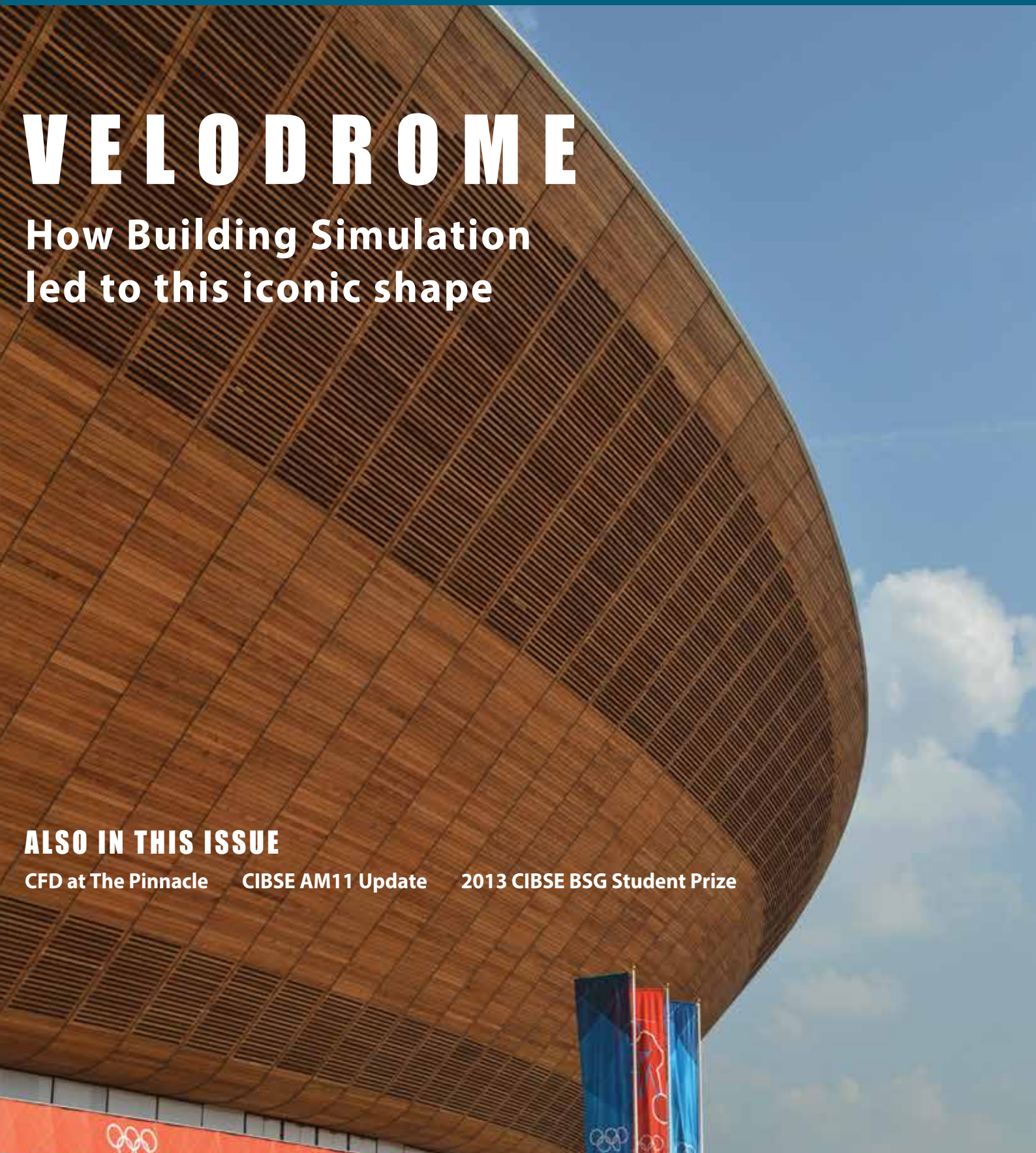
Engineering a Sustainable Built Environment

CIBSE

BUILDING SIMULATION GROUP

June 2013 Edition



VELODROME

How Building Simulation led to this iconic shape

ALSO IN THIS ISSUE

CFD at The Pinnacle

CIBSE AM11 Update

2013 CIBSE BSG Student Prize

Introduction to the First Edition by the Group's Chairman

This Group was established four years ago with the aim of supporting good practice on, and informing CIBSE members of the role of building modelling and simulation in building services design.

I am privileged for introducing this first edition of the CIBSE Building Simulation Group (BSG) Newsletter. This Group was established over four years ago with the aim of supporting good practice on, and informing CIBSE members of the role of building modelling and simulation in building services design. In the last two or three decades more and more reliance has been placed on using building and system simulation codes for design and performance evaluation. This has been more highly elevated recently not only for meeting compliance with energy and building regulations but also for incorporating low energy solutions, renewable energy systems and meeting occupants' need for better indoor environment quality.

The Group's activities cover all areas of building services simulations, including energy modelling, dynamic thermal simulation, computational fluid dynamics, plant simulation, lighting and acoustics.

Since its inception the Group has taken active role in promoting and informing the profession of best practice in different areas of building simulation. This has been affected through organising a number of seminars covering different topics of building simulation, some jointly with other CIBSE Groups. Last year the Group launched an annual award for the best MSc Dissertation from UK and overseas universities that includes a major element on the application of building simulation tools in the research. Highlights of some of the Group's activities are shown in parts of this Newsletter.

Prof. Hazim Awbi
BSG Chairman
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BSG Events

The CIBSE Building Simulation Group organise regular, free, half day events to explore current and future application of building physics in the built environment.

The last event 'Designing for Better Indoor Environmental Quality in Buildings' was held on 11th June 2013 at University College London.

Upcoming Events

Design and Simulation for Zero Carbon Buildings (September 2013)

Linking Building Design Performance with BIM (April 2014)

Papers for the above are welcome. Please address all enquiries to the group events secretary Sham Sawaf at **events@cibsebsg.org.**

For more details visit the group website **www.cibsebsg.org.**

Call for Articles

The CIBSE BSG are seeking articles or case studies for submission to appear in this newsletter. If you have some news or a good example of how building simulation has improved and aided building design, please contact the editor Darren Coppins at editor@cibsebsg.org

Building Simulation Group Prize for Best MSc Dissertation

The Building Simulation Group supports and encourages the application of advanced building simulation tools for building and system design with the aim of achieving best performance, reliability and energy efficiency. In 2012 the Group initiated an annual prize open to postgraduate students from UK and overseas universities who undertake a research project at Master's level or equivalent which includes a major element involving the application of building simulation tools in the research. The aim is to encourage the use of, and innovation in, building simulation techniques for research and development.

The 2012 £1,000 prize has been awarded to Yair Schwartz from the University College London for the dissertation "Variations in results of different building energy simulation tools and their impact on BREEAM and LEED ratings: A case study".

The 2013 award will focus on projects involving the application and development of advanced simulation techniques and/or software for predicting the performance of natural or mixed mode (hybrid) ventilation systems. The title of this award is "Simulation of Ventilation in Buildings".

Expressions of interest in the form of a one page summary outlining the title, name(s) of participants, a brief description of the project and endorsement need to be submitted to competition@cibsebsg.org by 30 August 2013.

Further details on this competition are available on the group's website **www.cibsebsg.org.**

VELODROME

The London 2012 Velodrome has become one of the iconic buildings of the 2012 Olympics with its distinctive shape and roofline, a shape that was formed partly through the modelling of energy use and internal environmental conditions.

The building form began life as a competition entry from a team lead by Hopkins Architects. The team included M&E engineers BDSP who began work on evaluating the Energy and Internal environment. One of the first challenges was to understand the differing environmental conditions required for a Velodrome and with limited criteria available for this type of venue, the engineers set out to develop and agree the required design criteria. Such criteria included the need for very low air movement at track level, accompanied with higher air temperatures during competition use which formed part of the requirements to permit world records to be broken.

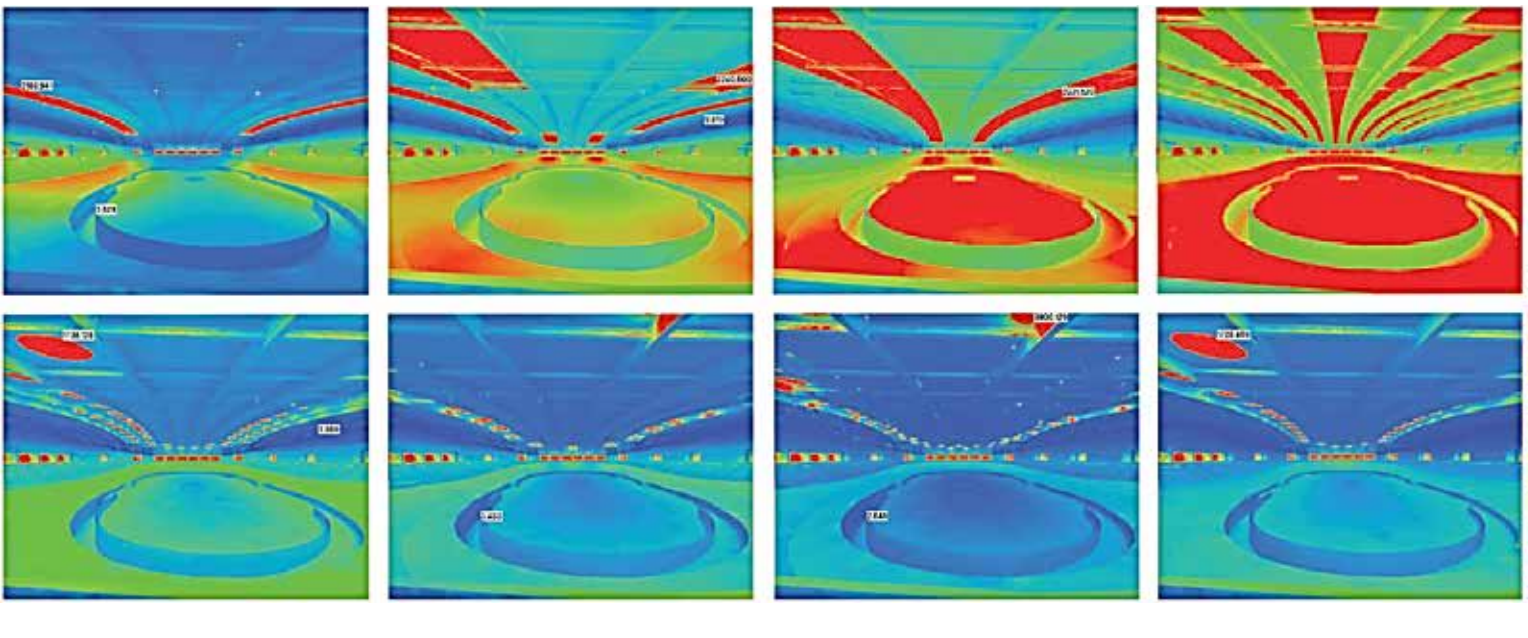
A taller building with a greater volume formed the original design. Dynamic Thermal Simulation using TAS demonstrated the benefits of reducing the internal volume of the building and the roofline was lowered, leading to the iconic sharp edged 'pringle' roofline. This minimised unnecessary energy use. Thermal modelling was also employed to evaluate occupant comfort with the proposed hybrid natural and mechanical ventilation systems.

CFD was utilised to model air movement within the building, focussing on the requirement for very low air movement and consistent temperatures at the track. Conversely whilst the spectator zones are intented to have elevated air movement during periods of high occupancy or warm weather to improve thermal comfort.

With a number of usage scenario's run, the image below highlights a potential issue with higher velocity air when entrance doors to the velodrome are open, a situation that may arise when the track is in use. Understanding these risks allowed suitable baffles to be designed to prevent such circumstances.

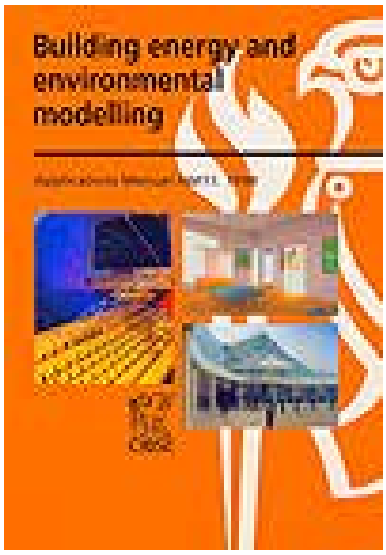
A first for indoor Velodrome is the incorporation of daylight. Uniformity of lighting on the track is of paramount importance and usually results in daylight being excluded in favour of controllable, artificial light. Radiance was used to model a number of rooflight options in detail to evaluate uniformity and light levels at the track. The images below shows a number of rooflight options that were evaluated.

Deployment of energy, thermal, air flow and daylight modelling at an early stage of the building design has allowed the engineering of the internal environment to dictate and refine the building form in harmony with the low carbon ethos of the London Olympic Games and provide a building which will continue to serve the cycling community for many years into the future.



CIBSE UPDATE:

CIBSE Application Manual AM11 Update



Since its inception the CIBSE Building Simulation Group has taken active role in promoting and informing the building services profession of best practice in different areas of building simulation. One of its current activities is revising the CIBSE Application Manual AM11 (Building Energy and Environmental Modelling). Many of the Group's Committee Members are currently involved in re-writing this rather outdated Manual.

The new Manual will be written with the aim of helping practicing engineers and architects in the modelling of buildings and their environmental and energy systems for the purpose of design as well as compliance with current regulations.

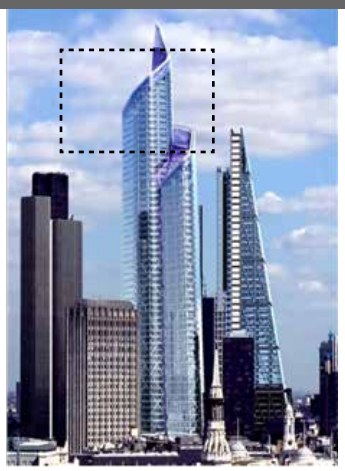
It will cover a range of modelling topics that are relevant to building design as well as an outline of the software packages that are used and some guidance on their selection for particular applications.

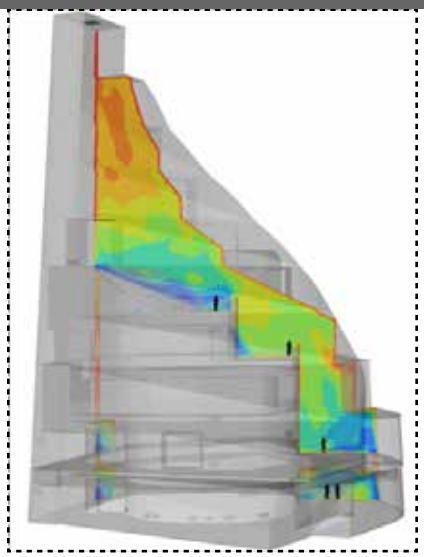
The Manual will contain some 9 chapters covering the general concepts of energy and environmental modelling and in particular focuses on the following areas:

- Thermal and energy modelling
- Electric and day-lighting modelling
- Ventilation modelling
- Plant modelling
- Quality assurance procedure in modelling
- Compliance with building codes for energy performance assessment

The modelling process for each of the topics covered by this Manual is dealt with in some detail in order to give specific guidance and, where possible, by means of examples and case studies. The Manual is at an advanced stage of preparation and is expected to be launched for distribution in 2014.

Case Study : The Pinnacle





The Pinnacle is a landmark tower in the City of London currently under construction. Hilson Moran was commissioned to carry out the M&E services for the building for which its original design included the Viewing Gallery at Level 60.

DTM modelling was initially carried out (using TAS software produced by EDSL) to determine the peak heating and cooling loads for the space. From this, and additional energy modelling, a facade performance specification was proposed.

The design team used the peak heating and cooling loads to help size the mechanical services, but as a result of the unusual geometry they were constrained to certain locations to position the VAV supply grilles. Consequently, a steady-state CFD assessment was carried out to confirm that the proposed design would deliver good airflow to all areas, therefore providing adequate thermal comfort for occupants during both peak summer and winter conditions. Fluent CFD software was used for the analysis due to its ability to deal with complex geometry and multi-physics problems. Operative temperatures were calculated for the whole space and then results were plotted at various slices (see image). After a couple of optimisation runs to fine tune the grille inlet/outlet positions, the design team were reassured that acceptable thermal comfort could be achieved with the proposed design.

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