreme climate events.
- Review if solar shading devices are simulated correctly in thermal models.
- Evidence whether thermal simulations can predict risks of overheating in buildings.
- Assess if the performance gap between the real case study data and simulation affect the adaptation strategy choices for designers which in turn could benefit mitigation of climate change .

The Case Study Building

- A commercial, urban rennovation orientated South West (242°) located in North London.
- Rennovated with aluminium windows with low e double glazing.
- Thermally lightweight building with single aspect ventilation.



Methodology

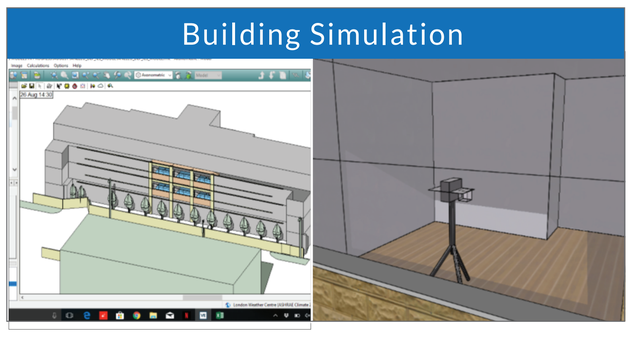
Step 1.

Real World Monitoring

- Operative, Air, Glazing Surface Temperatures and Lux data collected during Summer 2016.

Step 2.

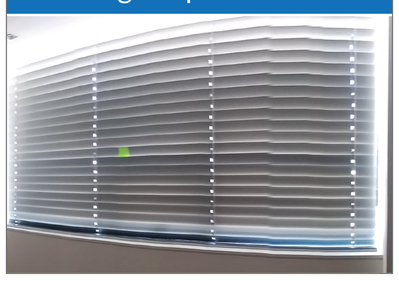
Building Simulation



- Modelled building in IES thermal modelling software and simulated building performance .

Step 4.

Design Optimisation



- Solar shading modelled and real data comparisons evaluated.

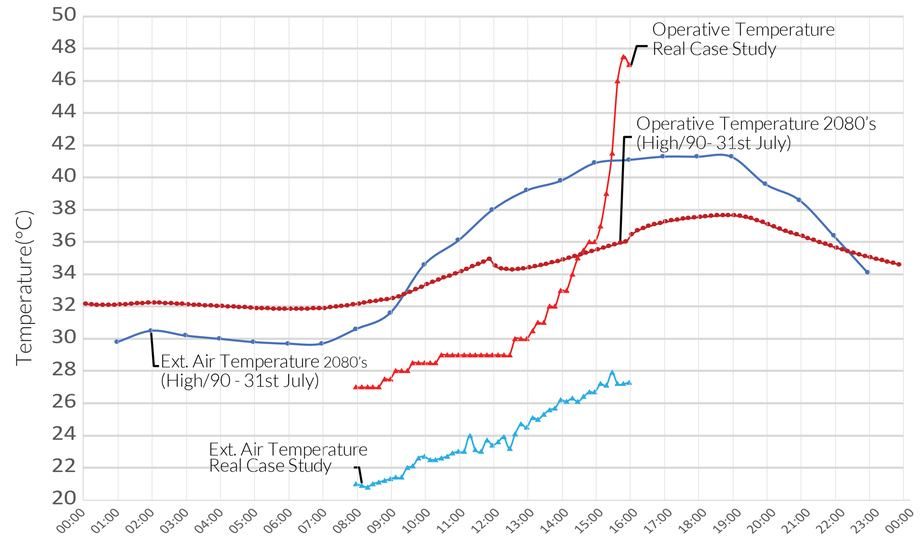
Step 3.

Comparison of Real World and Simulation

- Comparisons made between real world data and thermal simulation with future weather scenarios, IES weather data and Energy Plus.

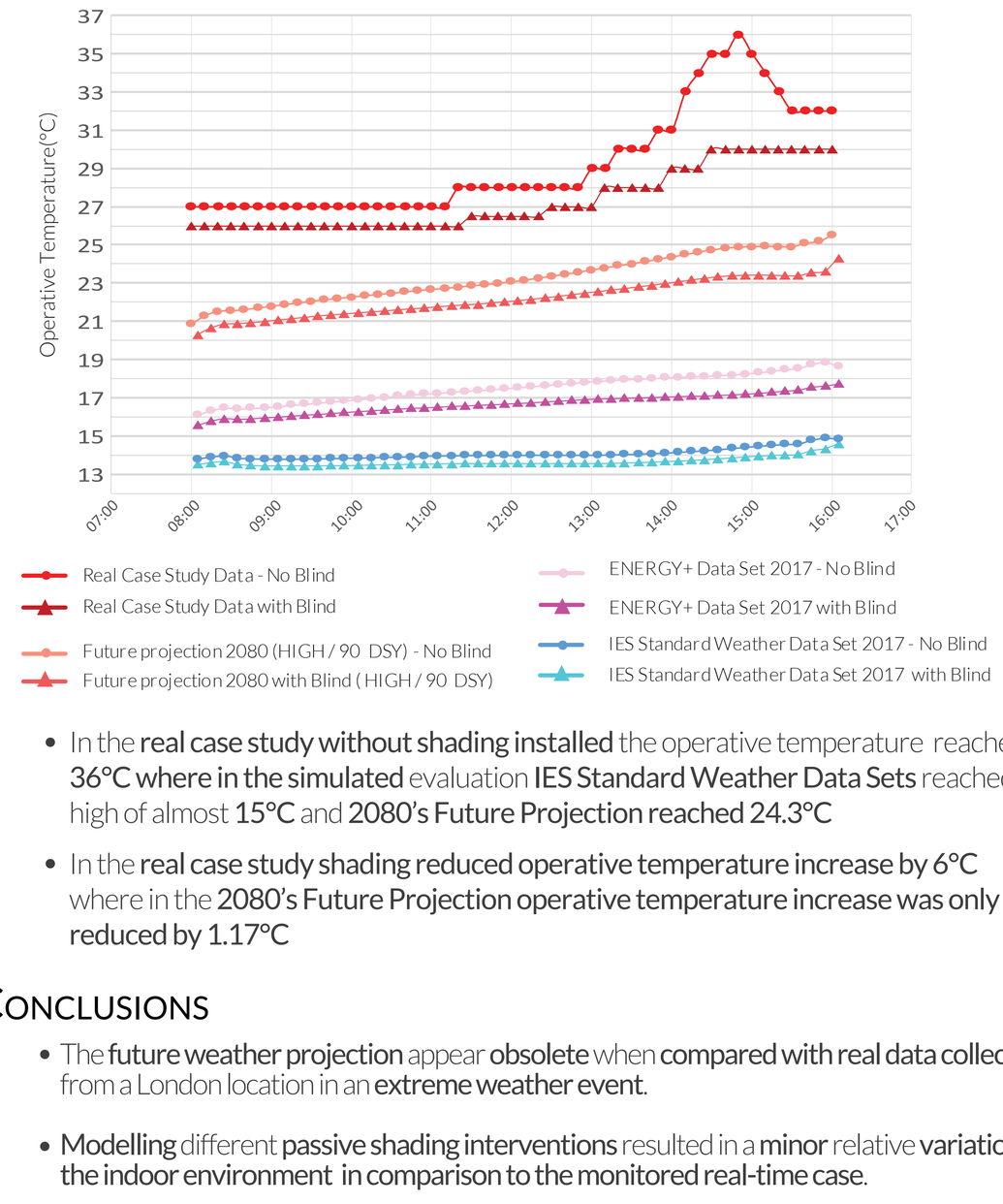
Results

Operative & External Air Temperature Comparison between Case Study Real Data & Simulated Extreme Weather Events



- The hottest day (31st July) from the 2080's - High - 90th Percentile Future Weather Projections was used within a simulation. Although simulated external air temperatures exceeded those that were collected on the 26th August 2016 the **internal operative temperature increase** was almost **15 °C higher** in the **real case study** when **compared to the simulation**.

Comparison of Operative Temperatures between Case Study Real Data & Simulated Weather Projections - With and Without Blinds



- In the **real case study without shading installed** the operative temperature reached **36°C where in the simulated** evaluation **IES Standard Weather Data Sets** reached a high of almost **15°C** and **2080's Future Projection reached 24.3°C**
- In the **real case study shading reduced operative temperature increase by 6°C** where in the **2080's Future Projection operative temperature increase was only** reduced by 1.17°C

Conclusions

- The **future weather projection** appear **obsolete** when **compared with real data collected** from a London location in an **extreme weather event**.
- **Modelling** different **passive shading interventions** resulted in a **minor** relative **variation of the indoor environment in comparison to the monitored real-time case**.
- The **software seems to overlook** the **extensive solar heat gains in addition to the mitigation effect caused by the blind system**.
- Further longitudinal studies of **real-world data compared to simulations** are needed in order **to reduce the performance gap and improve design optimisation strategies**.

Acknowledgements

- David Bush and Andrew Chalk, The British Blind and Shutter Association

Refererences: *De Grussa Z et al ., A Case Study assessing the impact of Shading Systems combined with Night-Time Ventilation strategies on Overheating within a Residential Property Proceedings of the joint 38th AIVC, 6th TightVent and 4th venticool Conference: "Ventilating healthy low-energy buildings", Nottingham 13-14 September 2017, Energy Plus Weather Data Set, Energy Plus Website, 2017. IESVE, Integrated Environmental Solutions Virtual Environment. Version 2017.0.1.0, 2017, Jenkins D., The "low carbon futures" project, Heriot Watt University, 2012. UKP09 Generator, Prometheus, University of Exeter, 2017.*