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Natural Ventilation News

THE NEWSLETTER
OF THE
CIBSE NATURAL
VENTILATION GROUP

this issue

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www.cibse.org/nvg

About Natural Ventilation News

This Newsletter is produced by the CIBSE Natural Ventilation Group Management Committee to inform members and potential members of the work being undertaken by the Group to benefit the discipline of natural ventilation within CIBSE. The management committee wish to encourage contact with all interested partners. Communication can be directed to the Group at CIBSE Headquarters or to individual Management Committee members.

Editor

This edition has been designed, edited, and compiled by
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EDITORIAL

Building Relationships

The CIBSE Natural Ventilation Group is building relationships and branching out.

During the summer, the group helped to secure UK membership of the Air Infiltration and Ventilation Centre (AIVC). This should be welcomed by all industrial and academic practitioners who are interested in ventilation, indoor environment quality, and energy demand reduction. It will provide formal links with the AIVC umbrella organisations that produce guidelines and contribute to standards, access to its significant library of publications, and participation in the many seminars and conferences that it organizes on topical issues. Membership is funded by the CIBSE, and will be supported by the Natural Ventilation Group; see the article on page 7 for more details.

The NVG has also signed a memorandum of understanding with Venticool, an international platform that raises awareness of ventilative cooling. It aims to accelerate the uptake of ventilative cooling by sharing experience and steering research and development efforts in the field of ventilative cooling. Venticool is a collaborator in International Energy Agency Annex 62 that is investigating ventilative cooling and co-organizes events including the annual AIVC conferences, workshops, and webinars. See the Venticool website, at www.venticool.eu, for more details.

The NVG will continue to run its own seminars and webinars. It is also uploading content to its own website. For example, its April seminar entitled "Ventilation: The Once and Future King" is now available as an MP3 download, and its October webinar entitled "Understanding Performance Tests" is available on the CIBSE YouTube channel. Search for "CIBSE" on the YouTube homepage.

These relationships that we're building will help the Natural Ventilation Group, CIBSE, and the wider community of ventilation academics and professionals to learn more and to share more, and we're very excited about them.

Dr Benjamin Jones, editor
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The CIBSE Natural Ventilation Group

The CIBSE Natural Ventilation Group is a large, international group, that was founded in 1994. The committee comprise some 55 members serving a wider membership of over 10,000.

Group Aims

The aims of the group are:

- to ensure natural ventilation is properly considered at the design stage equally with mechanical ventilation or air conditioning;
- to disseminate knowledge via seminars and publications;
- to recommend research projects;
- to be at the forefront of knowledge about the low energy, environmental and economic performance of natural ventilation;
- to work with consultants, contractors, manufacturers and researchers in pursuing these aims.

Links

To access the Natural Ventilation Group cut and paste the following link into your browser or click here:

http://www.cibse.org/index.cfm?go=groups.details&item=11

Committee Officers

Overheating Corridors: Performance of mitigation actions measured

Chris Iddon, SE Controls

In some ways it is ironic that the issue of building overheating can be partly accredited to the increased drive towards improving energy efficiency, a fact that has been recognised by the Zero Carbon hub in its recent report into overheating in homes.

Within this framework, retaining heat within a building is usually a key design goal, as it reduces energy demand for heating, and the cost of maintaining a comfortable internal environment. The application of various energy reduction techniques, such as improvements to air tightness and increased insulation, can have some surprising and unintended consequences.

Innovative designs of multi-storey residential buildings seek to maximise rentable space legitimately. This often creates 'landlocked' communal spaces that have limited ventilation. Given that corridors are often sealed by fire doors and that the practice of routing heating pipework through ceiling voids is a common solution, it's unsurprising that communal corridor temperatures can readily exceed 30 degrees Celsius, even during temperate weather.

> SAP Section 3.3.2 Stairwells and access corridors in flats states "*stairwells and access corridors are not regarded as parts of the dwelling*".

Communal transit spaces in multi-storey residential blocks are not regarded as part of the dwelling in the Standard Assessment Methodology (SAP).

Because of this, the thermal environment of these spaces is rarely considered at design stage.

However, Developers and Designers are now becoming concerned about the thermal environment in communal corridors due to an increase in occupant complaints. Also there are health and safety concerns about such excessively hot spaces, particularly as these spaces are usually kept clean by domestic workers who have to work in these excessive conditions.

Understanding the Dynamics of Overheating

Smoke control ventilation systems are a legal requirement in most multi-occupancy residential buildings. It is possible to use these smoke shafts to provide a day-to-day natural ventilation solution if it is considered at an early stage of the design. To improve the efficacy of these strategies it is preferable to also consider low level ventilation openings, means of holding open doors to promote airflow, and the utilisation of stairwells as additional stacks. Throughout 2014 we have monitored the corridor temperature of a London building (Building A) where early design interventions were made to utilise the smoke control system to provide additional day to day ventilation in order to mitigate overheating risks. As a comparison we also monitored a similar building in Kent (Building B), where no similar ventilation solution had been installed, for 6 months.

Temperature Measurement and Adaptive Comfort

Hourly temperatures in the first floor lobby of both buildings were monitored to obtain a clearer picture of the internal thermal profile, while corresponding hourly external weather information from RAF Northolt provided relevant

Table 1: Typical corridor temperatures recorded in monitored buildings works issues log.

	External (°C)	Building A (°C)	Building B (°C)
Average	12.0	18.6	28.5
Median	12.0	18.8	28.8
Maximum	30.0	27.3	33.8

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Table 2: Building Performance Against Overheating Guidance.

	Building A	Building B
Hours>28°C	0	2218 (64%)
Hours that fail TM52 criterion 1	0	2369 (68%)
Days that fail TM52 criterion 2	0	103 (3%)
Hours that fail TM52 criterion 3	0	19 (0.5%)

'ambient' temperature data for the same period. During the study, a MET Office Level 2 heatwave warning (max temperature of 30 degrees Celsius) was issued for 18th to 20th July 2014.

Although the latest edition (8th) of CIBSE Guide A does highlight the need to consider the thermal environment in corridors in some instances, there is not any guidance on a metric for measuring overheating. Table 1.5 Guide A states that corridor temperatures should be in the range of 21-25°C in air conditioned buildings and the typical overheating metrics or 1% of occupied hours over 28°C and TM52 adaptive comfort methodology are both related to occupied hours. Occupancy in corridors is transient, so one could argue that it is therefore never occupied or conversely that it is (or at least has the potential to be) occupied 24/7.
For the purpose of this analysis we have assumed that the monitored corridors are occupied 24/7, i.e the worst case scenario, measured overheating based on 1% of hours over 28°C and the three criteria of CIBSE TM52 with respect to adaptive comfort.

Over the duration of the study, the external temperature ranged from a minimum of -6°C during December to a maximum of 30°C in July, with an average of 12°C throughout the period; see Table 1.

In comparison, the London building (Building A) utilised its smoke ventilation system to provide supplementary environmental ventilation. It has a maximum temperature of 27.3°C that is much cooler than the maximum external temperature. Its median air temperature is a moderate 18.8°C.

However, the Kent building (Building B) has unventilated corridors. In stark contrast to Building A it recorded some disturbing results with temperatures ranging from 22.3°C up to an extremely uncomfortable high of 33.8°C with an average 28.5°C.

Even more concerning is the fact that for 2,218 hours of total monitoring period (64%), the temperature in Building B exceeded 28°C. This massively exceeds the current CIBSE guidance 1% threshold for overheating. Using the methodology of TM52 demonstrates that Building B also massively exceeds adaptive comfort guidance, whilst Building A, utilising smoke shafts for ventilation, had no hours of overheating as measured by both CIBSE Guide A and TM52 guidance, Table 2.

Colour maps generated for the monitored period

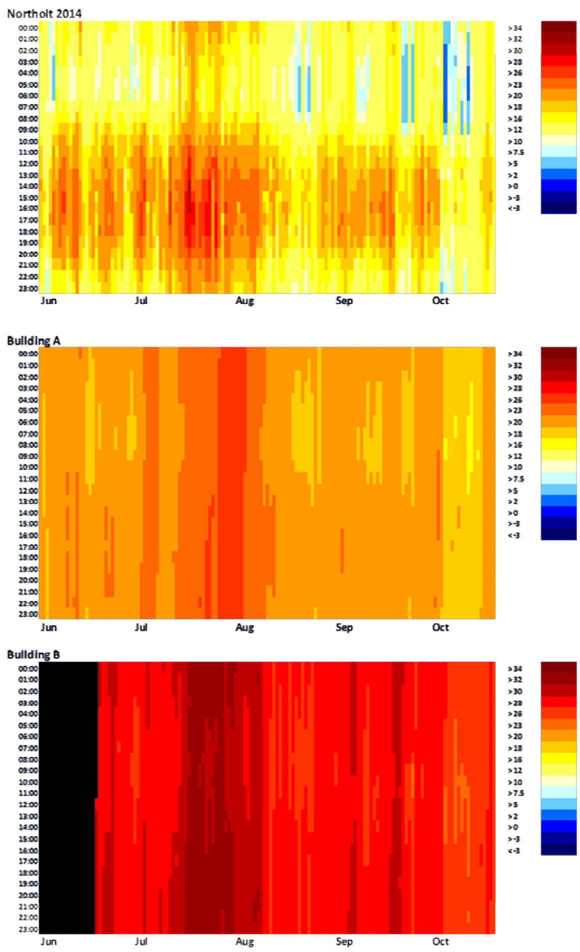

Figure 1: Colour maps of hourly external and corridor temperatures in Building A and Building B, The hours of the day run from the top of the chart to the bottom, from midnight to 11pm. Days run from left to right, from June through to end of October.

clearly demonstrate the differences in internal corridor temperatures experienced between these two buildings and the significant cooling effect that provision of ventilation can deliver. Each individual coloured block represents the temperature of one hour as measured against the colour scale. The hours of the day run from the top of the chart to the bottom, from midnight to 11pm. Days run from left to right, from June through to end of October.

> *Although the main concern of the engineer is to ensure that continuously occupied spaces remain at acceptable temperatures, corridors and other transitional spaces may also suffer overheating. This might be due to the their use as passages for extract air, the absence of any significant air supply or even the presence of poorly lagged hot water pipes. Such issues are easily overlooked and some attention should be shown these spaces. In the case of well insulated dwellings bare pipes may cause overheating in winter.*
> CIBSE Guide A, 8th edition 2015

About the Author

Chris is Design Manager at SE Controls where his primary focus is on the development and application of innovative natural ventilation solutions and the role also fully utilises his distinctive combination of extensive academic research skills and detailed construction sector experience.

Chris began his career in academic research in biochemistry and developmental genetics before pursuing a career in design co-ordination and management within the construction sector. Chris then returned to the academic world and achieved an MSc Low Carbon Building Design and Modelling from Loughborough University, for which he was selected as a finalist in the CIBSE Graduate of the Year Award in 2013.

Using the New CIBSE Design Summer Years to Assess Overheating in London

Owen Connick, Breathing Buildings

Across the UK construction industry, the standard weather data used for assessing thermal comfort is normally obtained from the Chartered Institute of Building Services Engineers (CIBSE). CIBSE provide two types of weather file, known as the Test Reference Year (TRY) and the Design Summer Year (DSY), with an accompanying range of data formats and geographical locations for each.

What is a TRY? What is a DSY? Which one should I use?

To facilitate the creation of characteristic weather files, CIBSE assembled 20 years of real weather data (between 1983-2005) for 14 locations around the UK. These files include information about the air temperature, wind velocity and solar radiation.

The following definitions are adapted from the descriptions given on CIBSE's website.

> *TEST REFERENCE YEAR*
> *The Test Reference Year consists of hourly data for twelve typical (although not necessarily consecutive) months. This data was selected from the 20-year data sets, and then smoothed to provide a composite, but continuous, 1-year sequence of data.*
> *The TRY weather files are intended to enable the likely energy consumption of buildings to be assessed by simulation under typical weather conditions.*

> *DESIGN SUMMER YEAR*
> The Design Summer Year is an actual continuous twelve month sequence of hourly data, from the 20-year data sets. It represents a median year with a reasonably warm summer. The year selected is the mid-year of the upper quartile, based on dry bulb temperatures during April–September.
> The DSY enables designers to simulate the expected building performance during a year with a hot, but not extreme, summer.

In London, the middle year of the upper quartile was 1989; hence, the London DSY weather file is the actual weather recorded in London in 1989. In other UK locations, a different year is selected; for example, in Norwich the DSY year is 2004, in Cardiff it is 1999 and in Glasgow it is 1997.

TM49 and the London Conundrum

Previously, DSY weather files were available for 14 locations around the UK; all of Greater London, including central London and much of Sussex & Essex, being characterised by the London (Heathrow) data.
In 2014, however, CIBSE published technical memorandum TM49: Design Summer Years for London. TM49 addressed three key questions:

CIBSE TM49

1. Is the DSY a sufficiently warm year, or should a warmer year be used?
2. How will future climate change affect the suitability of the DSY?
3. What is the effect of the urban heat island (UHI), and should weather data be supplied for other parts of London?

This detailed technical report concludes with some brief and fairly stark recommendations:

1. *Because…* the estimated return period for the current London (Heathrow) Design Summer Year [1989] is just 1-3 years (i.e. summers as hot or hotter than 1989 are expected every 1-3 years), this weather file is not considered sufficiently extreme to provide a basis for overheating assessments in London; it is recommended that … warmer weather data should be used.
2. *Because…* it is impossible to prejudge the impact of warm weather on a building in a general sense, it is recommended that … a range of weather files should be modelled, to investigate the sensitivity of the design to different weather conditions.
3. *Because…* there are significant climate variations across London, associated with the urban heat island effect, it is recommended that … more specifically appropriate weather files should be used to characterise development in central, suburban and rural locations, respectively.

One major outcome of TM49 was that CIBSE released a new set of 'Design Summer Year' weather files for greater London. These additional data sets mean that DSY weather files are now available for three London locations: London Weather Centre (LWC), London Heathrow Airport and London Gatwick Airport, for the following baseline years:

- 1976 – a relatively intense persistent warm spell
- 1989 – a moderately warm summer
- 2003 – a single intense warm spell

These weather files aim to better represent urban (LWC), semi-urban (Heathrow) and rural or peri-urban (Gatwick) locations. The report recommends that

- London Weather Centre data be used for development in the central zone

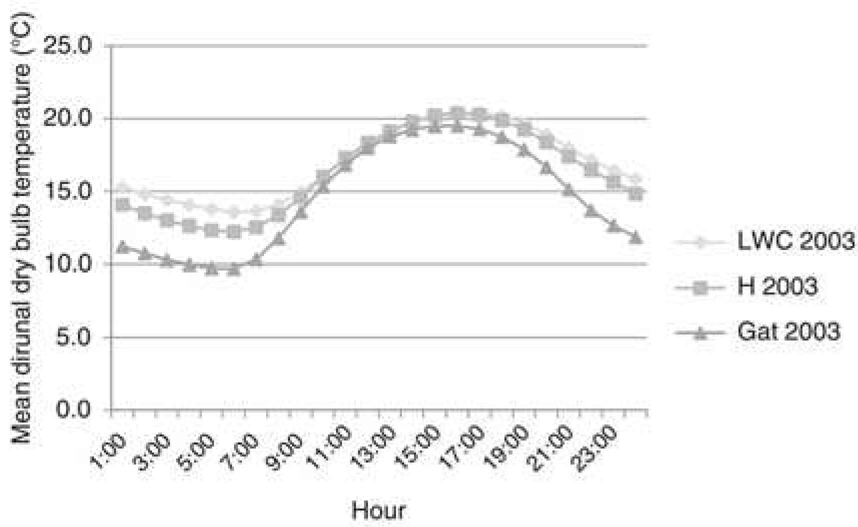

Figure 1: Mean diurnal temperature variation for during 2003 for three London locations.

- Heathrow data be used for development in urban and suburban areas, and
- Gatwick data be used for more rural areas around the edge of Greater London.

What does it all mean?

In a recent paper(1), published in the CIBSE journal Building Services Engineering Research & Technology, researchers from University College London and CIBSE tested how the newly-released Design Summer Year weather files impacted the assessment of overheating in a naturally ventilated office in London.

The study found that, regardless of which London weather file was employed, it was very difficult to achieve a CIBSE-compliant design without incorporating useful thermal mass/insulation and automated night cooling.

Once these strategies had been implemented, the Urban Heat Island effect was strongly observed in the form of large differences between similar buildings depending on their location. As demonstrated by Figure 1, which is taken from Virk et al.'s article, the urban heat island effect is predominantly a night-time phenomenon. With almost negligible differences observed in the mean of the daytime temperatures, but 3-4°C differences observed in the mean of the night-time minimum temperatures. Crucially, this emphasises that night-cooling will be far more effective in rural locations, such as Gatwick, because of the cooler night-time temperatures and the greater day/night diurnal variation.

Interestingly, the choice of thermal comfort metric also had a significant impact on the level of overheating between sites. Buildings in the centre of London are more likely to pass the 'adaptive thermal comfort' criteria of TM52, than the fixed temperature criteria used previously. This is because the adaptive model compares internal temperatures to the 'running mean' outdoor temperature, which is itself often higher than the static, measured temperature. And results in simulations indicating that occupant will accept higher internal temperatures if the weather has been consistently warm in preceding days. Whether this perceived willingness to accept higher temperatures truly reflects the attitudes of occupants is probably still up for debate. In terms of compliance with guides and applying the most recent thinking on overheating, however, the adaptive thermal comfort model is definitely something designers should work with.

References

1. Virk et al. Using the new CIBSE design summer years to assess overheating in London: Effect of the urban heat island on design. Building Serv. Eng. Res. Technol. 2015 Vol. 36(2) 115–128.
2. CIBSE Guide A: Environmental design. Chartered Institution of Building Services Engineers. 2015.
3. CIBSE TM52: The limits of thermal comfort: Avoiding overheating in European buildings. Chartered Institution of Building Services Engineers. 2013.
4. CIBSE. TM49: Probabilistic design summer years for London. Chartered Institution of Building Services Engineers. 2014.

About the Author

Owen Connick is a Consulting Engineer at Breathing Buildings. He completed his PhD at Imperial College London, investigating the fluid mechanics of hybrid (mixed-mode) natural ventilation. Through his research, Owen assessed different prediction methods for modelling naturally-ventilated buildings, gained experience in developing and validating predictive models, and spent time working with the water bath modelling technique for visualising ventilation flows. Owen gives regular seminars on natural ventilation and has presented at numerous CIBSE/ASHRAE events.

UK Joins Air Infiltration and Ventilation Centre

Benjamin Jones, University of Nottingham

This summer, the UK formally re-joined the Air Infiltration and Ventilation Centre (AIVC). This move will be welcomed by all industrial and academic practitioners who are interested in ventilation, indoor environment quality, and energy demand reduction. It will provide formal links with the AIVC and umbrella organisations that produce guidelines and contribute to standards, access to its significant library of publications, and participation in the many seminars and conferences that it organizes on topical issues.

What is the AIVC?

The AIVC is an annexe of the Energy in Buildings and Communities Programme (www.iea-ebc.org), which is one of the implementing agreements of the International Energy Agency (IEA). The IEA inaugurated the AIVC in 1979 and for many years it was located in the UK when Martin Liddament (the current chair of the CIBSE Natural Ventilation Group) was its head. The AIVC offers industry and research organisations technical support aimed at optimizing ventilation technology. It offers a range of services and facilities, including a comprehensive database on literature standards, and ventilation data. The AIVC is the hub of ventilation knowledge and membership brings significant benefits.

Benefits of Membership

Membership gives the UK three distinct rights:
One vote on the AIVC Board and may send two individuals to any meeting of the AIVC Board.
The right to join any AIVC-approved working group or other similar activity.
Free online access to AIVC publications, which contains more than >20,000 documents.
In addition, there are a number of other benefits.

Firstly, the AIVC has very close links with umbrella organisations that produce guidelines and contribute to standards, such as ASHRAE and REHVA (see www.aivc.org/links for further details). Furthermore, the AIVC works very closely with Venticool on purpose-provided ventilation and with TightVent on airtightness. Both of these initiatives have close interactions with policy makers and are considered influential in Europe. The AIVC is a founding member of the IEQ Global Alliance, a new international organization whose mission is to provide an acceptable indoor environmental quality to occupants of buildings and work-places around the world, and to make sure the knowledge from research on IEQ is implemented in practice. ASHRAE serves as the secretariat.

Secondly, the AIVC organises an annual international conference, and numerous seminars in Europe and the US on topical issues. In many cases it invites Board Members to participate. These seminars are influential and are usually attended by policy makers and other stakeholders

UK board members:
Professor Maria Kolokotroni (top) and
Dr Benjamin Jones (bottom).

from the 18 AIVC countries. Companies from AIVC countries are invited to give presentations and take part in exhibitions.

UK Board Members

Membership entitles the UK to two board members who, guided by their stakeholders, can propose initiatives research and knowledge dissemination initiatives. These may include professional guidelines or proposals for small focussed projects that can be sponsored. Current AIVC board members are well known internationally and, in most cases, are long established members of influential national organisations. For example, in April of this year the CIBSE Natural Ventilation Group (NVG) welcomed the U.S.A board member, Dr Max Sherman of Lawrence Berkeley National Laboratory, who have his ASHRAE distinguished lecture entitled "Ventilation: The Once and Future King" at a seminar held at the University of Nottingham.

The CIBSE have proposed two UK board members who will serve a two year term in the first instance. Maria Kolokotroni is Professor of Engineering at Brunel University. Maria has been involved with the AIVC for many years attending conferences and participating in joint research projects. She has been a visiting board member of the AIVC for many years. Dr Benjamin Jones is an Assistant professor at the University Of Nottingham. He is the Secretary of the CIBSE Natural Ventilation Group. Ben has been attending AIVC conferences since 2007.

Funding and Administration

The CIBSE has agreed to fund UK membership for 4 years in the first instance. All travel and subsistence costs are funded by other sources. The UK's participation with the AIVC will be overseen by the NVG who will elect the UK representatives on an annual basis.

Links and References

The AIVC: www.aivc.org
AIVC board members: www.tinyurl.com/q25wyad
The CIBSE Natural Ventilation Group: www.cibse.org/nvg
Venticool: www.venticool.eu
Tightvent: www.tightvent.eu
IEQ Global Alliance: www.ieq-ga.net/
Maria Kolokotroni: www.tinyurl.com/ojs4r4f
Benjamin Jones: www.tinyurl.com/o84w8dw