

Cover story:
IOA schools' competitions and STEM visits to inspire the next generation of acousticians
Page 18

Research: Measuring particle size distribution
Page 26

Relationship between WHO 2018 Environmental Noise Guidelines for the European Region and the 1999 Guidelines for Community Noise for dwellings exposed to transport noise
Page 32

The Institute of Acoustics Diploma results 2023-24
Page 54

Low-frequency sound at outdoor concerts – a necessary noise
Page 60

ACOUSTICS BULLETIN



NoiseMap five

Mapping the way to a quieter future...

... for all types of environmental noise

- Standard prediction methods
- Built-in enhancements
- Models of any realistic size
- Complete all-in-one solution
- Contour & individual results stored in database
- Compare and combine results
- Built-in context-sensitive help
- On-line technical support
- Printed and video support



A rail construction site in London analysed by NoiseMap

Click on bullet points to see more, or visit our website:

www.noisemap.com

email: robertompsett@noisemap.com

tel: +44 20 3355 9734

NoiseMap



CAMPBELL ASSOCIATES

UKAS CALIBRATION



EXPRESS DELIVERY

ANY MAKE & MODEL

BOOK NOW



Contacts

Publisher

Juliet Loisel

Contributions, letters and information on new products to:

Nicky Rogers

Email: nickyr@warnersgroup.co.uk

Tel: 01778 391128

Advertising:

Dennis Baylis MIOA

Email: dennis.baylis@ioa.org.uk

Tel: 00 33 (0)5 62 70 99 25

Published and produced by:

The Institute of Acoustics

Silbury Court,

406 Silbury Boulevard,

Milton Keynes,

Buckinghamshire MK9 2AF

Tel: 0300 999 9675

Edited, designed and printed by:

Warners Group Publications

The Maltings

West Street

Bourne Lincs

PE10 9PH



Views expressed in Acoustics Bulletin are not necessarily the official view of the Institute, nor do individual contributions reflect the opinions of the Editor. While every care has been taken in the preparation of this journal, the publishers cannot be held responsible for the accuracy of the information herein, or any consequence arising from them. Multiple copying of the contents or parts thereof without permission is in breach of copyright.

Permission is usually given upon written application to the Institute to copy illustrations or short extracts from the text or individual contributions, provided that the sources (and where appropriate the copyright) are acknowledged.

The Institute of Acoustics does not necessarily endorse the products or the claims made by the advertisers in the Acoustics Bulletin or on literature inserted therein.

All rights reserved: ISSN 0308-437X

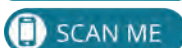
Annual Subscription (six issues) £150.00

Single copy £27.00

@2025 The Institute of Acoustics



Scan the QR code for the IOA printing and sustainability statement



ACOUSTICS BULLETIN

Acoustics Bulletin Volume 51 No 1 January/February 2025



Cover image: The IOA runs two competitions each year: one for primary school-aged children and one for secondary school-aged children. This is a great way to encourage children to think about sound and the soundscapes around them. The enthusiasm demonstrated by the staff and pupils at Rendlesham Primary School highlights how fun and engaging acoustics can be when delivered by passionate acousticians, and how STEM engagement can make a huge difference to the exposure to acoustics children get.

Page 18

Features

23 ANC news

30 The NAS John Connell Awards

32 Clarifying the relationship between the WHO 2018 Environmental Noise Guidelines for the European Region and the 1999 Guidelines for Community Noise for dwellings exposed to transport noise

38 Sound from unmanned aircraft systems: Progress in acoustics and psychoacoustics

50 A history of IOA education and training

60 Low-frequency sound at outdoor concerts – a necessary noise

Regular

26 Research – measuring particle size distribution

65 Specialist Group news

66 Branch news

70 Institute diary

Letter to the editor

44 Response to letter by Clarke and Fiumicelli 'Reductive Proposals for BS 8233 Update' – Acoustics Bulletin November/December 2024

Technical articles review procedure

All technical contributions are reviewed by an expert identified by the IOA Publications Committee. This review picks up key points that may need clarifying before publication, and is not an in-depth peer review.

Institute affairs

5 President's letter

6 Engineering Division

8 Engineering Division success stories

10 IOA Environmental Sound Group update

12 Events (including update to BS 8322)

14 IOA Bursary Fund update

16 Obituary: Andrew Ewing Watson

18 **Cover story:** IOA Schools' competition results

20 Farewell Linda

22 IOA STEM – visit to Mellor Primary School in Stockport

24 Sustainability – the IOA's sustainability journey has begun

28 IOA consultations

54 IOA Diploma results 2023-24

59 IOA 2025 short courses update

The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society. The Institute of Acoustics is a nominated body of the Engineering Council, offering registration at Chartered and Incorporated Engineer levels.

The Institute has over 3000 members working in a diverse range of research, educational, governmental and industrial organisations.

This multidisciplinary culture provides a productive environment for cross-fertilisation of ideas and initiatives. The range of interests of members within the world of acoustics is equally wide, embracing such aspects as aerodynamics, architectural acoustics, building acoustics, electroacoustic, engineering dynamics, noise and vibration, hearing, speech, physical acoustics, underwater acoustics, together with a variety of environmental aspects. The Institute is a Registered Charity no. 267026



Noise Monitoring Instruments

From the experts at Cirrus Research

Since 1970 we have been developing world-class noise monitoring instrumentation!

- Sound Level Meters
- Environmental Noise Monitors
- Cloud-Based Monitors
- Noise Nuisance Recorders
- Vehicle Noise Monitors
- Noise-Activated Warning Signs

Speak to the experts to find out more:

- ☎ +44(0) 1723 891655
- ✉ sales@cirrusresearch.com
- 🌐 www.cirrusresearch.com



Precision You Can Trust

With Cirrus Research's Calibration Service

- ✓ Five-working-day turnaround
- ✓ Calibration of ANY manufacturer's instruments
- ✓ Traceable and UKAS-accredited
- ✓ No hidden costs with fixed prices
- ✓ Specially-built laboratory accredited by UKAS to ISO 17025



Dear Member

As we look forward to another calendar year, I'm pleased to reflect on the celebrations of our 50th anniversary and to share recent developments and achievements at the IOA.

A 50th year of progress

The past 12 months have been a whirlwind of activity. Our Acoustics 2024 conference was a resounding success and we concluded our 50th anniversary celebrations with a memorable dinner at the Vintners' Hall in London. The Middle East Branch joined in the festivities, marking their 50th anniversary with a meeting and awards ceremony in Dubai. Reproduced Sound 2024 in Bristol also garnered excellent feedback.

Our Council and Executive Committee have been hard at work, making important decisions for the future of the IOA. We've developed plans to revise the future format of our meetings and the sustainability of our operations. The Sustainability Advisory Group, led by Peter Rogers, met in December and we can expect an update on the website by the time you are reading this.

Publications and guidance

Several new publications are in the pipeline. These include the ADO Noise Guide, Acoustic Classification for Buildings, and the Cost of Road Noise Pollution briefing note, which has been updated to include a section on Acoustic Vehicle Alerting Systems (AVAS).

Building relationships

Collaboration is key and we've been actively engaging with other organisations. Our presentation at the CIEH Noise Management Conference opened doors for potential partnerships in sustainability. We sponsored the Parliamentary and Scientific Committee Christmas reception to connect with policymakers and raise awareness of the IOA's work.

Membership matters

Our members are at the heart of the IOA. We're committed to enhancing your experience and are exploring new opportunities, such as a Middle East Branch Awards. We're also finalising the criteria for the Education Director position to ensure we continue to provide high-quality education and training.

Financial health and sustainability

The IOA is in a sound financial position and to maintain this, we're reviewing membership fees and staff salaries. Sustainability is a top priority and our Sustainability Advisory Group is developing a roadmap to achieve net-zero emissions.

Celebrating excellence

We're proud to support and recognise excellence in acoustics. This year, we will again sponsor the John Connell Awards and the DW Robinson Prize.



Shaping the future of acoustics education

Investing in the next generation of acousticians is essential. We're actively contributing to the EngineeringUK Careers Report and exploring ways to modernise our secondary schools STEM competition to inspire young minds.

UKAN+ Integration

The integration of the UK Acoustics Network Plus (UKAN+) into the IOA is progressing smoothly. We're working to combine the best of both organisations to create a stronger, more vibrant acoustics community.

Looking ahead

As we conclude our celebrations of our 50th anniversary, we're optimistic about the future of the IOA. We're grateful for the dedication of our staff, especially Linda Canty who is retiring after 34 years of service, and I would like to thank Alistair Somerville for his kind words in acknowledging Linda's service at the Reproduced Sound 2024 conference. Looking ahead, we welcome Sheema Ali as our new Events Manager.

Conclusion

2024 was a year of remarkable celebrations and significant achievements. We're committed to providing value to our members and advancing the field of acoustics.

Thank you for your continued support.

David Waddington

David Waddington, IOA President

Engineering Division



The IOA Engineering Division will support you through the process to help you become one of more than 229,000 registrants that hold international professional recognition.

By Blane Judd BEng FCGI CEng FIET FCIBSE, Engineering Manager

We had a good round of interviews just recently. See page 8 to read profiles of successful applicants. There is no time like the present to start the process and you could find yourself on these pages too. The postnominals after your name are the shortest CV you'll ever have to write – they say so much about you to peers and clients alike. We are always willing to help you through the process and give extra guidance to those who need it. The outcome is not a pass or fail, but some are not always successful first time. In those cases, we will support you to come back a second time and be successful.

Follow the example

Please make sure any professional review reports you submit follow the pattern of the example that Emma sends you when you sign up for the process. We still get a few applications where candidates do not seem to have referred to UK SPEC 4 when drafting reports. This is a very important part of the process and there is a lot of additional guidance in UK SPEC to help you put your report together, including examples of how to present the evidence in the best way.

We will still need an IPD report, detailing how you transitioned from a postgraduate to a practicing acoustician. Occasionally candidates who, once they have paid their invoice, ask what the next steps are. These are all clearly laid out in the guidance so please take the time to study it as it will tell you what documents are needed and



The UK Standard for Professional Engineering Competence and Commitment (UK-SPEC)

Fourth edition

Published August 2020



Above: We are now interviewing using the Engineering Council UK SPEC version 4

which items need to be endorsed by your sponsors. It also explains what to do if you cannot find IOA members to act as your sponsors.

When you first approach us about becoming registered, we send you the guidance document together with the support report examples and we are always ready to comment on the content of your professional review report prior to submitting the final draft.

Don't just spell out what happened on a project you were involved in, make sure you link the detail in the project to the A-E competencies. We need more detail about your involvement and what you did, *not* what the project was specifically.

Show your workings

We will always comment on submissions and ask for re-drafted versions, but to avoid an iterative process, try to include evidence that

shows you have the underpinning knowledge related to the projects you have submitted. For example, if you have selected a particular software to conduct modelling, explain why you chose it, what the shortfalls are, what results you were expecting and how you validated the outputs. These are all part of the A and B competencies and will save you having to do several rewrites.

The initial stages of your application will be processed by Emma Lilliman, who does a great job making sure all the fundamentals are in place. To access the UKSPEC version 4 go onto the Engineering Council website and search for UK-SPEC (<https://www.engc.org.uk/ukspec>).

Neil Ferguson still helps us with academic equivalence support for those candidates who do not have recognised qualifications. You can check for yourself if your

qualifications meet the required specification by visiting the Engineering Council website (<http://www.engc.org.uk/courses>) but please don't panic if your specific qualification is not listed, as we can still help you through the process using individual assessment (see later in the article).

Interviews

We hold several interview events through the year, depending on the number of candidates we have coming forward for registration. Our next set is scheduled for early February 2025. If you are interested in taking the next step to becoming a professionally registered engineer, contact us at acousticengineering@ioa.org.uk sending a copy of your CV and

copies of certificates and transcripts of your qualifications. It is important that we have all of your further and higher education certificates, not just your highest attainment, training courses are not relevant at this point.

There are two routes to registration:

The **recognised qualification** route, if you have achieved the required learning outcomes through recognised qualifications in acoustics. Qualifications which provide the required level of knowledge and understanding are for IEng and accredited Bachelor's degree and for CEng an accredited integrated Master's degree or a combination of accredited Bachelor's and Master's degrees (see table below).

The **individual assessment** route, for applicants who do not have the recognised qualifications and who will have an individual assessment of their qualifications and any other relevant learning such as: formal academic programmes, in-employment training and experiential learning, or self-directed learning. In many instances, it is likely to be a combination of some or all these options.

Remember we are here to help you get through the process and advice and support is offered to every candidate personally.

For **individual assessment**, the Institute accepts several courses from certain academic centres in relevant subjects, such as audio technology, as being equivalent to accredited courses for the purposes of EC registration, without the need for further assessment.

The Institute recognises the IOA Diploma course and the several Master's courses linked to it as providing evidence if you are looking to gain CEng registration. You could also offer a PhD qualification, depending upon the content of the associated taught element. We can also offer support for registration via a 'technical report' route, if you do not have the relevant qualifications to help you demonstrate you are working as a professional engineer in acoustics. If you need to follow the technical route, we will discuss this with you before you embark on that process.

Election process

The election process is overseen by the Institute's Engineering Division Committee, which is made up of volunteers from the membership, to whom we are extremely grateful. They represent the ever-growing number of members holding EC registration and provide the essential peer review process that affirms that you are at the appropriate level for recognition as an Engineering Council Registered Professional Engineer. ©

Recognised qualifications

Incorporated Engineer (IEng) One of the following:	Chartered Engineer (CEng) One of the following:
An accredited Bachelor's or honours degree in engineering or technology	An accredited Bachelor's degree with honours in engineering or technology, plus either an appropriate Master's degree or engineering doctorate accredited by a licensee, or appropriate further learning to Master's level*
An accredited Higher National Certificate (HNC) or Higher National Diploma (HND) in engineering or technology started before September 1999	An accredited integrated MEng degree
An HNC or HND started after September 1999 (but before September 2010 in the case of the HNC) or a foundation degree in engineering or technology, plus appropriate further learning to degree level	An accredited Bachelor's degree with honours in engineering or technology started before September 1999
A National Vocational Qualification (NVQ) or Scottish Vocational Qualification (SVQ) at level 4 that has been approved by a licensee, plus appropriate further learning to degree level*	Equivalent qualifications or apprenticeships accredited or approved by a licensee, or at an equivalent level in a relevant national or international qualifications framework†
Equivalent qualifications or apprenticeships accredited or approved by a Licensee, or at an equivalent level in a relevant national or international qualifications framework†	

* See: www.engc.org.uk/ukspec4th for qualification levels and HE reference points.

† For example, UNESCO's International Standard Classification of Education (ISCED) framework.

Our video explains how members can gain professional recognition and Engineering Council registration through the IOA. [Watch at https://www.ioa.org.uk/video/recognising-your-professionalism-0](https://www.ioa.org.uk/video/recognising-your-professionalism-0)

Engineering Council

successful candidates



The Engineering Council is the UK regulatory body for the engineering profession. It holds the national registers of Engineering Technicians (EngTech), Incorporated Engineers (IEng), Chartered Engineers (CEng) and Information and Communications Technology Technicians (ICTTech).

It also sets and maintains the internationally recognised standards of professional competence and ethics that govern the award and retention of these titles. This ensures that employers, government and wider society can have confidence in the knowledge, experience and commitment of professionally registered engineers and technicians.

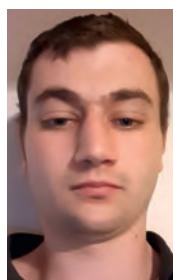
The IOA is pleased to announce that Ben Baddour, Nikhil Banda and Jerry Rees have all attained the standard required for admission to the national register.

Ben Baddour CEng

Ben is a chartered engineer with six years' experience in acoustics and vibration. He works as a senior engineer in the underwater group at the Defence Science and Technology Laboratory, where he leads the hydro-acoustic research programme that aims to develop the fundamental science and technology for hydroacoustic modelling and prediction within the MOD.

After completing his master's in mechanical engineering at the University of Surrey, Ben started his PhD in duct acoustics. His PhD was a study into the effect of ducts on free-field acoustic source radiation and this led to the publication of two journal articles.

He initiated his professional recognition in 2022 by applying for associate membership of the IOA while he was writing up his thesis and later successfully applied for full membership. In 2024 he started the application process for CEng recognition and achieved recognition in November 2024. He said: "I am very proud to have achieved CEng status, it signifies a great achievement on the academic ladder. I would highly recommend others considering CEng or professional



Above:
Ben Baddour CEng

institutional recognition to start on the journey as it increases career prospects greatly."

Nikhil Banda CEng

Nikhil Banda is a lead systems engineer at Leonardo Ltd, working at the forefront of radar signal processing and low TRL solutions. With over 14 years of expertise in acoustics and sonar signal processing in academic and industrial spheres, he underscores the value of CEng for professionals aspiring to excel in industry. Nikhil's journey to his CEng status was strengthened by academic achievements, which include MSc and PhD from University of Southampton, UK and as well as a BEng and MTech from India.

Choosing to pursue CEng is a defining step for career growth, it signifies a deep commitment to excellence and provides a globally recognised validation of skills.

He said: "My journey towards writing the PRI report was challenging. Unlike traditional technical reports, which often emphasise evidence and results, the CEng application asks for a personal narrative that highlights your competencies, contributions and ethical standards. It's an opportunity to show how you've approached complex problems, upheld codes of conduct, and applied innovative solutions in your field.

"To aspiring Chartered Engineers, I encourage you to seek support and guidance. Plan your application thoroughly and anticipate challenges. This approach will strengthen your confidence both for the interview and afterwards.

"CEng is a very personal achievement—and yes, perks like 50% off a Costco membership add to the celebration!"

Below:
Nikhil Banda CEng



Above:
Jerry Rees CEng

Jerry Rees CEng

Jerry is a technical manager of acoustics at Hilson Moran, with over 11 years' experience in the field of acoustics, noise and vibration. His work spans a broad range of services and he has gained extensive experience in leading and delivering complex projects nationwide and internationally, from initial concept to completion.

He said: "I enjoy transforming intricate problems into practical and budget-friendly design solutions that can be presented to design teams and clients with clarity."

Speaking about the process of his CEng qualification Jerry said: "Having completed an MSc in Environmental and Architectural Acoustics at London South Bank University I was able to go down the standard chartership route. It was challenging getting to grips with the requirements of the UK-Spec and aligning that with acoustic consultancy, but the variety in projects I've worked on enabled me to draw from a wide range of experience.

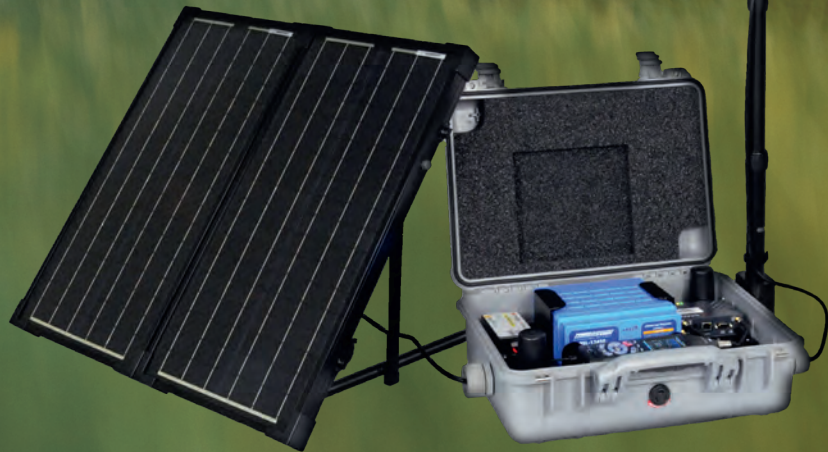
"Developing the Professional Review report involved digging a bit deeper into aspects of projects that I didn't necessarily think about day-to-day, to provide evidence that each of the competencies were met. In the end, it was highly rewarding, as it not only deepened my technical expertise but also has prepared me for future opportunities where I can continue to apply and expand these skills." 🌐



CAMPBELL ASSOCIATES
SOUND, VIBRATION & AIR SOLUTIONS



GET A PRICE



5 Year Microphone Warranty As Standard



LARSON DAVIS

A PCB DIVISION

PROUDLY SUPPLYING LARSON DAVIS EQUIPMENT

IOA Environmental Sound Group update

Navigating noise: The impact of the UK's Future Airspace Strategy on communities.

By Steve Mitchell

As the UK's airspace undergoes a transformative modernisation, acousticians face the challenge of balancing aviation progress with community wellbeing, requiring innovative approaches to environmental noise assessment and mitigation.

The UK's Future Airspace Strategy Implementation (FASI) programme aims to modernise the airspace in the country, affecting flight paths to and from the UK's 20 largest airports^{1,2}. This initiative will impact noise distribution around these airports, potentially affecting more than 1.5 million people.

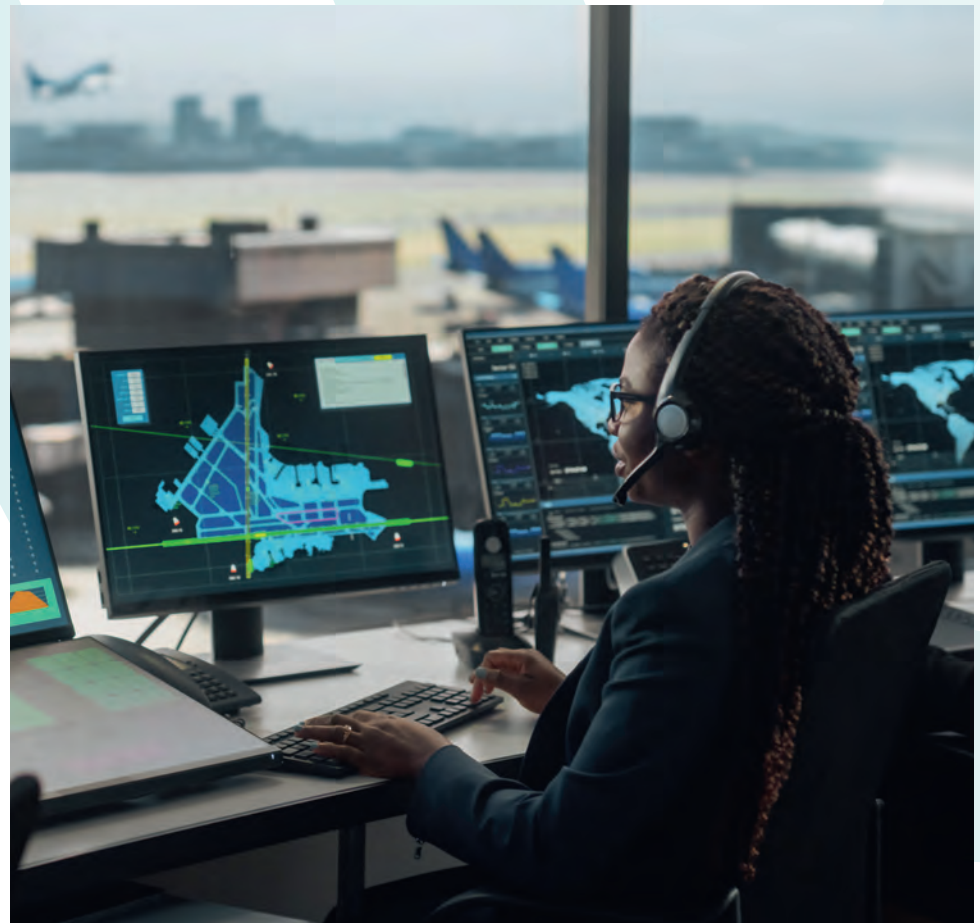
The Civil Aviation Authority (CAA) regulates this process, which follows the CAP1616 airspace change procedures³. This involves extensive stakeholder consultation and is already underway for most airports, though completion will take several years⁴.

FASI offers opportunities to reduce noise through:

- 1 steeper departures;
- 2 smoother arrival flight paths; and
- 3 changing flight paths

While routes aligned to runways close to airports will remain unchanged, some changes are inevitable:

- new routes may be introduced;
- some areas may experience increased noise exposure; and
- more precise navigation technology could lead to concentrated flight paths in certain areas¹.



Above: The UK's FASI programme will cause some redistribution of aircraft noise

Mitigation options for affected areas are limited:

- noise insulation can help but has limitations; and
- compensation for reduced house value, unlike for new roads and railways, is not currently available.

Implications for IOA members

IOA members involved in planning new noise-sensitive developments

should consider these upcoming changes to avoid excessive aircraft noise exposure. The noise impact is the most significant direct effect on communities beneath the altered flight paths⁵. Significant efforts will be needed in the coming years to fairly minimise, reduce and manage noise impacts, while also addressing social acceptability and community wellbeing. ☺

References

- 1 <https://www.caa.co.uk/publication/download/20089>
- 2 <https://assets.publishing.service.gov.uk/media/5c0e6fe3e5274a0bad85ad8c/nats-cao-feasibility-airspace-modernisation.pdf>
- 3 <https://www.gov.uk/government/publications/update-on-airspace-modernisation/dft-and-cao-update-on-airspace-modernisation-march-2021>
- 4 <https://airspacechange.caa.co.uk/documents/download/153>
- 5 <https://www.nats.aero/airspace/consultations/id/161259/>



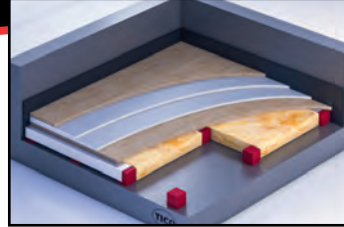
Isolation Solutions for a quieter world



Machine Mounting



Movement Bearings



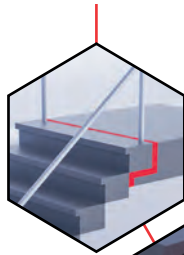
Room in Room



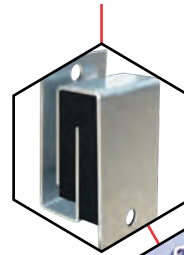
Structural Decoupling



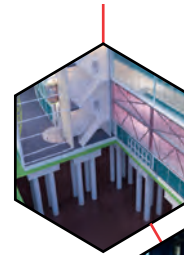
Low Frequency



Stairwells



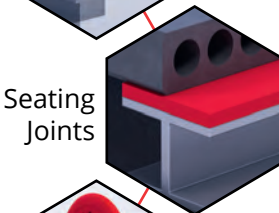
Walls



Foundation Isolation



Heavy Duty



Seating Joints



Ceilings



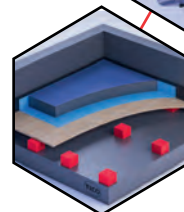
Cinemas



Pit & Plinth Isolation



Pipework Isolation



Floors



Stadiums

To support your efforts in achieving -

Sustainable Building Acoustic Design – A Practical Framework (Jan 2024)

As a leading UK manufacturer specialising in noise and vibration isolation, we are dedicated to contributing positively to sustainable building practices. Our commitment is evident through our conscientious approach to sourcing and operations. We exclusively use rubber and cork obtained from verified sustainable sources, reinforcing our pledge to environmental stewardship. Our zero-landfill strategy ensures that nothing from our operations contributes to landfill and we are proud that a substantial (and growing) proportion of our manufacturing energy needs come from our renewable power generation systems. Furthering our commitment to sustainability, we utilise water boreholes to fulfil our water requirements for production, ensuring minimal environmental impact.

We are committed to fostering sustainable development through collective action, recognising that each of us holds a crucial role in advancing our shared environmental journey.

- Tiflex House, Doublebois, Liskeard, Cornwall. PL14 4NB UK
- Tel: +44 (0) 1579 320 808
- Email: tico@tico-solutions.com
- Web: tico-solutions.com

View Website



Tiflex a proud sustainable British manufacturer of the Tico bonded cork and rubber range of vibration isolation solutions.



IOA EVENTS FOR 2025

PROPOSALS TO UPDATE BS 8233 – A DEEPER DIVE

14 January 2025

Voco Manchester (See the advert below for more details)

THE ART OF BEING A CONSULTANT

Organised by the Early Careers Group & UKAN+

27 March 2025

Bridge5 Mill, Manchester

THE ART OF BEING AN ACOUSTICIAN

Organised by the Early Careers Group & UKAN+

28 March 2025

Bridge5 Mill, Manchester

12th INTERNATIONAL CONFERENCE ON

AUDITORIUM ACOUSTICS 2025

8-10 September 2025

The Bristol Beacon, Bristol

Annual Conference and Exhibition

ACOUSTICS 2025

October 2025

REPRODUCED SOUND 2025

November 2025

Other event

AUTOMATIC SPEAKER RECOGNITION:

GETTING STARTED FOR RESEARCH

Thursday 16 and Friday 17 January 2025 (1.5 days)

£200 per delegate

In-person (University of York)

The course is only open to research students (those doing either Masters or PhD) who would like to know more about automatic speaker recognition systems and how to utilise them in research. Interested participants are invited to complete a **google form**

before signing up for the course.

For up-to-date information visit www.ioa.org.uk

Proposals to update BS 8233 – a deeper dive

Voco Manchester, 59 Portland Street, M1 3HP

Tuesday 14th January 2025 10:00 – 16:00

This deeper dive into the proposals is intended to help you inform a response to consultation. We'll be assuming some prior knowledge of the principles of the proposals.

In this extended session we'll be going into more detail, and give you the chance to try out the proposed methods with some hands on sessions.

Meet the speakers:

Dr David Hiller, Chair of BS 8233 drafting committee. David is an Associate Director with Arup.

Jack Harvie-Clark, Founding Director at Apex Acoustics.

Dr Benjamin Fenech, Noise lead at UKHSA.



Please register via the QR code

Special rates available for Public Sector/Local Authorities

FOR MORE INFORMATION:

E: sheema.ali@ioa.org.uk T: +44 (0)300 999 9675

IOA, Silbury Court, 406 Silbury Boulevard, Milton Keynes MK9 2AF www.ioa.org.uk



The Complete Solution for Noise, Vibration, and Air Quality Monitoring



**Transparent hire prices
from £85 per week**
with lots of kit in stock for
next day delivery

**Traceable calibrations
to national standards**
with a 1-3 day turnaround time



For more details or to register, get in touch on
01234 639550, sales@acsoft.co.uk or www.acsoft.co.uk

Bursary Fund profiles

This IOA Bursary Fund update includes the experience of two applicants that have obtained funding to kickstart their careers by studying the IOA Diploma. This proves how well regarded the IOA Diploma is out there for everyone wanting to learn more about acoustics and join the industry. Our third profile demonstrates how the Fund supports on-going studies.

By Reena Mahtani FIOA, Chair of the IOA Bursary Fund



In this issue, we feature

Amy Beeston from Orkney and Sidhin Soman from Qatar.

Both have different profiles, but their applications conveyed very clearly their motivations to continue with their studies and how they think their previous academic and work experiences can be beneficial to enhance their learning, and how they intend to bring this knowledge into their future roles as acousticians.

The third profile is from Mike Lotinga, who changed hats from consultancy to academia. He is currently studying a PhD at the University of Salford and presented his research on unmanned aircraft systems. (See his article on page 38 of this issue.)

We wish them all the best in their studies and will hear back from them at the end of the academic year.

As always, if you know of someone who could do with funding for acoustic related activities (attending a conference, studying or even starting a STEM project), please remind them to apply! All the details and the application form are at <https://www.ioa.org.uk/can-we-help/bursary-fund-application-form>

Above:
Amy Beeston
working on
Hoy, Orkney

Amy Beeston

I have an interdisciplinary training in sound, first studying a year of physics (Oxford) before swapping to music technology (Edinburgh) and later sonology (Den Haag) where I focused on developing sonic control methods for audio-responsive participatory sound art in gallery settings. In my PhD (Sheffield) I examined how human listeners can (or can't) adapt to different room acoustic conditions and built a computer model displaying perceptual compensation for reverberation effects. I then worked as a post-doctoral researcher in computer science (Sheffield) and music psychology (Leeds) in a range of applied acoustics projects concerning human listening and machine-mediated sound analysis in various health and wellbeing domains. Since moving to Orkney in 2018 my work has been increasingly influenced by principles of acoustic ecology and ecological sustainability, and I have been working as a freelance audio researcher and sound artist with both academic and community partners.

I applied to the IOA Bursary Fund to help with the costs of the IOA Diploma course – training I have been thinking about undertaking for several years now, and really

enjoyed getting started with last year. The tutorials so far (in Edinburgh) have been a welcome face-to-face reconnection with the acoustics community, a brilliant refresher of my existing knowledge and a super introduction to the regulatory frameworks that I need to learn about to open further work opportunities in the future.

The process of applying for the Bursary was relatively painless, even for a somewhat reluctant writer such as myself. When I initially rang to ask about the possibility of financial support, the IOA staff were very encouraging about applying to the Fund and reassured me that the application form was short and that the response would come quickly. Later, when the committee needed further details about my work history, they requested the information by email rather than reject the application outright. What a refreshingly straightforward way to work!

I would like to take this opportunity to thank everyone involved for supporting me at this time, and to whole-heartedly recommend the IOA Bursary Fund to anyone with the inkling of an idea that needs some financial support to see the light of day, go for it!



Sidhin Soman

Hailing from a vibrant village in Kerala, India, I've always been captivated by the nuances of sound. Growing up amidst the noise and chaos of traditional festivals, I witnessed firsthand the detrimental effects of excessive noise on people and the environment. These experiences ignited a passion within me to delve deeper into the world of acoustics and noise control.

My career journey led me to the bustling construction industry in Qatar, where I gained valuable experience in interior fit-out projects, including cinema auditoriums and multipurpose halls. These projects exposed me to the intricate interplay between sound and space, further solidifying my interest in the field.

However, financial constraints threatened to hinder my academic aspirations. The IOA Bursary Fund provided a lifeline, alleviating my financial burden and enabling me to enroll in the Diploma in Acoustics and Noise Control. This generous support has been instrumental in allowing me to focus on my studies and achieve my academic goals.

With the knowledge and skills gained through this programme, I aspire to become an acoustic consultant, addressing noise pollution issues and promoting

Above:
Sidhin Soman

Below:
Mike Lotinga

sustainable acoustic solutions. I am particularly interested in applying my expertise to urban planning and environmental acoustics.

I am deeply grateful to the IOA for this invaluable opportunity. The Bursary has not only provided financial support but has also boosted my confidence and motivation. I am committed to giving back to the acoustics community by sharing my knowledge and expertise. Thank you once again for the generous support and the opportunity to be a part of the IOA community.

Mike Lotinga

I'm currently a doctoral research student at the University of Salford's Acoustics Research Centre, where for my PhD study I'm investigating human perception and response to sound from unmanned aircraft systems (UAS). My research is part of a consortium-led, EU Horizon and UKRI-funded multidisciplinary project, aimed at developing tools to enable airspace regulators, planners and operators to incorporate UAS route optimisation alongside conventional aircraft flightpath mapping. We hope

that this research will contribute to ensuring that the anticipated benefits of these technologies can be realised, while at the same time managing potential issues such as noise in a responsible and sustainable way. With a view to promoting and supporting my studies by engaging with the latest research, as well as to strengthen existing partnerships and establish new collaboration opportunities, I've benefitted from attending international conferences. This year, I was privileged to be awarded a grant by the IOA Bursary Fund, which I used to support attendance at Inter-noise 2024 in Nantes – one of the most engaging and exciting conferences I've attended. As well as a session dedicated to urban air mobility, there were several inspiring plenary speakers and numerous other technical sessions on subject areas related to my study that provided opportunities to broaden my awareness and develop new ideas.

The IOA Bursary Fund provides a fantastic opportunity for existing and future researchers, as well as others interested in innovation within our industry. ☺



Andrew Ewing Watson

25 October 1936 – 12 September 2024

Andrew Ewing Watson, known by friends and colleagues alike as Andy, died peacefully in his sleep on 12 September 2024, at the age of 87.

By Alistair Somerville

A stalwart of IOA Scottish Branch, he was well known as long-serving Branch Treasurer and Chair of the Workplace Noise Advisory Committee, for his expertise in motorsports noise assessment and control, and as the 'go-to' person for CEL sound measurement instrumentation.

Andy was a dedicated figure in the field of acoustics and a passionate motorsports enthusiast. He leaves behind a legacy of expertise and kindness that touched many lives.

Early life

Born in Bearsden, Scotland, on 25 October 1936, Andy was raised in a family that valued adventure, which took the form of travels in Europe by car in the years after the war. With his love for cars and motorsports developing at an early age, he became an accomplished rally driver, competing from 1955 to 1975 with notable success.

After completing his education at the High School of Glasgow, he ventured into the world of agriculture, studying dairy technology before embarking on a diverse career path that included national service in the RAF. However, Andy developed a fascination for acoustics and returned to studies, which resulted in attaining firstly the IOA Diploma in 1980, then an MSc in acoustics at Heriot Watt University in 1982. His passion for the automotive world found an outlet and professional focus in his newly chosen career, where he gained recognition as a leading consultant in motorsports noise assessment and control.

Rewarding professional life

His partnership with Fiona Watson, whom he married in 1984, was both personal and professional. Together, they founded



Above:

Andrew accepting his Lifetime Achievement Award from the Motorsports Association, presented by Prince Michael of Kent.*
**I have included a photograph of this occasion as it celebrates both his interest in motorsports and his acoustics expertise. At the same time I must apologise for the quality of the image which is entirely due to image submitted and not the publishers*

Acoustic Consultancy Services. Andy's talent for problem-solving and communication flourished, and he was known for his ability to bridge technical knowledge with practical application. Professional accolades followed, including a Distinguished Service Award from the Institute of Acoustics, and a Lifetime Achievement Award from the Motorsports Association, presented by Prince Michael of Kent.

Andy faced many health challenges in his later years, yet he remained resilient and grateful for the support of his loved ones, especially Fiona, who cared for him with unwavering devotion. Despite his struggles, he maintained a keen sense of humour and a zest for life, sharing memorable moments with friends and family.

A man who loved travel, wine and fine cars, Andy's journey through life was marked by passion, integrity and a deep appreciation for those around him. He is survived by Fiona, who cherished their 40 years of marriage, and a network of friends and colleagues who will miss him greatly.

Your journey has come to an end, Andy, and you have taken your final chequered flag. So time for me to say goodbye and thank you for your company and chats; for the times enjoying the motorsports and hospitality at Goodwood, at home reminiscing on past Scottish Branch socialising and IOA matters and latterly, in hospital – still smiling and chatting all things acoustics, IOA and F1 Grand Prix. 🕊️

INNOVATION IN NOISE & VIBRATION MONITORING

The Wireless Generation

- ✓ **Excellent battery performance**
Continuous monitoring for several months
- ✓ **Rubust and weather-proof design**
Complete with colour display and keypad
- ✓ **Time- and cost-effective**
Manage remotely from your device

INFRA Net
Measurement
Management System



INFRA C22
Wireless Triaxial
Vibration Monitor

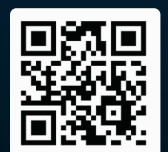


INFRA C50
Wireless Sound
Level Meter



At the forefront of remote monitoring

Sigicom offers a complete and compact wireless solution for measuring vibrations and noise. Thanks to exceptional battery life, and remote monitoring your work will be both simplified and more cost-effective.



Discover our
product range

IOA schools' competitions

The IOA runs two competitions each year: one for primary school-aged children and one for secondary school-aged children. This is a great way to encourage children to think about sound and the soundscapes around them.

By Angela Lamacraft, Sustainable Acoustics Ltd and Heulwen Peters, SRL Technical Services Ltd

Primary school competition

This year's primary school competition theme was 'Where Sounds Best?' Children were asked to think about somewhere with sounds they like and produce a hand-made drawing, picture, patchwork, collage or similar, to illustrate what they like about the place and the sounds. 75 entries were received this year from 15 different schools, making this year's competition the most successful yet. In fact, it was so hard to identify the best entries from the many that were received that the judges commended two entries and made three others highly commended! The winner was eight-year-old Myah-Rose from

Below:
Award-winning Myah-Rose with Heulwen and Bea

Rendlesham Primary School in Suffolk. Heulwen and her colleague Bea (both SRL Technical Services) were delighted to go to the school to present Myah-Rose with her award and prize and run a STEM session with the Year 3 to Year 6 pupils.

For her entry, Myah-Rose created a beautiful diorama of a playground at the seaside, including swings, a slide, a seesaw and an ice cream van. Using her art and descriptive words, she painted a picture of her favourite soundscape, saying "The sound of the ice cream van makes me happy and reminds me of summer", "The park gets louder when more people play in the park", "The cracks on the path sound funny when I ride over them on

my scooter" and "I like the sound of birds because they sound funny and the big ones steal people's chips".

Over the course of an hour, Myah-Rose and her friends at Rendlesham Primary learned about acoustics and sound, and what an acoustic consultant is. They then did a range of activities and experiments with Heulwen and Bea. Great fun was had by all first trying to guess how 'quiet' they would be if they tried to make no noise at all – and then how loud they thought they could be if they really tried, using a sound level meter to see if they predicted correctly.

The music boxes then came out and the pupils experimented with reradiated noise and isolation – looking at how the music boxes worked and how the isolation felt. Finally, the pupils did a soundscape exercise, listening to the world

Below right:
Myah-Rose's beautiful diorama of a playground at the seaside





around them and talking about the noises they liked and didn't like and what they could hear best and least well.

Having had a wonderful morning of sound, noise and STEM, when asked for any 'final questions' they asked, "when can the IOA come back?" It was a delight and privilege to meet so many engaged and excited pupils keen to learn more about the wonderful world of acoustics, so we too hope we will go back again next year!

Secondary school competition

2024 was the fourth year the IOA has run the secondary school competition. Pupils were asked to investigate the connection between acoustics and ecology by identifying the birds present in three acoustically different areas to encourage them to think about the effect of sound on wildlife. Firstly, they needed to familiarise themselves with the measurement hardware and software, an important first step in any experiment. Then they were asked to identify three local areas that sound different and describe the soundscape in each. Finally, they used the BirdNET app to identify any birds that were present in each area and discuss the differences between the three areas.

The three judges, Gloria Elliott (CEO of the Noise Abatement Society and Co-Founder and Chair of Quiet Mark), Fiona Rogerson (IOA Honorary Secretary and Senior Acoustic Consultant at Arup) and Matthew Muirhead (Associate Acoustics Director at AECOM) come from different backgrounds, bringing a valuable diversity to the decisions that were made. The entries all

Above:
Rendlesham Primary School pupils using music boxes to experiment with reradiated noise and isolation

Below:
Orla Keane, Emily Clarke, Isla Parker and Mr Clarke from St Oscar Romero Catholic School with Dr Beccy Cooper MP and Sir Peter Bottomley

demonstrated excellent quality and creativity, reflected in the fact that all three judges ranked them in a completely different order.

After discussion and careful consideration, Izzy, Samuel and Jessica from Balshaw's Church of England High School were highly commended and Ewan and Clarissa from the same school were commended.

However, the entry from Orla Keane, Emily Clarke and Isla Parker from St Oscar Romero Catholic School in Sussex was declared the winner: the judges loved how well-presented the entry was, and the good descriptions provided throughout the presentation.

Orla, Emily, Isla, a parent each and Mr Clarke, second in science and teacher of science and A-Level physics at the school, attended the Noise Abatement Society's John Connell Awards at the Houses of Parliament (see the report on page 30). The group was met by their local MP Dr Beccy Cooper, as well as the previous MP, Sir Peter Bottomley, both of whom were eager to talk to the pupils and learn about the competition.

Mr Clarke is keen to recognise the impact of seeing an all-girl team win a national STEM competition has on younger pupils and the school hopes it will inspire others to take up opportunities in the STEM fields.

This is the third time St Oscar Romero Catholic School has won the competition, and right from winning the first competition in 2021, Mr Clarke and the school have demonstrated an inspiring hunger for knowledge of acoustics. The school welcomes IOA STEM Ambassadors each year to work with KS3 pupils (Years 7 to 9), and this year they also welcomed

Dr Gianluca Memoli from the University of Sussex to speak to pupils, with acoustic demonstrations, in addition to hosting some Year 10 pupils on their work experience placements.

The school has been working with researchers from UCL on a project since 2022 and it is hoped that their paper (*Student Perception of School Soundscapes and Wellbeing: A Mixed Methods Examination of Natural and Musical Sounds*) will be published shortly. Pupils from the school have also visited ISVR at the University of Southampton and experienced the reverberation chamber, anechoic chamber, 3D Audio Lab, vibration lab and attended a lecture on sound. Pupils have also demonstrated binaural recording and an acoustic camera at the Teen Tech event with HEAD Acoustics and the school is really looking forward to piloting a series of acoustics-related activities for pupils, which will hopefully be ready by the time you read this. Pupils at St Oscar Romero Catholic School will soon be more experienced than many of us!

Engaging acoustics

The enthusiasm demonstrated by the staff and pupils at Rendlesham Primary School and St Oscar Romero Catholic School highlights how fun and engaging acoustics can be when delivered by passionate acousticians, and how STEM engagement can make a huge difference to the exposure to acoustics school pupils get.

The 2025 school competitions will be slightly different so please keep checking the IOA website, Acoustics Bulletin and e-Bulletin for announcements which should be coming at the beginning of 2025. ©



Farewell Linda

After 34 years (how long?) Linda Canty HonFIOA has retired from the IOA. It does feel like the end of an era and to commemorate this amazing career, members were given the opportunity to upload a message to an e-card for her. Here is just a small selection, which show how much she will be missed and how grateful we all are for her hard work, patience and unassailable ability to keep all her ducks in a row.



Above: Linda Canty and some of her colleagues in the IOA boardroom during the December Council meeting

- *Without you the Institute would have been a shadow of itself and I have no trouble saying that you have been a massive help to me in my various roles and made things that little bit easier with a smile and a degree of calm I've often wondered was touching on the ethereal.*
Peter Rogers
- *How on earth will we organise and run a conference without you? You have always been so helpful and generous with your time. You always seemed to appreciate the common aim.*
Steve Mitchell
- *You have always been professional and unflappable throughout your service to the IOA. We simply couldn't have done it without you. You're a star.*
Robin Cross

- *I think you've been working at the IOA longer than I've been working. It's hard to imagine the place without you. Through all the challenges you've been the steady hand. Your dedication, warmth and integrity have set the bar high, and it's safe to say you'll be missed.*
Daniel Goodhand
- *I first met you back when we were organising ICBEN 2011 in London. You have always been there with a smile and calm manner to help me cope with my own disorganisation. Enjoy your retirement – may it be free of acousticians.*
Charlotte Clark
- *Massive thanks for all your help over the years, especially your wonderfully flexible and constructive attitude towards our poor attempts at getting papers submitted on time and to the right length. We will miss you enormously.*
Phil Nelson

- *Auditorium Acoustics throughout the world would not be where it is today without your dedicated, thoughtful, persistent and efficient organisation – it has been absolutely outstanding and we are so very grateful. We will try to keep up standard when you retire but it will be a challenge.*
Raf Orlowski
- *It's the end of an era. The IOA will learn to be a different place as you enjoy your well-earned retirement. Your mastery of the graceful swimming swan is something to which I aspire.*
Emma Shanks
- *Thanks for being the rock on which the transformation and modernisation of the IOA has rested.*
Raj Patel
- *I've been getting emails from you for longer than anyone else in my working life and we've never met! Amazing service to the IOA.*
Peter Barry
- *Linda, you are a legend. Thanks for your kindness, commitment and endless patience.*
Paul Shields
- *The IOA (as we know it today) has been shaped to a rather large extent by your tireless commitment. Of course, we will all miss you, but safe in the knowledge your next chapter awaits (with a glass or two of chilled bubbly).*
Alex Krasnic
- *You have been the most super-helpful and efficient organiser I have ever had the pleasure of dealing with. You have had a hugely positive impact on the IOA. The Linda Canty era. We'll all miss you.*
Chris Adair

Message from Past-President, Barry Gibbs

My first contact with Linda was as at an Autumn conference of the IOA at Windermere. At this and subsequent Spring and Autumn meetings, Linda became the go-to person on all matters. We were all guilty of inventing excuses for late payments and submissions, which Linda handled with good humour and great efficiency.

The accompanying social events of these earlier meetings were fun but could be a bit chaotic. Linda enjoyed the social aspects whilst remaining professional and focused on achieving a successful conference outcome. And this has been the case in the many conferences since. If Linda was on the reception desk, then people knew they were in safe hands. Conference organising committees come and go, but Linda has been a constant presence and has been the face of the IOA meetings programme.

The International Congress on Sound and Vibration, in London in 2017 presented the IOA with several challenges. The hotel venue at Westminster Bridge was possibly too small for the numbers attending and

size of the technical programme, the organisation of which was behind schedule. As programme co-chair and proceedings editor, I found Linda a constant source of help and support, a calming influence through various crises. The ultimate success of the congress was much down to her. The same can be said about Linda's contribution to the Inter-noise conference in Glasgow in 2022. Here, we successfully addressed the challenge of getting a healthy turnout at the first major international event following the pandemic.

It has been my pleasure to work with Linda and to observe how she interacted so positively with her colleagues and members of IOA. I wish her a long and happy retirement.

Message from IOA Council member, Martin Lester

I first met Linda at the IOA Spring Conference of 1990, shortly after she had started with the IOA. Since that time Linda has been such a support to me with help, advice and making things happen, in the

various roles that I've held within the Irish Branch, Council, Executive and Meetings Committee.

Linda's dedication and time given to the IOA as a whole is well beyond that appropriate to her role; it's as though (like those volunteer members involved in the running of the IOA) she gives so much of her own time (many early morning and weekend emails).

During the many years of knowing Linda, I know that she doesn't like being in the limelight; but (as has been said by so many) Linda has given such commitment to the IOA, and her knowledge of, and dedication to, the Institute will be a great loss.

Signing off

We thank Linda for absolutely everything she has done for the IOA, this small selection of messages taken from the hundreds in her e-card confirm exactly what we've always known. She is a one-off, calming, entirely reliable influence and a very much loved colleague. 🌟

Sheema Ali will continue Linda's work in organising IOA events, so normal service is secured!

IFC and BIM import made possible!

Enjoy great new features with the latest version of ODEON, including automated import from REVIT and ArchiCAD

BIM software

Before 😞 **278685 surfaces**

Now 😊 **664 surfaces**

Try ODEON 18
odeon.dk



odeon.dk/product/whats-new/
sales@odeon.dk

STEM visit to Mellor Primary School in Stockport

Helen Sheldon braved a classroom full of Year 4 pupils to bring acoustics to life by employing the use of a plant pot, a balloon, some rubber bands and some salt.

By Helen Sheldon, RBA Acoustics



paying attention to their science lessons as they had a really good understanding of the things I was discussing. So much so that it was hard to get a word in edgeways!

Hands-on

Following that, we did some 'experiments' about sound – we used a sound level meter to measure how quiet the class could be (a very impressive 35 dB, which was driven mainly by the smartboard speaker) and also how loud (an equally impressive 108 dB, which we shut down very quickly so as not to disturb the rest of the school). We tested our hearing and discovered that the children had much better high frequency hearing than adults. With the use of some elastic bands and a plant pot we also looked at how acoustic guitars naturally amplify sound, made a tonoscope with a plant pot, a balloon and some salt, and looked at the difference between airborne and structure borne sound using a music box mechanism.

All in all, it was a really fun afternoon. It was great to see how enthusiastic and engaged a room full of eight- and nine-year-olds can be about sound, and see that they were able to figure out how and why things work.

I might have to volunteer to go again next year! ☺



Back in September last year I went to a 'Meet the Teacher' event at my youngest daughter's school. She'd just joined Year 4 and had a new teacher, Ms Yerkes.

At some point during the event, Ms Yerkes mentioned that one of their science topics during Year 4 would be sound. This brought me back to a few years ago when my eldest daughter was the same age; I got roped in to talk to her class about sound during British Science Week. I'd had a fun time chatting to her and her class about all things sound and some famous historical acousticians. Back then I'd promised my youngest daughter that I'd do the same for her when she was the same age, so I collared Ms Yerkes and offered my services to come and talk to the children about sound as part of their topic.

Lottie lends a hand

As it happens, by the time we'd managed to arrange a date, the talk fell during Tomorrow's Engineers Week when here at RBA Acoustics we were also taking part in the Women's Engineering Society 'Lottie Tour'. The tour involves a doll, (Lottie) visiting a whole host of engineering practices and disciplines to find out more about what they do, with the results shared on social media to raise awareness and engagement. The IOA STEM Committee has coordinated its members taking part in this for the last couple of years, so I took Lottie and my bag of tricks down to Mellor Primary School for an afternoon with Year 4.

I gave a bit of talk about how sound travels, how we hear it, and the difference between sound and noise – Year 4 had definitely been

Above:
Lottie muscling in to the STEM presentation at Mellor Primary School

Right:
Ms Yerkes and Lottie

Below: Two new ANC guidelines align with the UN's sustainable development goals



Association of Noise Consultants sets out on a path to sustainability with two new guides for members

New guides have been published, explaining how the ANC's members can use their skills to help society to take a softer step on the planet.

The Association's sustainability committee has prepared two short sets of guidelines aimed at highlighting how acousticians can play a sustainable role in supporting biodiversity and in education.

Committee members hope the guidance, split into two key documents, will serve as a resource to help members form sustainable working practices, and to understand a little more about the issues facing the planet.

The guides align with the UN's sustainable development goals, and the UN Frontiers Report 2022, which identifies noise as one of the three key challenges that need to be faced.

Heulwen Peters, Chair of the ANC's Sustainability Committee, said: "These guides address some of the issues that face our planet, and we hope it will give ANC members some inspiration as they take steps to contribute to a more sustainable future.

"They focus on how we can work and provide advice for our clients with more consideration of what construction and design methods are sustainable."

To find out more or to download the guides, visit <https://www.association-of-noise-consultants.co.uk/resources/sustainability/>

Why join the ANC?

The ANC is the only recognised association for acoustic consultancy businesses in the UK – and offers a range of member benefits.

Join us and take advantage of opportunities including:

- Entry on the ANC website, where you can list the services you provide
- ANC publications available at a discount
- Regular technical presentations, discussions and networking at bi-monthly meetings
- Your views represented on BSI and ISO committees
- Consultation on impending and draft legislation, standards, guidelines and Codes of Practice
- The chance to look at new ideas and interesting themes – and celebrate the achievements of the industry – at the ANC annual conference and awards event

...and much more!

To find out more about joining the ANC, visit: www.theanc.co.uk/membership

ANC | ACOUSTICS & NOISE CONSULTANTS

Charting a sustainable path: The IOA’s sustainability journey has begun

The IOA has taken significant steps towards embedding sustainability into its core operations through the Sustainable Design Task Force (SDTF) strategy for 2023-2025. The revival of this group was with the purpose of energising the IOA’s strategic plan to provide a comprehensive approach to sustainability within the field of acoustics, addressing environmental, social and economic impacts. This article charts the ‘fast burn’ phase of the SDTF and a summary of its ‘stand-down’ report to IOA Council.

By Richard Grove, Immediate Past Sustainable Design Task Force Chair, and Peter Rogers, Co-chair of Sustainable Advisory Group and Strategic Lead for Sustainability of the IOA

The SDTF initially established five strategic themes. However, the SDTF quickly realised the broad nature of the proposed themes were potentially overwhelming to articulate how acoustics relates to each one exhaustively. They therefore adopted a flexible ‘Plan, Check, Act, Do’ methodology inspired by ISO IWA 42:2022 approaches, with a timeline spanning from Q3 2023 to Q4 2024.

SDTF composition and engagement

The SDTF comprised key representatives, including:

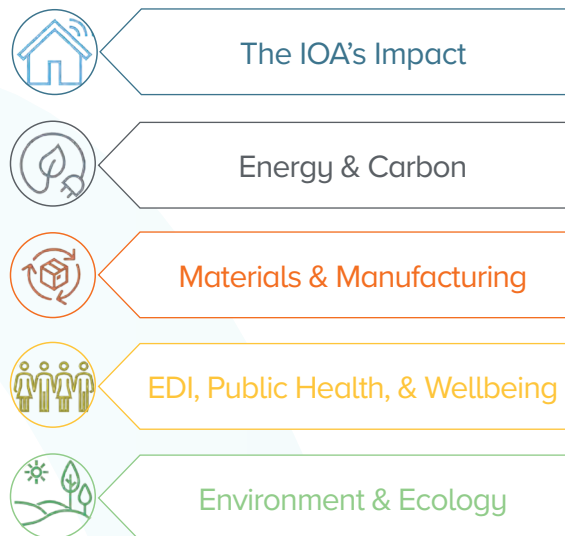
Chair	Richard Grove
Theme 1: The IOA’s impact	Richard Grove and Peter Rogers
Theme 2: Energy and carbon	Barry Jobling
Theme 3: Materials and manufacturing	Momo Hoshijima and James Bligh
Theme 4: EDI, public health and wellbeing	Angela Lamacraft and Benjamin Fenech
Theme 5: Environment and ecology	No representation

Though not all strategic themes were fully represented, notably the group sought to connect with internal committees and wider institutions to reinvigorate the IOA’s sustainability efforts. A huge thanks goes to all those involved.

Key engagements and insights

Two critical meetings shaped the SDTF’s approach:

- 1. Temple Group Meeting (17 April 2024) – who had achieved B Corp status.**
Key takeaways included:



- the need for short-, medium-, and long-term goals;
- the importance of industry engagement; and
- the focus on high return on investment activities.

2. Chief Pollinator Meeting (22 April 2024)

- Recommendations included:
- conducting a climate Fresk* to establish sustainability priorities; and
 - driving sustainability through membership engagement.

Membership survey and findings

A survey conducted during Acoustics 2024 in Manchester received 12 responses providing some insights into members’ sustainability engagement and priorities. This included the need to:

- identify a budget to assist in driving IOA organisational change related to sustainability – specifically to fund and champion initiatives. This is likely to be a role, either as part of another role or as part-time to be within the organisation;
- drive organisational change related to sustainability and lead by example, including the development of a reasonable short-, medium-, and long-term roadmap;
- develop mechanisms for the membership to succeed in their code of conduct commitments related to sustainability; and
- organise a sustainability Fresk, noting we need to cover (as a minimum) both environmental and social sustainability topics, this to be a separate meeting to the Conference, drawing on responses received on the IOA exhibition stand.

Challenges and new direction

The SDTF recognised the value and need for guidance but a focus on

*A Fresk’ is a method devised in 2015, which brings the views of a group of people together. <https://climatefresk.org/>

action over documentation. They observed that engagement with IOA Committees and external groups proved challenging within their resource constraints. Consequently, they pivoted to developing a strategic roadmap for the IOA to focus on:

- understanding and improving IOA's impact;
- providing tools for members to meet sustainability obligations; and
- encouraging member engagement in sustainability efforts to meet their professional obligations.

Recommendations and next steps

The SDTF in its second incarnation proposed several key recommendations, before standing down:

1. Identify a budget to drive organisational sustainability change.
2. Develop a comprehensive roadmap with short-, medium-, and long-term goals.
3. Create mechanisms for members to fulfil sustainability code of conduct commitments.

4. Organise a sustainability Fresh covering environmental and social sustainability topics.

Formal outcomes

The IOA Council and the Strategic Sustainability Lead have approved several significant actions as a result:

- continued sustainability-focused articles in Acoustics Bulletin;
- formation of a Sustainability Advisory Group (SAG);
- development of an IOA Roadmap to Net Zero by 2050 led by the SAG; and
- potential budget allocation to support sustainability initiatives should they be needed.

Conclusion

While the SDTF's journey faced challenges, it has defied the noise and laid crucial groundwork for the IOA's sustainability strategy to move forward with purpose and determination with an eye on the clock. By shifting from a comprehensive but overwhelming documentary approach to a more focused, action-oriented method,

the IOA is positioning itself to make meaningful progress in sustainability over the coming critical period for climate change and keeping 1.5 degrees challenge alive.

The establishment of the Sustainability Advisory Group (SAG) and Council's commitment to develop a Net Zero Roadmap demonstrates the IOA's serious intent to integrate sustainability into its core mission and support its members in this critical endeavour to be a profession fit for the future. ☺



UKAS Accredited Calibration Laboratory
Visit www.ukas.com for full scope



WE CALIBRATE:

- ||| Sound Level Meters
- ||| Sound Calibrators & Pistonphones
- ||| Microphones
- ||| Octave/Third-Octave Filters
- ||| Accelerometers*
- ||| Vibration Meters*
- ||| Tapping Machines
- ||| Reverberation Time



A FOCUS ON:

- ✓ Fast Turnaround
- ✓ Competitive Pricing
- ✓ Customer Service

"We are very pleased with the excellent service we received from ANV in recent months. Most notably, they provided an efficient and hassle-free calibration service with which we couldn't have been more satisfied."

Jack Richardson, Hilson Moran Partnership Ltd

* Not accredited by UKAS

Measuring particle size distribution

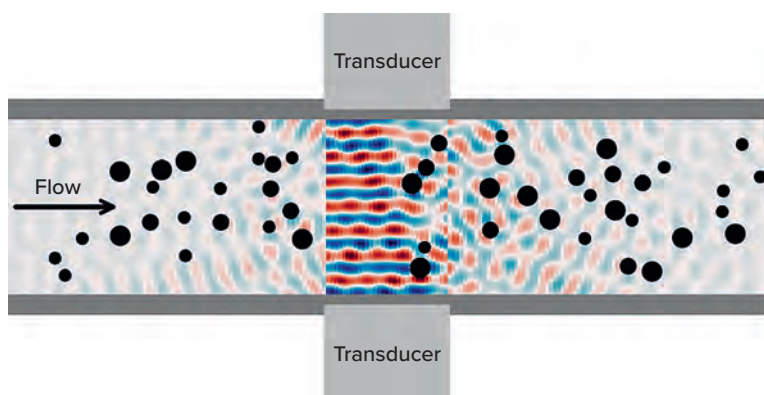
Real-time monitoring of particle size distributions for powders, emulsions or any particulate material would be a game changer for chemical, pharmaceuticals and other industries.

By Paulo S. Piva and Art L. Gower

Particulate materials are vital in a wide range of industries, usually as precursors of a final product. They are composed of small particles mixed in a homogeneous medium, like lithium powders in batteries, oil emulsions in food and pharmaceutical preparations, or metallic catalysts in chemical reactions. The particles used range in size from a few hundred nanometers to many hundreds of microns, and most applications require precise particle size distributions for their products.

What is known

There is currently no inline and online method to measure particles in production so industries with high value products will spend a lot of time and resources to take small samples of their materials to laboratories to measure the particle size distribution, often by using laser diffraction, which requires that the sample be diluted. Laser diffraction methods can be reliable, but require training staff, are slow and can only analyse very small samples.



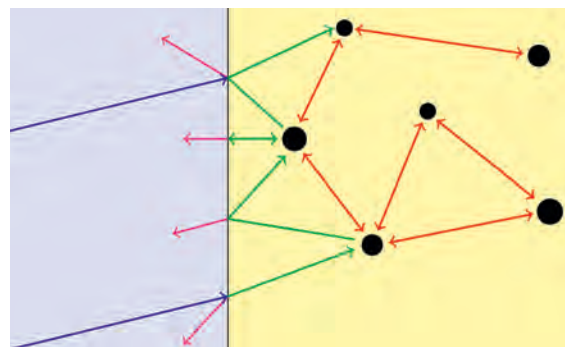
Above: Figure 1: Showing the cross-section of a pipe. Particles are suspended in the fluid, represented by black circles, with a flow in the direction of the black arrow. A pair of transducers (acoustic sensors) are attached to the pipe walls. One transducer emits waves and measures their reflection, while the other measures the transmitted wave. This illustration is just a pictorial representation, for any real applications, particles would be much smaller and more numerous. Figure was taken from [1]

The solution: use ultrasound

Sound waves seem like an obvious choice to measure particles. Sound penetrates solid media much more than light, meaning we can measure transmitted and reflected waves in inline conditions, which are usually large bulk material moving through a pipe. With ultrasound inspection, the measurements can be taken without stopping the process or diluting the material. An example is illustrated in Figure 1, where a particulate suspended in a fluid runs

through a pipe, and two transducers are used to send and measure ultrasonic waves being reflected by and transmitted through the particulate.

In more detail: each sound wave sent through the particles is difficult to analyse as it contains irrelevant information about the specific position of the particles. To extract useful information, such as the average particle size, we can average the signal in time, which is then sensitive to the statistics of the particles^{1,2}.



Knowledge gaps

The reason ultrasound has not yet been used to measure particulates is due to gaps in the knowledge. The main complications stem from multiple scattering of sound waves by the many particles. The frequencies that are sensitive to the particle size (wavelength comparable to particle size) get scattered multiple times before the signal reaches any sensor. See Figure 2 for a schematic example of multiple scattering between particles and walls of a pipe or container. What has been achieved is measurements of effective properties of suspensions for long wavelengths, which are not sensitive to particle size distribution.

The authors, together with others, have recently overcome the last remaining knowledge gaps^{1,3,4}, which means there is now a reliable description of how sound waves propagate through particulates for any frequency and particle volume fraction.

Where are we now?

We are currently developing sensors with an industry partner for chemical industries. Trials will be ongoing for the next few years. If you work on any application that needs a dense particulate, powder, or slurry, to be measured inline, then please get in touch with Paulo Piva at ppiva1@sheffield.ac.uk or Art Gower at a.l.gower@sheffield.ac.uk ©

Above: Figure 2: Showing the different waves that are scattered from, and arrive at, the particles and walls. Each arrow identifies where the wave was generated and what it excites. In the case of one transducer submerged in the particulate, the blue arrows represent the waves generated by the transducer, red and green arrows represent reflection on walls and particles, and magenta arrows represent the waves which will reach the transducer. Figure taken from [1]

References

- 1 P. S. Piva, K. K. Napal, A. L. Gower (2024). *Acoustic waves in a halfspace material filled with random particulate*. ArXiv:2407.07032.
- 2 A. L. Gower, R. M. Gower, J. Deakin, W. J. Parnell, I. D. Abrahams (2018). *Characterising particulate random media from near-surface backscattering: A machine learning approach to predict particle size and concentration*. EPL (Europhysics Letters).
- 3 Artur L. Gower and Gerhard Kristensson (2021). *Effective waves for random three-dimensional particulate materials*. New Journal of Physics.
- 4 A. Karnezis, P. S. Piva, and A. L. Gower (2024). *The average transmitted wave in random particulate materials*. New Journal of Physics.



SOUNDSCAPE

How Does Our Environment Sound?

Binaural recordings, mobile measurement systems, (psycho-) acoustic analyses with HEADscape, standardization (ISO 12913 and BS 4142): Pioneering soundscape innovation that evaluates ambient noise quality holistically - only with HEAD acoustics.



For further information and requires please email us at HEAD acoustics UK: Sales-UK@head-acoustics.com
www.head-acoustics.com



Current parliamentary and policy news

Mary Stevens supports the IOA to bring acoustics to the attention of policy makers. Her report in this issue covers the IOA response to the call for evidence on measurement of outdoor equipment noise, which advocates measures that will support UK acoustics engineering to become a world leader, and in England, Government to remove the 1m rule on siting of air source heat pumps.

Measurement of outdoor equipment noise

The IOA has submitted evidence to the UK Government on their proposal to update measurement of outdoor equipment noise in line with changes to EU regulation. We see the update as presenting both challenges and opportunities for the UK acoustic engineering sector. While our response states that maintaining alignment with EU regulations is crucial for preserving market access and preventing migration of testing expertise, we also observe that there is scope to enhance these requirements through adoption of additional measurement methods and standards, and secure the UK's place as a world leader in the sector. For example, despite the directive purporting to take advantage of the latest measurement technology, we note the omission of sound-intensity based standards. Our view is that these methods allow greater flexibility in testing environments and improved handling of potential interference from background noise and we detail the benefits of these measurements. The updated directive also contains several new equipment-specific test standards. These updates would require initial investment, but failing to adopt them would result in the migration of acoustic testing expertise to the EU, diminishing the UK's position as a centre of excellence in the field. Should the UK fail to maintain parity with EU standards, there is a real possibility that facilities in EU countries will have a significant competitive advantage. We also flag up the risk that overly rigid test procedures can pose [threats] to innovation and to the development of technologies that provide real world benefits – as has been demonstrated where products have been designed to pass lab tests, not for real world operation. This was demonstrated in the issues that arose around vehicle emission testing.

We raise the risk that continued alignment with prescriptive EU testing standards could restrict UK manufacturers' ability to compete effectively in non-EU markets where more flexible regimes may allow for greater technological innovation.

In conclusion, we recommend adoption of the updated EU regulations alongside careful implementation of supplementary provisions that encourage innovation. This balanced approach will best serve the interests of UK manufacturers, testing facilities and the broader acoustic engineering sector, whilst maintaining the high standards of environmental protection that are crucial for public health and wellbeing.

See the IOA's full response here: <https://www.ioa.org.uk/publications/response-consultations>

Scotland: Comment on proposed Passivhaus Standards

In response to the stage 1 consultation from the Scottish Government, which supports their pledge *'to introduce new minimum environmental design standards for all new build housing to meet a Scottish equivalent to the Passivhaus Standard in order to improve energy efficiency and thermal performance'*, the IOA Scottish Branch highlighted the potential risks to occupants of noise from ventilation, cooling and heating systems. They raise concerns that if acceptable sound levels from these systems are not properly considered, there is a risk of discomfort from noise and that an occupant will not use the system – resulting in additional issues such as overheating and poor indoor air quality. The Branch suggests that the stage 2 consultation should contain further detail and guidance on acceptable sound levels generated by these systems, and that further guidance will be required within a future revision

of the Building Regulations on the issue of overheating and noise. They also suggest the current standard could be improved, for example by prescribing a minimum requirement for indoor ambient sound levels in different buildings/rooms (in particular, noise-sensitive rooms like bedrooms at night), giving the example of Approved Document O (Overheating) of the Building Regulations in England, which sets out limit values for nighttime noise within bedrooms.

See the full response here: <https://www.ioa.org.uk/publications/response-consultations>

England: New noise mapping data

Defra has published strategic noise map data for England that gives a snapshot of the estimated noise from road and rail sources across England in 2021. The data was developed as part of implementing the **Environmental Noise (England) Regulations 2006**, and is intended to help transport authorities better identify and prioritise relevant local action on noise. An accompanying document explains the noise maps which were generated using a new geospatial noise model developed by Defra.

See more here: <https://tinyurl.com/2022noisemaps>

England: Permitted development for air source heat pumps to be relaxed

The Government has announced the relaxation of permitted development rules in England around air source heat pumps. In a letter to the Energy and Net Zero Committee, Miatta Fahnbuelh, Minister for Energy Consumers, set out the changes. The letter states *'Government has decided to remove the rule that an air source heat pump cannot be installed within one metre of a property boundary;*

to increase the permissible size limit of an air source heat pump to 1.5m³ (to support even quieter heat pump models); to increase the number of air source heat pump units that can be installed on detached dwellinghouses from one to two, thereby allowing those who need cascade systems to use permitted development rights, and allowing air-to-air heat pumps to utilise them.’

In responding to the consultation the IOA agreed that having a fixed setback distance is an overly simplistic proxy for controlling noise impact, and that a performance-based approach allowing heat pumps to be situated closer to boundaries, as long as they comply with an appropriate noise criterion at nearby receptors, aligns better with standard noise control practices.

These changes will be implemented into law as soon as parliamentary time allows. The move is one of several measures announced as part of Government plans for warmer homes and lower energy bills.

See the full letter here: committees.parliament.uk/publications/45752/documents/226414/default/

See the full IOA response to consultation here: <https://tinyurl.com/ioaresponsetocons>

Department for Culture, Media and Sport research on library use

Research looking at barriers to library use has found that noise levels are a factor that prevents people from using them. This qualitative research was undertaken by IPSOS for the Department of Culture, Media and Sport (DCMS) in England, to look at drivers for behaviour change in using libraries, which have seen a decline in use. There are contrasting views expressed – some expecting a place for quiet study, while others preferring a community hub, “I think that they’re too quiet, and this is definitely enforced by librarians. It would be better for me if there was more of a social atmosphere where people could chat a bit more.” (Focus group participant, aged 18-24, North-East). For others, noise levels were seen as a barrier to quiet study: “I think that it’s more for children as in my experience there’s often a bit too much noise for me to make it a welcoming space.” (Depth participant, aged 55).

See the research report here: <https://tinyurl.com/libraryDCMS>

Below:
Some users think that libraries should be places where they can feel free to chat

Aircraft noise debated in Parliament

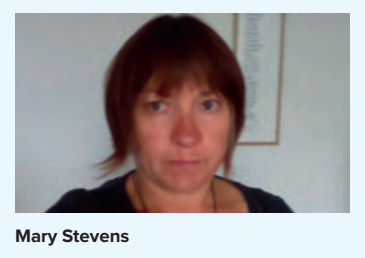
In a debate in the House of Commons in November 2024, Under Secretary of State for Transport, Mike Kane, said: “We need to strike a fair balance between the impact of aviation on the local environment and communities, and the economic benefits that flights bring. That is the challenge for aviation noise policy.” He acknowledged that aircraft noise is a sensitive issue when he was responding to Sarah Olney, MP for Richmond Park, who requested the debate on aircraft noise and local communities. She urged the Department for Transport to acknowledge the health impacts of night flights on airport communities and work to ban them above heavily populated areas. Munira Wilson, MP for Twickenham, also expressed concern about the impacts of noise from flights on children’s learning. In responding, Mike Kane set out the current regimes to manage aircraft noise and referred to research now underway on aircraft noise and health, and the forthcoming review of airspace.

Read the full debate here: <https://tinyurl.com/aircraftcommunities>

New ISO on noise and vibration from rail systems

A new ISO has been published *ISO/TS 14837-34:2024 - Mechanical vibration — Ground-borne noise and vibration arising from rail systems — Part 34: Characterising irregularity of the running surfaces with respect to vibration excitation. The document specifies methods for measuring and analysing irregularities of running surfaces for use in the prediction and assessment of ground-borne noise and vibration arising from railway systems.*

See more here: <https://tinyurl.com/ISOrailnoise> ©





John Connell Awards 2024

The Noise Abatement Society John Connell Awards 2024 took place at the Palace of Westminster on 16 October 2024, hosted by The Lord Balfe. Once again, IOA sponsored the Innovation Award. The awards were presented by Gabrielle Edwards CBE, Director for Environmental Quality at Defra.

By Gloria Elliott OBE, Chief Executive Officer, Noise Abatement Society

The John Connell Awards are named after NAS' founder, John Connell OBE, who lobbied the Noise Abatement Act through Parliament in 1960 when noise became a statutory nuisance in the UK for the first time. These unique awards, known as the 'Noise Oscars', are now in their 23rd year; they acknowledge the importance of the quality of sound in our lives and champion vital advances in reducing the negative impact of unnecessary noise for the public benefit.

The John Connell Innovation Award (sponsored by the Institute of Acoustics)

The Innovation Award recognises original thinking, products and solutions when faced with particularly challenging acoustic issues. The award judging panel was chaired for the IOA by Russell Richardson, Director of RBA Acoustics, and included Bridget Shield MBE, Professor Emeritus London South Bank University, Gloria Elliott OBE, Chief Executive Officer,

Noise Abatement Society, and Daniel Goodhand, Director, Goodhand Acoustics.

The judges were very impressed with the high calibre and number of submissions this year and after much deliberation, selected four finalists:

- Arup – Project Caelus: Quiet drones and medical delivery trials
- IFIELDNOTES: AI environmental assessments support tool
- Peninsular Acoustics and Apex Acoustics: Aligning acoustics and thermal modes
- UK Health Security Agency and colleagues: Putting noise on the map

The winner of the John Connell Innovation Award 2024 was **UK Health Security Agency and colleagues**, for developing the impactful project, 'Putting noise on the map', which aims to reduce the health burden of transportation noise through data and insight. This team estimated the burden of disease from road, rail, and aircraft noise across England, revealing over 130,000 disability-adjusted life years lost annually. The project used GIS mapping to highlight noise disparities and assist policymakers in planning healthier sound environments. With contributions to parliamentary inquiries and industry guidance, this project represents a vital step towards reducing noise-related public health risks in the UK.

Below: UKHSA and colleagues, winners of the John Connell Innovation Award (sponsored by IOA) with Gabrielle Edwards CBE (Defra) and The Lord Balfe



Arup was highly commended for developing 'Project CAELUS', which aims to create a national drone network to transport medical supplies across Scotland, including the remotest areas. This low-carbon initiative integrates public perception of drone noise into the design process, using innovative auralisation and listening tests.

The IOA's Secondary Schools' Competition 2024

The IOA held a schools' competition to encourage students to listen more carefully to the sound environment. The effects of sound on wildlife are a critical consideration for the improvement of biodiversity, so for this year's secondary schools' competition, children were asked to explore the connection between acoustics and ecology, specifically birds. They had to identify three acoustically different areas, describe the soundscape of each area and use the BirdNET app to identify birds that are present in each area. It was won by pupils at St Oscar Romero Catholic School, Worthing, and three pupils and their parents and a teacher from the school happily travelled to London to collect their award. They also won a trophy, £25 each and £500 for their school. The school seems to be making a habit of winning the IOA Secondary Schools' Competition – this is their third time – a clever lot of future acousticians.

The other awards and winners (selected)

The John Connell Soundscape Award 2024

(Sponsored by Anderson Acoustics) was won by Sustainable Acoustics and Thames Valley Police for developing an innovative project for police wellbeing which addresses noise issues in a police station's open-plan areas, interview rooms



Above: Pupils from St Oscar Romero Catholic School, winners of the IOA 2024 Secondary Schools' competition with Angela Lamacraft, FIOA

and the canteen, which affects privacy, communication and relaxation. Through a combination of acoustic measurements, biometric data and staff feedback, the team developed tailored interventions, including soundproofing, quiet spaces and flexible workspaces. These improvements have already positively impacted staff wellbeing, with plans to implement the findings in future police stations, setting a precedent for enhancing acoustic environments in similar settings.

The John Connell Rising Star Award 2024

(Sponsored by the Association of Noise Consultants and ANV Measurement Systems) recognises self-motivated individuals who have made impressive progress or an outstanding contribution within the first five years of their career within acoustics. The 2024 award went to Emily Forster from Apex Acoustics, who has made notable contributions to both the organisation and the industry by volunteering for urgent projects and expanded a skill set to include acoustics as Air Quality Lead with a leading planning consultancy. An innovative Diploma project on soundscapes influenced a significant paper presented at the IOA 2023 conference. Additionally, engaging in STEMtastic week to inspire future acousticians and, as Vice Chair of the Forum for the Built Environment (FBE) Northeast, Emily organised successful industry events and has become a strong ambassador for acoustics.

The John Connell Silent Approach Award 2024

(Sponsored by Brigade Electronics) salutes significant advances in industry best practice to minimise noise from operations and logistics by developing proven noise reduction initiatives. It was won by National Highways for developing the 'Period 2 Noise Mitigation Programme'. Since 2020, this initiative has reduced noise pollution for over 5,000 households, benefiting more than 12,000 people across England by replacing older, noisier road surfaces, installing noise barriers and providing noise insulation in high-impact areas.

The Quiet Mark Logistics Award 2024

(Sponsored by Rolltek International). This award, which recognises advances in low noise technology in the logistics industry to facilitate quieter delivery and services especially in urban areas, was won by University of Salford and Travis Perkins for the development of an innovative sound-informed vehicle alert sound system for electric material handling equipment. It improves workplace safety by creating detectable but less intrusive sounds, enhancing worker health and customer experience. This solution promotes sustainability, reduces carbon emissions and sets a new standard for industry-wide acoustic safety design.

The John Connell

Local Authority Award

(Sponsored by Rockwool UK) celebrates services and projects that are shining examples of co-operation and creative solutions to solve noise problems within the community. It was won by the London Borough of Barking and Dagenham for its effective approach to managing noise pollution which saw a local resident fined for an excessively loud party at their home, despite warnings from a local council officer. The council's actions demonstrate their strong commitment to maintaining peaceful environments by swiftly responding to noise complaints and taking appropriate action. The award recognises the council's dedication to reducing noise nuisances and promoting a quieter living environment for all its residents. 🌍



Left: 2024 John Connell Award Winners and Highly Commended (representatives)

The John Connell Awards 2025 will take place on Wednesday 22 October 2025, again kindly sponsored by The Lord Balfe. Entries will open in the spring. See the full list of winners at <https://noiseabatementociety.org/john-connell-awards-2024/>

Use up-to-date guidelines

Clarifying the relationship between the WHO 2018 Environmental Noise Guidelines for the European Region and the 1999 Guidelines for Community Noise for dwellings exposed to transport noise.

By Benjamin Fenech¹ and Stephen Stansfeld²



1. Noise and Public Health Programme Lead, UK Health Security Agency and Honorary Associate Professor, University of Leicester
2. Emeritus Professor of Psychiatry, Queen Mary University of London and Chair of the Guideline Development Group for the WHO Environmental Noise Guidelines for the European Region

Since the publication of the WHO 2018 Environmental Noise Guidelines for the European Region (ENG2018)¹, one particular paragraph that references the Guidelines for Community Noise (CNG)² seems to have caused differing interpretations amongst some practitioners in the UK.

This issue has recently cropped up in a 'Letter to the Editor' by Clarke and Fiumicelli³ and in a position statement published online by the CIEH⁴

The paragraph in question is (Section 2.6.3, p.28)¹:

The current environmental noise guidelines for the European Region supersede the CNG from 1999. Nevertheless, the GDG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid.*

In this article we provide guidance on how this statement should be interpreted correctly, following the principles clearly set out in the respective WHO guidelines. In particular, we explain why the ENG2018 supersede the CNG,

and which aspects of the CNG remain valid.

This article is only relevant to residential settings ('dwellings') exposed to transport noise.

Summary

When referring to WHO guidelines to set criteria for residential settings (dwellings) exposed to transport noise, the main reference should be to the WHO Environmental Noise Guidelines for the European Region (ENG2018), because they are the most up-to-date guidelines. Additional consideration can be given to the indoor **P34**

References

- * Guideline Development Group – see glossary for more details.
- 1 WHO (2018). Environmental Noise Guidelines for the European Region. WHO Regional Office for Europe.
 - 2 WHO (1999). Guidelines for community noise. Geneva: World Health Organization.
 - 3 Clarke E and Fiumicelli D (2024). Reductive proposals for BS 8233 update. IOA Acoustics Bulletin 50(6).
 - 4 <https://www.cieh.org/media/mf1cdqk/cieh-statement-on-proposed-revisions-to-bs8233.pdf>



architectural acoustic finishes

SonaSpray fc acoustic ceiling spray in the SonaSpray Training Academy.

Oscar Acoustics' new state-of-the-art headquarters in Halling, Kent showcases its fire-rated and recycled SonaSpray acoustic spray range throughout.

By booking a tour today you will get a real sense of how SonaSpray can visually and acoustically transform a project. Call +44 (0)1474 854902 or email mail@oscar-acoustics.co.uk for more details.

Photo ©Antonia Stuart.



OSCAR
acoustics

Specific environment	Critical health effect(s)	L_{Aeq} (dB)	Time base (hours)	L_{Amax} fast (db)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	
Inside bedroom	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

guideline values in the Guidelines for Community Noise [CNG (1999)], but only if this is done in conjunction with the external guidelines in the ENG2018, and taking into account the source-specific characteristics of the sound (e.g. intermittency, low frequency content, etc). In writing the ENG2018 it was clear that the indoor guidelines from the CNG (1999) could not and should not be quoted or used in isolation. This is in accordance with the principles and underpinning evidence clearly set out in both documents.

Supporting information

To get clarity on the relationship between the CNG (1999) and the ENG2018, it is important to first understand how the CNG values for dwellings were derived.

WHO Guidelines for Community Noise (1999)

The WHO Guidelines for Community Noise (CNG) were the outcome of a WHO expert task force meeting held in the UK in April 1999. They were based on a 1995 report *Community Noise* prepared for the World Health Organization by the Stockholm University and Karolinska Institute. The objective was then formulated as²:

‘to consolidate scientific knowledge of the time on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in nonindustrial environments’.

The term ‘community noise’ was defined as ‘noise emitted from all sources except noise at the industrial workplace’. It included noise from road, rail and air traffic, industries, construction and public work, indoor sources (ventilation systems,

Above:
Figure 1:
An extract from Table 4.1 in the WHO Guidelines for Community Noise (1999)

office machines, home appliances), neighbours and neighbourhood (from premises and installations related to the catering trade, discotheques, live or recorded music; sport events including motor sports, playgrounds, car parks, and domestic animals such as barking dogs). The CNG were based on studies published up to 1995 and a few meta-analyses published between 1995-98. Guidelines were set for specific environments, depending on the health effects deemed relevant for a specific environment.

For dwellings, the critical effects were deemed to be sleep, annoyance and speech interference. Figure 1 reproduces the relevant part from Table 4.1 in the CNG. A fundamental principle that is often overlooked is that the CNG provided a set of criteria for inside **and** outside dwellings. Compliance with the CNG can only be claimed if values are met **both outdoor and indoors**. Of particular note is that the outdoor and indoor guideline values are linked together by a fixed difference of 15 dB. This was chosen as representative of the outdoor to indoor sound level difference for a typical room in a dwelling with a partially open window.

In the next sections we look in a bit more detail at the underpinning evidence that informed the 35 dB $L_{Aeq,16hr}$ guideline for inside dwellings and the 30 dB $L_{Aeq,8hr}$ + 45 dB $L_{A,fast}$ for inside bedrooms.

Dwelling, indoors

For inside dwellings, the critical effects were speech intelligibility (interference with speech communication) **and** moderate annoyance. For speech intelligibility the guideline was based on the following (Sec 3.3):

‘For complete sentence intelligibility in listeners with normal

hearing, the signal-to-noise ratio (i.e. the difference between the speech level and the sound pressure level of the interfering noise) should be 15-18 dBA (Lazarus 1990). This implies that in smaller rooms, noise levels above 35 dBA interferes with the intelligibility of speech (Bradley 1985) ... For vulnerable groups even lower background levels are needed.’

For annoyance, the indoor guideline was based on the observation that during the daytime few people are moderately annoyed with L_{Aeq} levels (outdoors) below 50 dB (Section 4.2.7), and assuming that the noise reduction from outside to inside with windows partly open is 15 dB (Section 4.3.1).

Therefore, the CNG indoor guideline level is only met in dwellings that can achieve 35 dB $L_{Aeq,16hr}$ indoors **and** ≤ 50 dB $L_{Aeq,16hr}$ outdoors. Or framed differently, the CNG indoor guideline level needs to be met with a window partly open. A dwelling achieving 35 dB $L_{Aeq,16hr}$ indoors with, say 60 $L_{Aeq,16hr}$ outdoors does not meet the criteria that underpinned the CNG Guideline Value, because it would not achieve 35 dB $L_{Aeq,16hr}$ indoors when the windows are partly open.

The CNG also state that for annoyance, *‘Noise with low frequency components require even lower levels. It is emphasised that for intermittent noise it is necessary to take into account the maximum sound pressure level as well as the number of noise events.’*

Inside bedrooms

In bedrooms, the critical effect was considered to be sleep disturbance. The CNG states (Sec 3.4):

‘If negative effects on sleep are to be avoided the equivalent sound pressure level should not exceed 30 dBA indoors for continuous

References

² WHO (1999). Guidelines for community noise. Geneva: World Health Organization.

noise. If the noise is not continuous, sleep disturbance correlates best with L_{Amax} and effects have been observed at 45 dB or less. This is particularly true if the background level is low. Noise events exceeding 45 dBA should therefore be limited if possible. For sensitive people an even lower limit would be preferred. It should be noted that it should be possible to sleep with a bedroom window slightly open (a reduction from outside to inside of 15 dB). To prevent sleep disturbances, one should thus consider the equivalent sound pressure level and the number and level of sound events. Mitigation targeted to the first part of the night is believed to be effective for the ability to fall asleep.’

This paragraph is reflected in Table 4.1 of the CNG (reproduced in Figure 1 above), which clearly sets out guideline values for both indoors and outdoors, expressed as both an equivalent sound pressure level and $L_{A,f,max}$. The 30 dB $L_{Aeq,8hr}$ value was derived from two studies on road traffic noise and self-reported sleep disturbance. (Kageyama et al. 1997, Öhrström 1993). The CNG also state that special attention should be given to sources with low frequency components, combined noise and vibration if present, and environments with a low background noise level. To protect sensitive persons, lower guideline values for $L_{A,f,max}$ would be preferred when the background level is low.

Why do the ENG2018 supersede the CNG?

The Environmental Noise Guidelines for the European Region (ENG2018) describe in detail how they differ from previously published noise guidelines. In the interests of brevity, we only highlight a selection of these differences here.

- The development process for the ENG2018 adhered to a new, rigorous, evidence-based methodology, consistent with the WHO Handbook for Guideline Development (WHO, 2014c). WHO adopted these internationally recognised standards to ensure high methodological quality and a transparent, evidence-based decision-making process in the guideline development.
- The process of guideline development was conducted by several groups with clearly defined roles and responsibilities: Steering Group, the GDG, the Systematic Review Team and the External Review Group.
- Guidelines were based on relevant risk increases of adverse health effects defined a priori.
- The process of guideline development was based on high quality systematic reviews and meta-analyses of the scientific evidence commissioned specifically by the WHO.
- The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was followed to rate the quality of the body of evidence.

- The ENG2018 include an exact exposure value for every health outcome regarded as critical, for each noise source. Guideline recommendation values were set for each of the noise sources separately, based on the exact exposure values and a prioritisation scheme.
- The ENG2018 apply a 1 dB increment scheme, whereas prior guidelines formulated or presented recommendations in 5 dB steps.
- In comparison to the 1999 CNG, which defined environment-specific exposure levels, the ENG2018 are source specific.
- The ENG2018 does not consider speech intelligibility as a health outcome, however disturbance of communication is considered as a contributor to noise annoyance⁵, which is included.

The recommendations in the ENG2018 are expressed in terms of annual averaged sound levels for outdoor exposures because:

- a) the relevant health outcomes are long-term (chronic) health outcomes; and
- b) the most relevant high-quality evidence is expressed in terms of long-term averaged **outdoor** sound levels.

In recent years there has been an increase in high quality mechanistic studies. These studies make an important contribution to the body of evidence, in particular to test whether observed associations are causal⁶. **P36**



References

- 5 R. Guski, D. Schreckenberger, R. Schuemer (2017). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance. Int. J. Environ. Res. Public Health 2017, 14, 1539.
- 6 T. Münzel et al. (2024). Transportation Noise Pollution and Cardiovascular Health. Circulation Research 134.



However mechanistic evidence tends to be less relevant when setting guidelines for the general population, due to issues with generalisability and the need for results to refer back to the population. It is also important to note that noise is a psychosocial stressor⁷⁻⁹, and the pathway between sound and health is not a simple, direct, straight line between the dose at a person's ear and a manifest disease. From this perspective, the averaged outdoor sound level should not be seen as a proxy to the indoor level, but a measure of the sound exposure at the place where people call 'home'.

One specific effect deserves special attention: physiological sleep disturbance. The ENG2018 state¹: *'the current guideline values for the night time are only based on the prevalence of self-reported sleep disturbance and do not take physiological effects into account. The causal link between immediate physiological reactions and long-term adverse health effects is complex and difficult to prove. Thus, the current guidelines are restricted to long-term health effects during night time and therefore only include*

recommendations about average noise indicators: L_{night} . Nevertheless, the evidence review on noise and sleep (Basner & McGuire, 2018) includes an overview of single-event exposure–effect relationships.'

It is important to note that 'sleep disturbance' is a broad term that should encompass the entire sleep process, including total sleep duration, time for falling asleep, difficulty falling back to sleep after an awakening and arousals during the sleep cycle.

What is the added value of the CNG1999 for dwellings exposed to transport noise?

Considering the evidence underpinning the CNG, the conclusion for disturbance to speech communication is likely to still be valid. However, the relevant value was derived under the assumption of a constant background sound, which would only be relevant to sound ingress from a constant stream of road vehicles moving at uniform speed, or for relatively large distances from source to receptor. The assumption is not applicable to other conditions of road traffic (e.g. dwellings close to busy roads in urban environments), nor to sound from

rail vehicle pass-bys and aircraft flyovers. The values linked to annoyance are superseded by the evidence in the ENG2018. Similarly for values linked to self-reported sleep disturbance. For L_{max} values indoors, more recent evidence¹⁰ suggests that road/rail/aircraft events with $L_{AS,max} > 35\text{dB}$ can cause a noise induced arousal.

Glossary

GDG – Guideline Development Group. This Group defined the key questions and priorities of the research, chose and ranked outcomes and provided advice on any modifications of the scope as established by the Steering Group. The members also outlined the systematic review methods, appraised the evidence used to inform the guidelines and advised on the interpretation of this evidence, with explicit consideration of the overall balance of benefits and harms. Ultimately, the GDG formulated the final recommendations, taking into account the diverse values and preferences of individuals and populations affected. It also determined the strength of the results and responded to external peer reviews. ©

References

- 1 WHO (2018). Environmental Noise Guidelines for the European Region. WHO Regional Office for Europe.
- 7 P. Lercher (1996). Environmental Noise and Health: An Integrated Research Perspective. Environment International 22(1).
- 8 W. Babisch (2014). Updated exposure-response relationship between road traffic noise and coronary heart diseases: A meta-analysis. Noise and Health 16(68).
- 9 C. Clark, D. Vienneau, GM Aasvang (2024). Ch. 4 Noise and Effects on Health and Well-Being. In A Sound Approach to Noise and Health. Springer.
- 10 M. Basner, S McGuire (2018). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep. Int. J. Environ. Res. Public Health 2018, 15, 519.

Akustik + Sylomer® Channel Clips

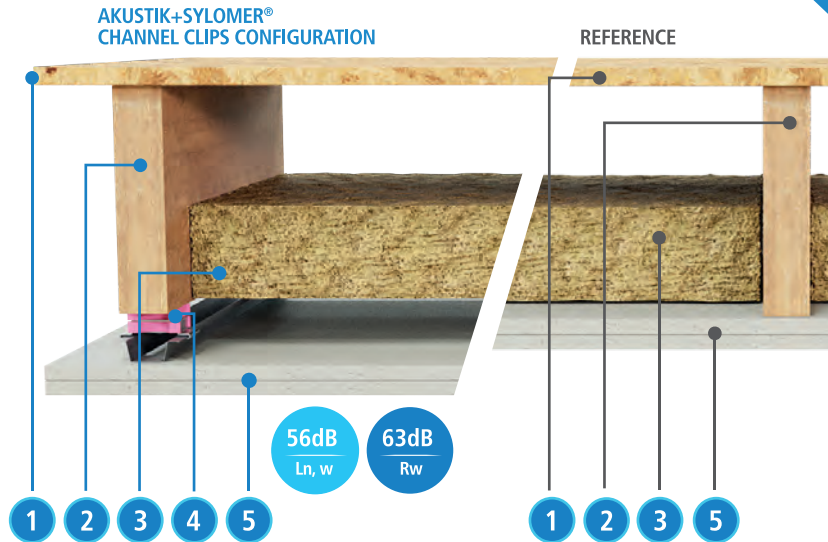
LABORATORY TEST RESULTS

Impact and airborne sound tests have been performed at the Sound Research Laboratories (SRL) in Sudbury, UK. A range of different ceiling configurations have been tested for the AMC Channel clip.

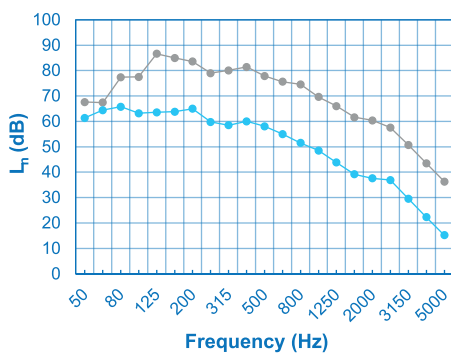


INSTALLATION
VIDEO

- 1 18mm OSB.
- 2 235x50mm Timber Joists.
- 3 100mm Mineral Wool.
- 4 AMC Akustik + Sylomer® 15 Channel Clips with MF5 Ceiling Furring Channels.
- 5 2x15mm Plasterboards.

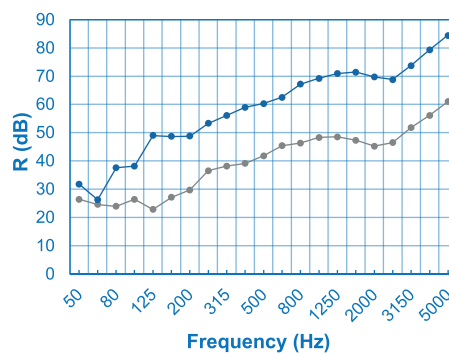


Akustik
+Sylomer®
Channel Clip



Reference: Ln,w 76dB

Ln,w 56dB



Reference: Rw 44dB

Rw 63dB



In general, timber structures are harder to acoustically isolate due to their lower mass compared to concrete structures. Due to this, the **proper selection of acoustic insulation products** becomes more critical.



Sound from unmanned aircraft systems:

Progress in acoustics and psychoacoustics

By Michael J B Lotinga, Marc C Green, Sam Barrett, Glen Hancocks, Riul Jung, Deepak Akiwate, Carlos Ramos-Romero and Antonio J Torija (University of Salford)

The emerging sector of unmanned aircraft systems has been gaining interest in recent years. Researchers at the University of Salford's Acoustics Research Centre are addressing several aspects of the topic, including aeroacoustics and fluid mechanics, noise control design, perceptual psychoacoustics, soundscape applications, and response to sound exposure for both humans and wildlife. This article provides an overview of developments from these efforts, along with a summary of recent conference activities addressing associated topics.



Above:
Image © MJB Lotinga

Advanced air mobility (AAM) technologies, which include unmanned aircraft systems (UAS, or 'drones'), have been rapidly developing, with test flights and pilot service trials taking place in the UK, Ireland, US and Australia, among other areas. Alongside the potential benefits for enhanced mobility, carbon emission reductions, congestion easing and economic growth, these

developments also raise concerns about public safety, privacy and the risk of added noise pollution (Torija & Clark, 2021). To address these concerns, researchers have been investigating the nature of AAM sound, how it affects people and wildlife, and how it can be measured and managed through design, engineering and planning, to enable benefits to be realised while controlling the potential for noise impact (Lotinga

et al., 2023). Regulators have also been engaging stakeholders and establishing the certification and operation frameworks within which the industry and market can develop and thrive, while ensuring that the wider public interest remains in the balance with commercial concerns (CAA, 2023; EASA, 2024; FAA, 2023).

In pursuit of these aims, several AAM-focused research projects have been underway at the

University of Salford's Acoustics Research Centre (ARC), including:

- 'DroneNoise', in partnership with the Civil Aviation Authority;
- 'InCEPTion', a project funded by Innovate UK and the Aerospace Technology Institute. This project was led by Greenjets (previously Blue Bear Systems Research), with a consortium of academic and industry partners (University of Cambridge, Drive System Design, Ricardo, Dowty Propellers and M&I Materials);
- 'REFMAP', an EU consortium partnership of seven European universities and four commercial organisations (<https://www.refmap.eu>);
- 'ImAFUSA', another pan-European industry-academia consortium project, which together with REFMAP has also formed the Aviation Twin Transition Cluster, an initiative for collaboration and information exchange within the AAM industry and stakeholder organisations (<https://www.imafusa-sesar.eu/aviation-twin-transition-cluster>).

These projects address the issues from multiple perspectives, including developing measurement techniques and databases, characterising and modelling perception and responses, assessing societal acceptance and engineering noise-optimised propulsion designs.

Aspects of the projects and other ongoing research activities are summarised in the following.

Systematic review

To provide information on aspects of the topic concerning human perception and response, and effects of UAS sound on ornithological receptors, a systematic review of existing research was undertaken within the REFMAP project.

The review methodology was developed in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 framework. Several databases were searched for evidence that met eligibility criteria designed to identify all relevant research for both UAS and larger UAM aircraft. The review screened over 9,000 publications, eventually resulting in 39 publications eligible for the review of effects on humans, and 172 eligible for the review of effects

on bird populations and behaviours (given the differences in these receptors and evidence limitations, a wider range of sound sources were considered for reviewing noise effects on birds, whereas the criteria for effects on humans were focused on UAS and UAM vehicles). Evidence was extracted from the reviewed publications, which were also critically appraised for quality and bias risks (Lotinga, Barrett, et al., 2024).

The research for humans covered 29 separate studies, along with three previous evidence reviews. The review summarised relevant findings from the evidence:

- nearly all of the research undertaken has been in experimental settings — only one study was identified addressing observational research, which was during the Wing Aviation trial in Australia;
- the experimental laboratory studies have focused mainly on short-term annoyance responses, with some studies also considering perceptual aspects such as loudness and other sound qualities;
- within experimental contexts, the sound of UAS tends to be judged as more annoying than conventional transportation sounds including road traffic, passenger jets and helicopters at equivalent exposure levels;
- loudness has tended to be the primary predictor for annoyance, but several studies have also highlighted the influence of other sound qualities. Of these, sharpness and tonality tend to be the most consistent, but variations in aircraft design and operation lead to differing sound quality importances;
- flyover/flyby operations tend to be judged somewhat less annoying than other operations at equivalent exposure levels; and
- personal and contextual factors can have an important influence: the acoustic environments in which flights occur affects responses, which may be due to both masking and context effects. Individual attitudes and judgement framing have also been found to influence responses.

Concerning birds, the review identified 172 studies investigating the effects of UAS

or other intermittent sources of anthropogenic noise. The review highlighted several findings:

- the majority of the studies focused on UAS sources were classified as anecdotal evidence, as avian response considered both visual and acoustic exposure;
- birds generally exhibited escape behaviours at UAS flight altitudes lower than 50 metres. However, this differed between species;
- very limited evidence was identified for UAS noise effects on population distributions, reproduction and physiological responses;
- most studies found that traditional ground-based surveys had a greater impact on* in relation to other anthropogenic sources, noise has been found to be associated with vocalisation changes, including frequency shifts and timing modifications.

Several gaps in the research base were also identified, which informed the development of the research directions being investigated and the experimental methodologies applied, some of which are described further below. In relation to birds, research is needed to better understand the noise impact of UAS without the confounding of visual exposure, as well as the long-term effects and impacts from larger aircraft, which would be expected to be associated with commercial operations such as UAS deliveries.

Human perception and response

Laboratory testing

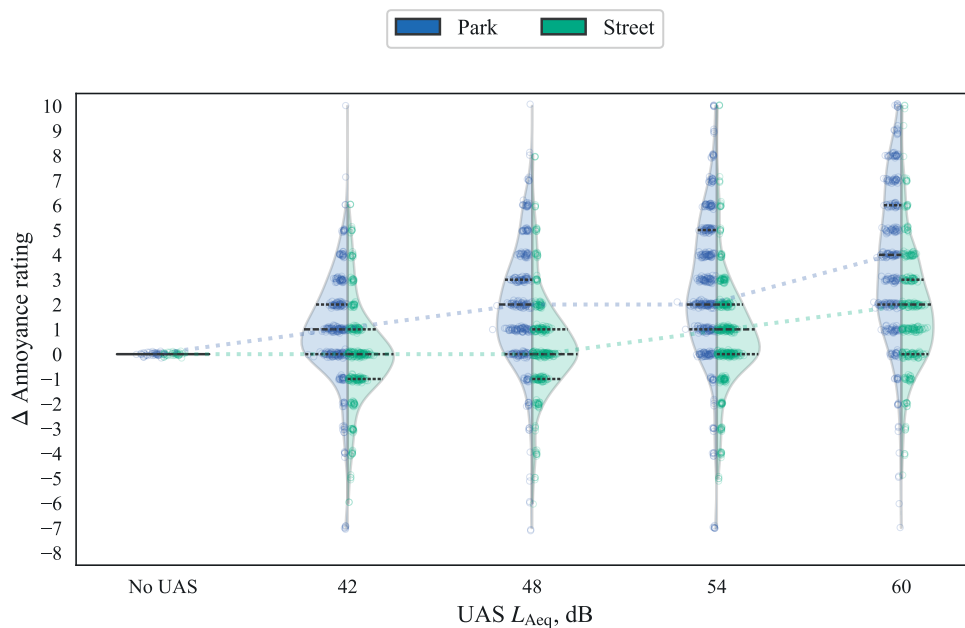
As part of the REFMAP project, a laboratory experiment was undertaken to address some research gaps identified in the systematic review of effects on humans. The aim of the experiment was to test noticeability and annoyance reactions to UAS sounds embedded within realistic ambient acoustic environments, spatially rendered as 3D audio scenes, reproduced over a 16-channel loudspeaker array. The experiment was designed to examine how judgements were influenced by different environments and by varying the aircraft features, including proximity, sonic qualities, operational modes and flight quantities (Lotinga, Green, et al., 2024). **P40**

UAS sounds for the experiment were obtained from extensive measurement campaigns undertaken by ARC researchers (Green et al., 2023; Ramos-Romero et al., 2023; Ramos Romero et al., 2024), which were used to render spatial flight events using a hybrid auralisation technique (Green, 2023; Ramos-Romero, Green, & Torija Martínez, 2024). Ambisonic field recordings were used to represent the ambient environments (Green & Murphy, 2017a, 2017b).

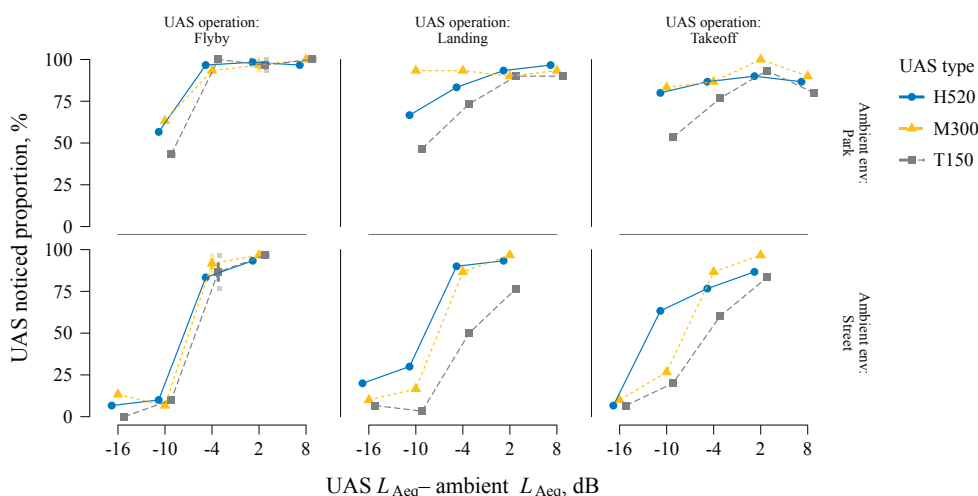
As shown in Figure 1, the results of the test indicated that participants rated UAS sound as having greater adverse impact on a calm urban park environment than in a busy city street, with increasing exposure levels.

The design and operational modes of the UAS also affected how participants judged both annoyance and noticeability, as illustrated in Figure 2. UAS events were generally far more noticeable in the park environment at the same relative levels. Interestingly, although flyby operations tended to be highly noticeable, they were also judged less annoying compared with landing or takeoff. Another feature of the results is that the smallest UAS tested, a 2 kg hexacopter design, tended to be judged as most annoying at equivalent exposure levels, when compared with a medium-sized (6 kg) quadcopter and a very large (60 kg) 'X8-copter' (four coaxial pairs of contra-rotors). The reasons for this seem to be related to particular sound qualities associated with each UAS – the hexacopter tending to be sharper and more tonal than the other aircraft examined.

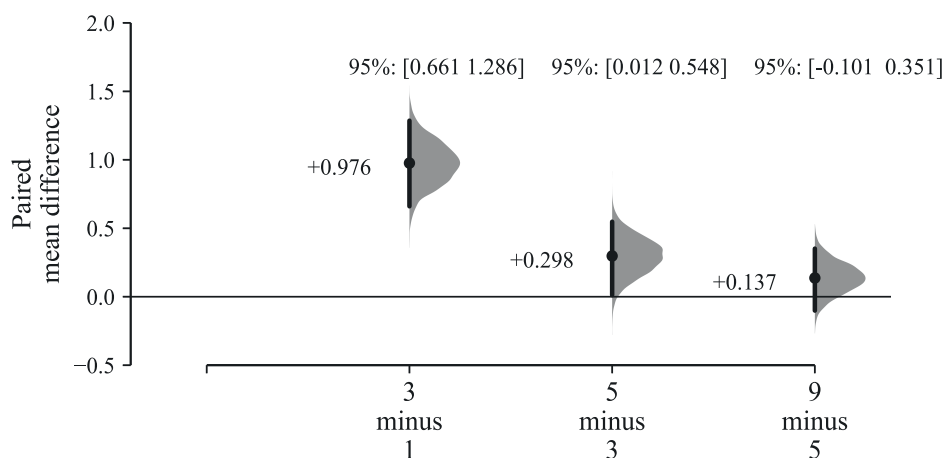
Concerning multiple UAS flight events, the stimuli design held the overall average UAS sound levels (L_{Aeq}) constant while increasing flight event quantities (meaning individual events were reduced in level as quantity increased). The results, shown in Figure 3, indicate that participants judged increasing events as more annoying, however this increased annoyance rapidly diminished in importance as quantities increased. This suggests that event numbers were only important for judgements up to a point, beyond which the overall sound energy became a more important factor.



Above: Figure 1: Laboratory test results – annoyance responses to UAS sound exposure within acoustic environments (Lotinga, Green, et al., 2024)



Above: Figure 2: Laboratory test results – noticeability of UAS within acoustic environments for varying type and operational mode (details on the UAS types can be found in a corresponding publication (Lotinga, Green, et al., 2024)



Above: Figure 3: Laboratory test results – annoyance responses to multiple UAS sound events (paired differences by condition comparison) (Lotinga, Green, et al., 2024)

Further analysis of this experiment is in progress with the results expected to support a predictive model for subjective judgements of UAS sound. The planned research will also extend the work to encompass further experiments to expand into other directions and to examine more closely some of the interesting aspects already uncovered.

Soundwalks

In addition to the lab-based experiment, research undertaken for REFMAP and ImAFUSA includes a series of field studies conducted using the soundwalk method specified in ISO 12913. This soundscape approach aims to assess emotional responses to acoustic environments along multiple dimensions in addition to annoyance. In a soundwalk, groups of participants are led around a location of interest to a set series of stopping points, at which they are quizzed on their perceptions. This standard approach was augmented by the controlled addition of drone flights performing the same types of operations (take-off, flyover and landing) as in the lab-based study, with each stopping location assessed both with and without the added drone events. Field studies such as these have the advantage of increased ecological validity over lab-based tests, as the stimuli are all real and not reproduced, but have the disadvantages of less tight control over variables, and lack of exact repeatability.

Studies were undertaken at three different sites – The Meadow, near the University of Salford; Egaleo Park in Athens, Greece, and the island of St. Martin’s in the Isles of Scilly. Each of these present a unique scenario with differing



Above:
Figure 4: XAG P100 unmanned aircraft system during field tests on the Isles of Scilly (image © S Barrett)

background ambiances and participant demographics, as well as different UAS, including the XAG P40 (29.1 kg) at Salford (shown in the title image) and P100 (31.5 kg) in Scilly (Figure 4), and a smaller DJI Mavic in Athens.

As shown in Figure 5, results from the Salford soundwalk indicate that compared with responses to the existing ambient sound scene, a decrease in pleasantness, calmness and comfort was observed for UAS landing events. Surprisingly, there is less perceptual impact indicated for a takeoff event, which may suggest important contextual factors, or an interaction effect with the background ambience (Green & Torija Martínez, 2024b). Analysis of the Athens and Scilly soundwalks is underway and due for publication in 2025.

Noise control: electric ducted fans

This research focused on noise reduction in electric engines for Advanced Air Mobility (AAM) propulsion systems, addressing the critical need for quieter, optimised designs. Building on insights gained from the successful InCEPTION project, Greenjets developed

electric ducted fans specifically designed to minimise noise. To advance the development of these designs further, a Knowledge Transfer Partnership (KTP) between the University of Salford and Greenjets was established.

As part of this KTP, an extensive acoustic analysis of different propulsion designs was conducted in the University of Salford’s fully anechoic chamber. The research compared conventional open propellers with Greenjets’ newly designed electric ducted fan, revealing significant noise reductions. In addition, the study tested a range of liner designs for the ducted fans to further enhance noise attenuation.

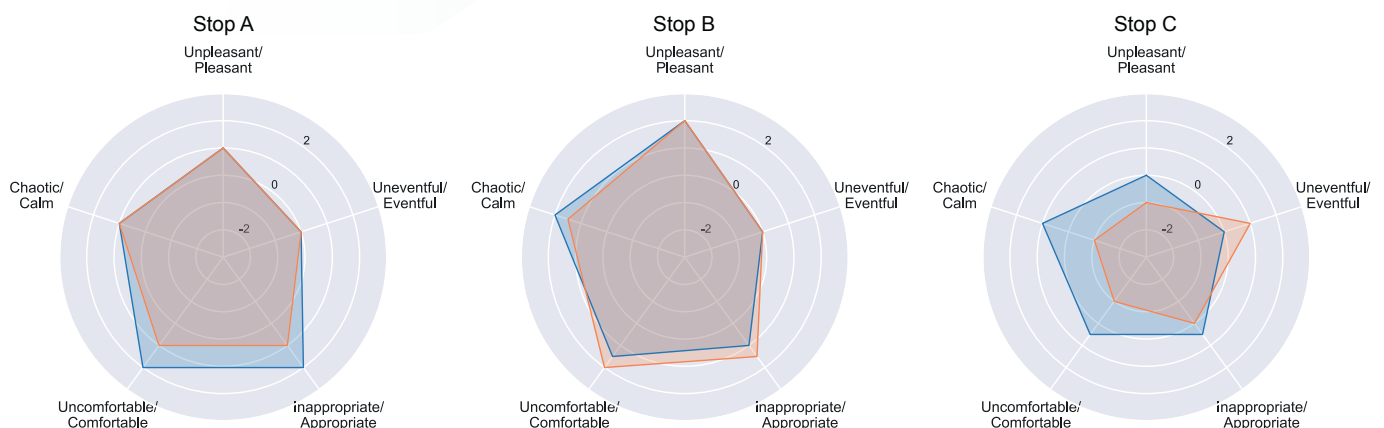
Crucially, these measurements are being used to develop novel noise prediction methods that will be integrated into Greenjets’ design process. The research team is using the acoustic data to create advanced models capable of predicting sound emissions for various designs before they are physically built. This predictive capability will enable Greenjets to optimise acoustic performance early in the development cycle, ensuring that quieter and more efficient propulsion systems are systematically achieved.

This research underscores the importance of innovative design and the value of collaboration between academia and industry in creating quieter, more efficient propulsion solutions that enhance the quality of life for communities worldwide.

Conference highlights

Further research findings and ideas emerged during the 2024 conference season. Brief highlights from relevant aspects are summarised here. [P42](#)

Below:
Figure 5: XAG P100 Field test results – soundwalk responses (median values) for UAS inactive (blue) and active (orange). Take-off, flyby and landing events took place at stops A, B, and C, respectively (Green & Torija Martínez, 2024b)



AIAA 2024

The annual American Institute of Aeronautics and Astronautics (AIAA) conference on aeroacoustics was held in Rome, bringing together aerospace researchers and engineers from around the world.

Analysis of acoustic measurements and psychoacoustic characterisation was presented, which identified relationships between UAS takeoff mass and integrated sound exposure levels, as well as associations between different operational modes and sound qualities potentially linked with noise annoyance (Torija et al., 2024).

A detailed methodology and open-source software tool for synthesising and auralising quadcopter UAS flyby sound was also presented (Ramos-Romero, Green, & Torija Martínez, 2024). This process incorporates source broadband and tonal component emissions by extracting characteristics from hover operational sound. Modulations are applied to simulate unsteady fluctuations, which are characteristic of UAS multicopters during flight, as the system controller makes rapid adjustments to the individual rotors to maintain the intended trajectory. Motion and propagation effects are also applied based on the defined flight path and incidence location, including Doppler shift, atmospheric absorption and complex ground effects. This process can be used for simulation activities and to support psychoacoustic experiments.

In work carried out as part of collaborative research between Salford's ARC and the University of Bristol, psychoacoustic analysis of a ducted fan installed in a turbulent gradient boundary layer, found in novel airframe-integrated propulsion systems, was presented (Ahmed et al., 2024). The research combined aeroacoustic analysis with psychoacoustic evaluation by connecting the fundamental aerodynamic mechanisms underlying far-field propagation and the perceived effects of sound at the receiver.

Inter-noise 2024

Inter-noise 2024 took place in Nantes, hosted by the Société Française d'Acoustique. A dedicated 'urban air mobility noise' session was held, enabling researchers and

specialists to engage and share knowledge and ideas.

ARC research presented included listening experiment results for comparisons between UAS and conventional jet aircraft, which examined how sound qualities could explain judgements of paired stimuli at equal loudness (Green et al., 2024). An intriguing aspect of this work is that it obtained a more nuanced result with respect to comparisons between conventional aircraft and UAS than previous studies, UAS sometimes being judged less annoying than some of the jet aircraft.

Another ARC research paper concerned applying deep learning to annoyance predictions for a pool of studies spanning both UAS and conventional aircraft sounds (Green & Torija Martínez, 2024a). This study constructed neural network models for responses based on spectrogram inputs and tested parameters to identify optimal settings, noting that the network had highest performance when the time resolution was sufficient to represent sonic roughness, but not so short as to add unduly to the network connections (model overfitting).

Quiet Drones 2024

The foremost international conference focused entirely on acoustics for AAM and UAS was hosted this year by the University of Salford in Manchester, abutting the IOA's own Acoustics 2024 conference. Starting with a perception-influenced design workshop and followed by three full days of technical sessions spanning a wide range of topics, more than 100 delegates from 22 different countries participated in this vibrant symposium.

Results from an ARC laboratory study were presented, which analysed subjective judgements of UAS alongside road traffic, passenger jet and helicopter sounds (Green & Torija, 2024). The results suggested that road traffic was by far the least annoying sound, as well as tending to be perceived as least loud. In-depth analysis was undertaken to investigate components influencing responses to the UAS, which identified sharpness, tonality and fluctuation strength as important, alongside loudness.

A paper by ARC researchers explored how blade rake angle affects noise generation in a coaxial contra-rotating UAS rotor system (Jung et al., 2024). Contra-rotor designs offer efficiency advantages for propulsion, but the interaction between the coaxial rotors can lead to added sound energy due to unsteady loading. Using computational fluid dynamic (CFD) numerical simulations, the research found that increasing rake angle reduced the interaction tones and overall acoustic pressure, resulting in quieter rotor operations.

Results of a research collaboration framework between the Universities of Salford and Manchester addressed experimental characterisation of the acoustics and flight performance of asymmetric propellers with uneven blade spacing ('V-propellers') (Koning et al., 2024). Preliminary results demonstrated that V-propellers exhibit improved acoustic performance, in terms of overall sound pressure level, compared to conventional propellers. However, these acoustic advantages were combined with a certain reduction in UAS performance, in terms of power consumption and vibration.

Another paper presented proposals for a conceptual framework that classified factors associated with UAS noise into a comprehensive taxonomy (Ramos-Romero, Green, Asensio, et al., 2024). Organising the wide range of factors that could influence noise impact of UAS promotes harmonisation and supports intercomparisons of data and research, contributing to enhanced understanding and coherent communication.

Outlook

Research into AAM acoustics, psychoacoustics and ecological impact is rapidly developing alongside rising global interest in the technologies and applications. Nonetheless, there remain substantial gaps in our understanding that require attention and investigation to address. Particular efforts concerning human responses are focused on further experimental studies, including both closely controlled laboratory research and in-situ soundscape approaches.

To address knowledge gaps regarding the impact of UAS noise on birds, field experiments are planned across a range of habitats to cover acute (short-term) and chronic (long-term) exposure. Preliminary field work has been undertaken on the Isles of Scilly to assess responses of breeding shore birds to a large UAS (Figure 4), while accounting for ecological factors that may impact responses, such as the breeding season or migration. It would be valuable for future research to investigate the effects on birds exposed to UAS sound across soundscapes with varying levels of ambient natural and anthropogenic noise. This could provide firmer evidence on how bird populations and behaviour may be impacted by UAS noise characteristic of systems used in commercial operations.


As the regulatory landscape evolves with further flight trials and real services emerging, the early investigative research will support development of wider observational field studies. Propulsion and vehicle designs will also be further optimised based on combinations of increasingly realistic aeroacoustic simulations and in-flow experiments. These physical investigations will also be informed by the psychological, perception-influenced design engineering approach (Torija et al., 2021). By combining these efforts through collaboration and synergistic thinking, it is hoped that benefits of AAM technologies can be achieved and maximised, while managing any adverse impacts with effective, evidence-based solutions.

Acknowledgements

ML, MG, SB, GH & AT acknowledge funding provided by EU Horizon Europe and UK Research and Innovation (UKRI) under the UK government's Horizon Europe funding guarantee (grant number 10061935).

AT & CR-R acknowledge the funding provided by the UK Engineering and Physical Sciences Research Council for the DroneNoise project (EP/V031848/1); and UKRI/Horizon Europe for funding of the ImAFUSA project, grant number 101114776).

AT, DA & RJ thank UKRI and Greenjets for funding of the InCEPTion project (ref. 73692).

ML is also very grateful for funding from the UK Institute of Acoustics Bursary Fund, used to support attendance at Inter-noise 2024. 

References

- Ahmed, F., Ramos-Romero, C., Torija, A. J., & Azarpeyvand, M. (2024, 4–7 June 2024). Boundary layer ingestion ducted fan: Aeroacoustic and psychoacoustic insights 30th AIAA/CEAS Aeroacoustics Conference (2024), Rome, Italy. <https://doi.org/10.2514/6.2024-3379>
- CAA. (2023). Airspace modernisation strategy 2023–2040 - Part 1: Strategic objectives and enablers. (CAP 1711). Civil Aviation Authority Retrieved from <https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8960>
- EASA. (2024). Easy access rules for U-space. European Union Aviation Safety Agency Retrieved from <https://www.easa.europa.eu/en/document-library/easy-access-rules/easy-access-rules-u-space-regulation-eu-2021664>
- FAA. (2023). Advanced air mobility (AAM) implementation plan. Federal Aviation Administration Retrieved from <https://www.faa.gov/air-taxis/implementation-plan>
- Green, M. C. (2023). uas-sound-propagation (Version 2023) [Computer software]. <https://github.com/acoustics-code-salford/uas-sound-propagation>
- Green, M. C., & Murphy, D. (2017a). EigenScape <https://doi.org/10.5281/zenodo.2628463>
- Green, M. C., & Murphy, D. (2017b). EigenScape: A database of spatial acoustic scene recordings. *Applied Sciences*, 7(11), 1204. <https://doi.org/10.3390/app711204>
- Green, M. C., & Torija Martínez, A. J. (2024a, 25–29 August 2024). A deep learning approach to predicting aircraft sound annoyance Inter-noise, Nantes, France. https://doi.org/10.3397/IN_2024_3340
- Green, M. C., & Torija Martínez, A. J. (2024b, 8–11 September 2024). Soundwalking in Salford: A soundscape approach to drone noise assessment Quiet Drones, Manchester, UK
- Green, N., Ramos-Romero, C., & Torija, A. J. (2024, 25–29 August 2024). Comparison of the noise perception of conventional aircraft and unmanned aircraft systems Inter-noise, Nantes, France. https://doi.org/10.3397/IN_2024_3958
- Green, N., Ramos-Romero, C., & Torija Martínez, A. (2023, 15–18 May 2023). Advances in the measurement and human response to noise of unmanned aircraft systems SAE Noise and Vibration Conference and Exhibition, Grand Rapids, US. https://doi.org/10.3397/NC_2023_01_1108
- Green, N., & Torija, A. J. (2024, 8–11 September 2024). Comparing the human response of unmanned aircraft system noise and other transportation noise Quiet Drones, Manchester, UK. <https://www.researchgate.net/publication/384102808>
- Jung, R., Akiwate, D., Torija Martínez, A., & Kingan, M. J. (2024, 8–11 September 2024). Reducing noise in contra-rotating unmanned aerial vehicle rotor systems through blade rake angle adjustment Quiet Drones, Manchester, UK
- Koning, D., Usov, D., Ramos-Romero, C., & Filipponne, A. (2024, 8–11 September 2024). Flight performance and acoustics of asymmetric propellers with uneven blade spacing Quiet Drones, Manchester, UK
- Lotinga, M. J. B., Barrett, S., Hancocks, G., Green, M., Leedale, A., Torija Martínez, A. J., & Wood, M. D. (2024). D4.3 Systematic review and framework for testing unmanned aircraft systems noise impact on humans and wildlife (REFMAP Deliverable 4.3). EU
- Lotinga, M. J. B., Green, M. C., & Torija, A. J. (2024, 8–11 September 2024). How do flight operations and ambient acoustic environments influence noticeability and noise annoyance associated with unmanned aircraft systems? Quiet Drones, Manchester, UK <https://www.researchgate.net/publication/383915149>
- Lotinga, M. J. B., Ramos-Romero, C., Green, N., & Torija, A. J. (2023). Noise from unconventional aircraft: A review of current measurement techniques, psychoacoustics, metrics and regulation. *Current Pollution Reports*, 9(4), 724–745. <https://doi.org/10.1007/s40726-023-00285-4>
- Ramos-Romero, C., Green, M. C., & Torija Martínez, A. J. (2024, 4–7 June 2024). Synthesis and auralisations of quadcopter flyovers for psychoacoustic assessment AIAA/CEAS Aeroacoustics Conference (2024), Rome, Italy. <https://doi.org/10.2514/6.2024-3272>
- Ramos-Romero, C., Green, N., Asensio, C., & Torija Martínez, A. (2024, 8–11 September 2024). Towards a taxonomy for the assessment of the unmanned aerial systems noise emissions Quiet Drones, Manchester, UK
- Ramos-Romero, C., Green, N., Torija, A. J., & Asensio, C. (2023). On-field noise measurements and acoustic characterisation of multi-rotor small unmanned aerial systems. *Aerospace Science and Technology*, 141(2023), 108537. <https://doi.org/10.1016/j.ast.2023.108537>
- Ramos Romero, C., Torija Martínez, A. J., Green, N., & Asensio, C. (2024). DroneNoise Database <https://doi.org/10.17866/rd.salford.22133411>
- Torija, A. J., Chaitanya, P., & Li, Z. (2021). Psychoacoustic analysis of contra-rotating propeller noise for unmanned aerial vehicles. *Journal of the Acoustical Society of America*, 149(2), 835. <https://doi.org/10.1121/10.0003432>
- Torija, A. J., & Clark, C. (2021). A psychoacoustic approach to building knowledge about human response to noise of unmanned aerial vehicles [Review]. *International Journal of Environmental Research and Public Health*, 18(2), 682, Article 682. <https://doi.org/10.3390/ijerph18020682>
- Torija, A. J., Ramos-Romero, C., & Green, N. (2024, 4–7 June 2024). Acoustic and psychoacoustic characterisation of unmanned aircraft systems as a function of vehicle mass and flight procedure 30th AIAA/CEAS Aeroacoustics Conference, Rome, Italy. <https://doi.org/10.2514/6.2024-3235>

Response to letter by Clarke and Fiumicelli 'Reductive Proposals for BS 8233 Update' – Acoustics Bulletin November/December 2024

By Benjamin Fenech and Jack Harvie-Clark

We thank Clarke and Fiumicelli for their letter published in *Acoustics Bulletin*

50(6) November/December 2024.

We welcome their agreement that:

- the case for updating BS 8233 is "good";
- recent studies show higher levels of annoyance and sleep disturbance due to transportation noise than those established historically; and
- internal acoustic conditions need to be considered holistically with indoor air quality and overheating risk.

We also welcome our shared objective to 'improve the protection provided to citizens and thereby reduce the burden of noise related disease'.

Clarke and Fiumicelli expressed some concern with our proposals. Their concern can be summarised by the following extract from their letter:

To align with public health research the proposal is to assess and control noise exposure via the external sound levels, under the mistaken assumption that this alignment with the evidence base justifies a departure from controlling internal levels.

I don't think anyone has ever actually suggested that the community health impacts from environmental sound on residents in buildings is predicated more on the noise levels outside the buildings in which they are exposed than those they experience internally. It is just much more difficult to do large scale studies on actual internal levels in comparison with the convenience of large-scale noise mapping. Hence all the recent studies refer to external levels as a proxy.

By definition, a proxy is not the parameter we are trying to control to the benefit of residents to deliver suitable internal living conditions. It's like trying to drive a car looking only at the sat-nav screen!

This lack of precision – the failure to target the parameter itself rather than the more convenient proxy is uniquely problematic in relation to exposure of individuals to environmental sound.

Clarke and Fiumicelli go on to suggest that because of this, one can disregard the body of high-quality epidemiological evidence published over the past 25 years, summarised in the WHO Environmental Noise Guidelines (2018), showing an increased risk of chronic adverse health outcomes with increased exposure to averaged external noise levels. Instead, they argue that for transport noise we should continue to be guided by the following evidence used to inform the WHO Guidelines for Community Noise (1999):

- an assumption and empirical observation that for speaker-to-listener distance of about 1m, speech in relaxed conversation is 100% intelligible in background noise levels of approximately 35 dBA;
- two studies on self-reported sleep disturbance from road traffic noise published in 1993 and 1997; and
- evidence on noise-induced EEG awakenings.

We disagree with Clarke and Fiumicelli on these points. We are concerned over their use of a single line in WHO 2018 about WHO 1999 internal values 'remaining valid' whilst ignoring the wealth of recent epidemiological evidence demonstrating how environmental noise affects health. In our proposals for the BS 8233 revision [Harvie Clark and Fenech 2024], we recommend a two-step approach. The first consideration should be minimising external sound levels – this is where the most robust evidence exists for health impacts. The second step is to address internal sound levels

through façade sound insulation requirements. This is not a departure from controlling internal levels, but rather a more holistic method of achieving healthier living conditions through better alignment with the evidence base. In the following sections we explain why, in our view, the arguments by Clarke and Fiumicelli are not supported by the scientific evidence.

Relevance of external vs internal sound for health effects

Noise is a psychosocial stressor [Lercher 1996, Babisch 2002], i.e. 'an environmental factor interacting with social and cultural factors to influence the mind and behaviour' [Clark et al 2024]. Within this framework, noise exposure at 'home' is not limited to the sound levels inside the physical space enclosed within a building envelope. It also covers any outdoor spaces that residents consider part of their home. The international standard for measuring noise annoyance (ISO/TS 15666:2021) clearly states that the terminology 'at home' does not mean strictly indoors, but covers inside the home or outdoors at home, including balconies, gardens, etc. The standard seeks to obtain general, consistent reactions that allow respondents to integrate their experiences over different times and locations in and around their home (Clark et al 2021).

The mechanistic evidence on the relationship between chronic noise exposure and chronic health outcomes supports a direct pathway and an indirect pathway [WHO 2018, Münzel et al 2024]. Noise can elicit both biological and psychological stress responses. The indirect (psychological) pathway is mediated by cognitive and emotional responses to the personal experience of the noise, which is not limited to the sound levels experienced when inside

a dwelling with windows closed [Lercher 1996, Guski et al 2017].

A dwelling is not just a physical structure – it represents a place where people call home [Weidemann and Anderson 1985]. The places where people live have a significant impact on their mental and physical health [NHS England 2018]. Furthermore, people’s perceptions of the neighbourhood in which they live can have significant implications for wellbeing, life satisfaction and resilience [MHCLG, 2021]. When residents feel a deep connection to their place of residence, they are more likely to be satisfied with their living conditions. This relationship is influenced by various factors, including the quality of the physical environment, social interactions and the availability of amenities. Noise has been shown to interact with some of these factors [Appleyard and Lintell 1972, Peris and Fenech 2020]. Socio-acoustic studies from Norway found that the noise levels in the immediate neighbourhood of a home can affect residential noise annoyance, with a similar effect on both outdoor and indoor noise annoyance [Klæboe et al 2005].

Based on these evidence-based frameworks, it should be evident that the health effects of noise are not solely influenced by the ‘dose’ that people are exposed to when inside their homes. To supplement these frameworks, we draw on the findings from two studies that investigated the influence of the external sound environment on disturbances inside the dwelling.

Öhrström (2004) presents the findings from a before-after longitudinal study carried out in Göteborg, Sweden in 1997 and in 1999 (before and after an intervention that led to a substantial reduction in road traffic volume on a main road). The investigation area was divided into an exposed and a control area, in which the houses were situated 25-67m and 125-405m, respectively, from the main road. About 40% of the houses in the exposed area had double-glazed windows in the living room, kitchen and bedrooms while the others had some form of triple-glazed windows. For the exposed group, outdoor levels ranged from 56-69 $L_{Aeq,24hr}$ on the noisy side. Noise from transport inside bedrooms and living rooms

ranged from <20 to 36 $L_{Aeq,24hr}$. For the control group, noise levels were 40-52 $L_{Aeq,24hr}$ outside and <20 $L_{Aeq,24hr}$ inside. Following the intervention, the noise levels for the exposed group reduced to 38-57 $L_{Aeq,24hr}$ outside and <20-24 $L_{Aeq,24hr}$ inside bedrooms and living rooms. Applying the arguments by Clarke and Fiumicelli, both the exposed and control group would be expected to experience minimum disturbance, because both dwellings achieve internal levels of approximately 35dB $L_{Aeq,16hr}$ or less (in accordance with requirements in the current BS 8233). Similarly we would not expect the intervention to have delivered any meaningful benefits to health.

Figure 1 shows the percentage of people reporting activity disturbances indoors and outdoors, for the exposed and control groups, before (1997) and after (1999) the intervention. For the exposed group before the intervention, 15% reported disturbances to conversation, 24% had difficulties falling asleep and 38% had their rest/relaxation disturbed. Following the intervention, these disturbances

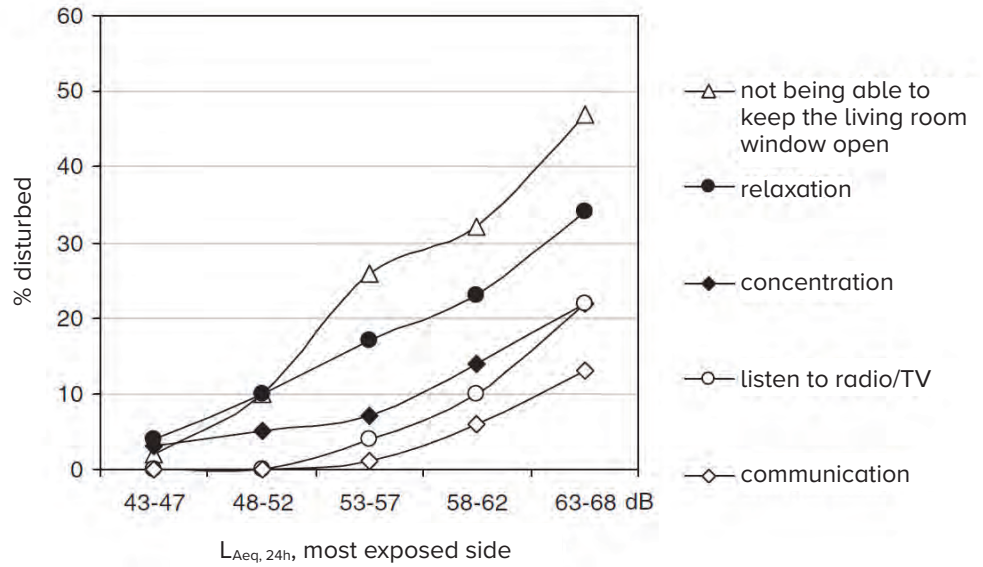
dropped to 0%, 9% and 11%, respectively. For the control group (external levels <52dB $L_{Aeq,24hr}$), less than 5% of respondents had these activities disturbed by road traffic. Before the intervention nearly 60% of the exposed group expressed annoyance because road traffic noise prevented them from having windows open as often as desired; this dropped to just 4% after the intervention. The differences between the exposed and control group were even larger for outdoor activities (conversation and relaxation) when at home. A second study looked at noise disturbance across four sites in the centre and outskirts of Gothenburg and Stockholm, Sweden (Öhrström et al. 2006). All dwellings were flats in 3-5 storey buildings. The windows were either double- or triple-glazed. The dwellings chosen were exposed to sound levels from road traffic ranging from about $L_{Aeq,24h}$ 45-68 dB at the most-exposed side. The speed of the road traffic did not exceed 50 km/h in any of the study sites. The study included responses from 956 individuals aged 18-75 years. [P46](#)

Below:
Figure 1:
Disturbances to indoor and outdoor activities from road traffic noise for an exposed and control group, before (1997) and after (1999) a major traffic intervention. Reproduced from Öhrström (2004)

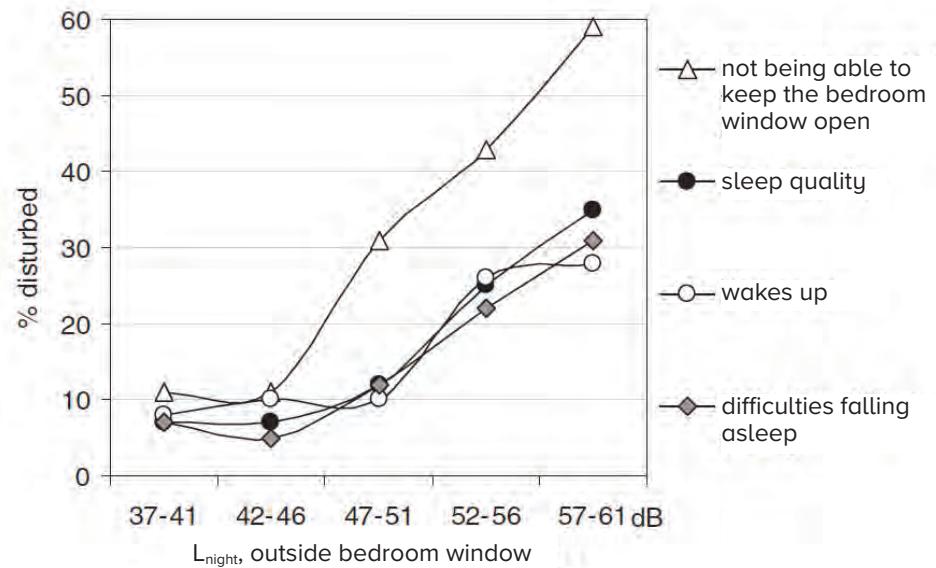
Percentage rather or very annoyed by road traffic noise during the following activities:	Exposed area		Control area	
	1997 n=50	1999 n=45	1997 n=92	1999 n=75
Indoor activities				
Conversation/telephone conversation	15	0	0	0
Radio/TV	12	2.2	1.1	0
Concentration	12	2.2	2.2	0
Rest/relaxation	38	11.1	5.4	0
Difficulties in falling asleep	24	8.9	2.2	0
Awakenings	28	8.8	3.3	0
Does not keep windows open as often as desired	58	4.4	3.3	0
Outdoor activities				
Able to be on the terrace or patio	38	4.4	1.1	0
Conversation	48	8.8	0	0
Relaxation	50	11.1	2.2	0

Figure 2 shows the activity disturbances indoors **with windows closed** in relation to sound levels at the most exposed façade. Communication was the least reported disturbance. Nearly three times as many participants reported disturbance to relaxation at any given external exposure level.

Figure 3 shows the percentage of respondents reporting daytime activity disturbances with windows closed, and the increase with windows open. If activity disturbance correlated better with the internal levels than with the external levels (as argued by Clarke and Fiumicelli), we would expect similar levels of disturbances for the 48-52 dB (windows open) and 63-68 dB (windows closed) exposure bands¹. These bands have the closest alignment to the current BS 8233 target range for internal levels during daytime. The results do not support this hypothesis: disturbances were consistently higher with windows closed than windows open, for approximately equal internal conditions: (communication: 13% vs 5%, listen to radio/TV 22% vs 0%, concentration 22% vs 5%, relaxation 34% vs 10%. [P48](#))



Above: Figure 2: Activity disturbances indoors with windows closed, as a function of noise exposure outdoors at the most exposed façade. Dwellings were flats in urban environments, all of which had double or triple glazing. Reproduced from Öhrström et al. (2006)




Above: Figure 4: Noise-related sleep disturbances indoors with windows closed in relation to sound levels in Lnight outside the bedroom windows. Reproduced from Öhrström et al. (2006)

L _{Aeq24h} dB most-exposed side	Communication		Listen to radio or TV		Concentration		Relaxation	
	Closed	Open	Closed	Open	Closed	Open	Closed	Open
45-46	0	+1	0	+2	3	+1	4	+2
48-52	0	+5	0	±0	5	±0	10	±0
53-57	1	+13	4	+13	7	+6	17	+8
58-62	6	+15	10	+19	14	+13	23	+12
63-68	13	+28	22	+24	22	+19	34	+15

Above: Figure 3: Percentage respondents reporting daytime activity disturbance effects with windows closed and the increase in disturbance with windows open. Reproduced from Öhrström et al. (2006)

Footnote

¹ Assuming an approximate external to internal sound level difference of 30dB for double and triple glazed windows, and 12dB for open windows.



Exposure to a wider variety of projects?

Greater career prospects?

A greater range of duties and responsibilities?

What are you looking for in your Acoustics career?

Or is it a wider range of duties and responsibilities?


Whatever the reason, Penguin Recruitment are here to help!

Penguin Recruitment is a multi-disciplined Engineering and Environmental Recruitment Consultancy established in 2004. We offer nationwide and international job opportunities for anyone looking to kick start or develop their profession.

With extensive knowledge in the Acoustics and Air Quality Industry, we are proud to offer an energetic can-do approach whilst providing a friendly, professional and knowledgeable service at all times.

If you're a growing business looking to access a wider pool of candidates to help with your expansion plans, then please get in touch!

Penguin Recruitment advertise on more job boards than any other specialist recruitment agency within the acoustics industry, and have a well-established and expansive network of candidates accumulated over 16 years of service, allowing us to provide leading advice on the current candidate market.



For more information please contact
Dina Bunkheila on **01792 365006**, or email
dina.bunkheila@penguinrecruitment.co.uk

PENGUIN
RECRUITMENT



www.penguinrecruitment.co.uk

Noise-induced sleep disturbances (percentage >3) with windows closed and the increase in disturbance when windows are open at different sound levels

L_{night} outside bedroom windows	Difficulties falling asleep		Wakes up		Decreased sleep quality	
	Closed	Open	Closed	Open	Closed	Open
37-41	7	+7	8	+5	7	+5
42-46	5	+6	10	±0	7	+4
47-51	12	+7	10	+5	12	+5
52-56	22	+14	26	+11	25	+11
57-61	31	+10	28	+15	35	+10

Above:
Figure 5:
Percentage respondents reporting noise-induced sleep disturbances with windows closed and the increase in disturbance when windows are open. Reproduced from Öhrström et al. (2006)

Similar observations were made for sleep disturbance. Referring to Figure 5, the two exposure categories aligning to current BS 8233 internal criteria (30dB $L_{\text{Aeq,8hr}}$) are 42-46 dB (windows open) and 57-61 dB (windows closed). The percentage of people reporting sleep problems is higher with windows closed than window open, for similar internal levels.

Some other studies on noise annoyance investigated differences between outdoor and indoor annoyance (see for example Danish Road Directorate 2016) and indoor annoyance with windows open and closed (see for example Preisendörfer et al 2022). These studies show that both outdoor annoyance, and indoor annoyance with windows open are important contributors to the overall annoyance reactions and therefore support the contribution of both the external and internal sound exposure at home.

Is disturbance to speech communication the key health outcome for daytime noise?

In the WHO Guidelines for Community Noise (1999), the daytime criteria were set based on interference with speech and annoyance from transport noise. The studies from Sweden suggest that interference with communication may not be the most appropriate health outcome to set indoor criteria (see Figure 2). The WHO 2018 guidelines chose annoyance as a better health endpoint that includes a broader range of disturbances [Guski et al 2017].

WHO Guidelines 2018 vs 1999

A notable omission in the letter by Clarke and Fiumicelli is any reference to the WHO Environmental Noise Guidelines for the European Region (2018),

other than to state (out of context) that ‘there seems to be no evidence to contradict the WHO 2018 confirmation that the internal values from WHO 1999 are still valid’. It is our view that this statement is incorrect. Fenech and Stansfeld (2024) explain the relationship between the 1999 and 2018 WHO Guidelines, and both guidelines emphasise the importance of considering both external and internal noise levels when setting health-based criteria for residential development.

The WHO 2018 Guidelines represent a significant methodological shift from earlier noise guidelines, moving from an ‘expert-based judgement’ approach to one that ‘formulates recommendations more strictly based on the available evidence’ [WHO 2018]. This evolution resulted in a more rigorous methodology that prioritised epidemiological evidence based on external noise levels. While the 2018 Guidelines note that internal guideline values from 1999 ‘remain valid’, these values need to be interpreted in conjunction with the external guidelines in the WHO 2018, and taking into account source-specific characteristics of the sound [Fenech and Stansfeld 2024].

Is external noise ingress with windows closed a suitable mitigation for disturbance from neighbour noise?

In their letter, Clarke and Fiumicelli also appear to suggest that up to a certain level, transport noise ingress in buildings with windows closed can have beneficial health effects:

‘If, for example, rather than achieving internal conditions at night of 30dB $L_{\text{Aeq,8hr}}$ with L_{max} levels in the low 40s in two apartment buildings, we get one building with 20 $L_{\text{Aeq,8hr}}$ (L_{max} in the low 30s) and one building at 40 $L_{\text{Aeq,8hr}}$ (L_{max} in the low 50s)

then BOTH sets of residents have dramatically compromised living conditions, due to annoyance and sleep disturbance in the under-attenuated case and high levels of neighbour noise disturbance in the over-attenuated building.’

We argue that this is a dangerous and unfounded assertion. To our knowledge, there is no robust scientific evidence demonstrating that lower internal sound levels due to higher façade sound insulation leads to ‘dramatically compromised living conditions’ or increased neighbour noise disturbance. While anecdotal reports of increased sensitivity to neighbour noise in quieter environments exist, these have not been substantiated by systematic studies. It is not clear how noise from discrete car/train pass-bys or aircraft flyovers that averages to an internal level of 30dB $L_{\text{Aeq,8hr}}$ can be effective at reducing disturbance from neighbour noise. External anthropogenic noise ingress with windows closed should not be relied on as a sound source contributing to a positive internal soundscape in homes, because it is completely out of the control of the building occupant. Research by Torresin et al (2022) demonstrates the importance of control over one’s environment to achieve an ideal indoor soundscape for work and relaxation.

We argue that neighbour noise disturbance should be managed by appropriate levels of sound insulation between dwellings and, if acoustic masking is necessary, this should be achieved by sources of sound that are under full control of the building occupants.

Towards a more holistic design of healthy homes

Our proposals for the BS 8233 revision recognise that different noise sources (road, rail, air) have

different health impacts at the same averaged decibel level [WHO 2018]. The current practice of treating all sources equally once they reach internal spaces does not reflect this evidence. Specifying different façade sound insulation requirements for different noise sources can be a way of inherently considering the characteristics of these sources and their varying health impacts, while maintaining control of the internal acoustic environment.

Evidence from Western Europe has consistently shown a desire by citizens to open their windows when inside their homes [WHO 2009]. From a soundscapes perspective this offers an opportunity to connect to the place where people call home [Torresin et al 2022, Torresin et al 2024];

from a broader health perspective it is an important means of controlling indoor sources of air pollution, temperature and humidity [van Rooyen and Sharpe 2024]. This may become increasingly important with a changing climate [Dimitroulopoulou et al 2023]. The evidence discussed in this paper shows that the external sound level can act as barrier to occupants' willingness to open windows. We believe this is yet another argument why both external and internal noise conditions should form part of standards for residential acoustic design.

Concluding remarks

The external sound environment at the place where people call 'home' is not merely a 'convenient proxy' as argued by Clarke and

Fiumicelli, but an important factor contributing to people's health and wellbeing. This is backed up by more than two decades of epidemiological evidence.

The revision of BS 8233 offers a once in a decade opportunity to revisit current approaches, and identify potential improvements guided by the best available evidence. The paradigm shift in our proposals is not about contradicting past guidelines, but about embracing a more evidence-based approach that reflects our current best understanding of how environmental noise affects health and wellbeing. It provides a framework that combines valuable insights from previous guidelines with the robust epidemiological evidence gathered under real world living conditions. ☺

References

- Appleyard D, Lintell M (1972). The environmental quality of city streets: The resident viewpoint. *J. Am. Inst. Planners* 38: 84-101.
- Babich W (2002) The noise/stress concept, risk assessment and research needs. *Noise Health* 4(16):1-11.s
- Clark C, Gjestland T, Lavia L, et al. (2021) Assessing community noise annoyance: A review of two decades of the international technical specification ISO/TS 15666:2003. *The Journal of the Acoustical Society of America* 150, 3362.
- Clark C, Vienneau D, Aasvang GM (2024) Noise and Effects on Health and Well-Being. In *A Sound Approach to Noise and Health*.
- Danish Road Directorate (2006) Noise annoyance from urban roads and motorways. Report 565 – 2016.
- Dimitroulopoulou S et al (2023) Chapter 5. Impact of climate change policies on indoor environmental quality and health in UK housing. In *Health Effects of Climate Change (HECC) in the UK: 2023 report*. UK Health Security Agency.
- Fenech B, Stansfeld S (2024) Clarifying the relationship between the WHO 2018 Environmental Noise Guidelines for the European Region and the 1999 Guidelines for Community Noise for dwellings exposed to transport noise. *IOA Acoustics Bulletin JAN/FEB 2025*.
- Guski R, Schreckenber D, Schuemer R (2017) WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance. *Int. J. Environ. Res. Public Health* 2017, 14, 1539.
- Lercher P (1996) Environmental Noise and Health: An Integrated Research Perspective. *Environment International* 22(1).
- Harvie-Clark J, Fenech B (2024). Updating BS 8233: Aligning residential acoustic design guidance with the health evidence. *Proceedings to Acoustics 2024*.
- Klæboe R, Kolbenstvedt M, Fyhri A (2005) The Impact of an Adverse Neighbourhood Soundscape on Road Traffic Noise Annoyance. *ACTA ACUSTICA UNITED WITH ACUSTICA* Vol. 91.
- Lercher P (1996) Environmental Noise and Health: An Integrated Research Perspective. *Environment International* 22(1).
- Ministry of Housing, Communities and Local Government (2021) *English Housing Survey Well-being and Neighbourhoods, 2019-20*.
- NHS England 2018. *Putting Health into Place: Introducing NHS England's Healthy New Towns programme*.
- Öhrström E (2004) Longitudinal surveys on effects of changes in road traffic noise—annoyance, activity disturbances, and psycho-social well-being. *J. Acoust. Soc. Am.* 115 (2).
- Öhrström E, Skånberg A, Svensson H, Gidlöf-Gunnarsson A. (2006) Effects of road traffic noise and the benefit of access to quietness. *Journal of Sound and Vibration* 295 (2006) 40–59.
- Peris E, Fenech B (2020). Associations and effect modification between transportation noise, self-reported response to noise and the wider determinants of health: A narrative synthesis of the literature. *Science of the Total Environment* 748 (2020) 141040.
- Preisendörfer P, Liebe U, Enzler HB, Diekmann A (2022) Annoyance due to residential road traffic and aircraft noise: Empirical evidence from two European cities. *Environmental Research* 206 (2022) 112269.
- Torresin S, Ratcliffe E, Aletta F, Babich F, Oberman T and Kang J (2022) The actual and ideal indoor soundscape for work, relaxation, physical and sexual activity at home: A case study during the COVID-19 lockdown in London. *Front. Psychol.* 13:1038303.
- Torresin S, Aletta F, Oberman T, Albatici R, and Kang J (2024) Factors influencing window opening behavior and mechanical ventilation usage during summertime: A case study in UK dwellings. *Building and Environment* 263 111880.
- Van Rooyen C and Sharpe T (2024) Ventilation provision and use in homes in Great Britain: A national survey. *Building and Environment* 257 (2024) 111528.
- Weidemann S, Anderson JR (1985) A Conceptual Framework for Residential Satisfaction. In: Altman, I., Werner, C.M. (eds) *Home Environments*. Human Behavior and Environment, vol 8.
- WHO (1999) *Guidelines for community noise*. Geneva: World Health Organization.
- WHO (2009) *Night Noise Guidelines for Europe*. WHO Regional Office for Europe.
- WHO (2018) *Environmental Noise Guidelines for the European Region*. WHO Regional Office for Europe.



A history of IOA education and training

The IOA offers the most comprehensive array of professional education and training courses in acoustics in the world as the result of the efforts of many people.

By Keith Attenborough HonFIOA

I have been involved with IOA education and training for about half of my 50 years as an IOA member including eight years as Chief Examiner for the Diploma and 17 years as (part-time) Education Manager.

I will soon be stepping down from the Education Manager role, so this is my record of how IOA courses were initiated and their evolution from 1974 to date. The imminent appointment of a full time Director of Education will open a new chapter.

My starting point is a draft entitled *A History of the IOA Education Committee and the IOA Diploma*, written by the late Bob Peters FIOA, who served two terms as Chair of the Education Committee. He played a major part in assembling the IOA's education and training portfolio and his many contributions were recognised by the inauguration of the Dr Bob Peters Education Award in 2022¹. I am very proud to have been the first recipient.

1974 to 1982

The IOA was formed on 1 January 1974 by amalgamating the British Acoustical Society (BAS) and the Acoustics Group of the Institute of Physics (IOP), but the first meeting of the newly-formed IOA Education Committee was held prior to that at the end of 1973. The Chair of that meeting, Mr A N Burd, outlined the ongoing work of the previous Committee, which included a programme of sixth form lectures, short courses in acoustics and noise control held at Newcastle and Ewell Colleges, and the continuation of the schools' 'project' competition organised by the Acoustics Group (of IOP) in 1974.

Early meetings of the Committee dealt with matters such as a survey of technician training needs in acoustics, refresher courses for teachers and a lecture on acoustics for people working in industry.

Important pieces of legislation in the 1970s were the Control

of Pollution Act in 1974, and the Health and Safety at Work Act of the same year. The first version of BS 5228 on Construction Noise appeared in 1975 and these publications promoted a significant increase in demand for information and training about noise from those required to deal with it.

Given this context, it is not surprising that the minutes of the tenth meeting of IOA Education Committee, on 5 February 1976 include the following: '*a favourable report has been received from Council to an Education Committee proposal to set up a working party to develop an IOA Diploma in Acoustics and Noise Control*'². Subsequently, the Diploma Advisory Board was set up and the first Diploma course started in September 1977. The first set of examinations in June 1978 were taken by 56 students based at four centres.

References

- ¹ The idea for this award was originated by Luis Gomez-Agustina at London South Bank University.
- ² Membership Committee made the initial proposal in respect of the education required for MIOA.

The first version of the Diploma included a compulsory general principles of acoustic (GPA) module and a choice of any two from four specialist modules. The specialist modules were architectural and building acoustics (ABA), noise control engineering (NCE), law and administration (LA), and transportation noise (TN). Laboratory work made up a significant part of study of these modules, but there was no assessed coursework or laboratory reports. Three more specialist modules (vibration control, measurement and instrumentation, and sound reproduction) were added during the following two years.

That the Diploma was created within four years of the first Education Committee meeting remains an outstanding and lasting achievement, and a great tribute to the hard work and vision of those early members of Education Committee.

On 8 May 1978, to save on meeting costs, the Education Committee was abolished and its responsibilities were shared between other committees and a Diploma Advisory Board. However, three years later, in 1981, Council accepted the recommendation from the Board that it be renamed the Education Committee and its terms of reference widened to encompass all matters of education relevant to IOA activities.

The final round of sixth form lectures was held in 1982 with lectures from Peter Lord, and from Peter Wells. Since their inception in 1974, the lectures had been delivered to more than 550 sixth formers.

1982 to 2000

During this period, much of the business of the Education Committee was occupied by organising and administering the IOA Diploma, which, at its height, had over 250 candidates per year, divided between 12 accredited centres. This period also saw the development and introduction of the five-day Certificates of Competence in Workplace Noise Assessment, Measurement of Environmental Noise, and the Certificate Course in the Management of Hand Arm Vibration.

A distance learning version of the Diploma was introduced initially at Heriot Watt University (HWU), then Cornwall College. Subsequently, the IOA used the HWU videos under licence. Eventually, initially authored by Roy Lawrence and Bob Peters, the IOA developed distance learning notes, and these were supported by a programme of face-to-face tutorial and laboratory sessions.

Minutes and annual reports from Council and from the Education Committee show that there was a need for the IOA to have its own

tutored distance learning scheme based on new extensive course notes, whereby, essentially, the IOA would become both a provider and validator of the Diploma course.

2000 to 2013

This period focused on the educational standing of the Diploma course, including its postgraduate status and its place within the newly published national educational framework of higher education courses. A major restructuring of the Diploma course was started at the beginning of this period, culminating in the revised Diploma in 2008.

During the preceding years, a large proportion of Diploma candidates came from local authority environmental health departments but few of them opted to take the specialist modules on measurement, speech reinforcement and vibration. It was decided to introduce a new laboratory and experimental methods module and to merge the content of some modules that had fewest candidates. As a result, the total number of specialist modules was reduced to four, in addition, the format of the examinations was modified to include a short section of compulsory short questions intended to test knowledge across the syllabus as well as optional longer questions concentrating on specific topics. **P52**

Below:
The IOA developed a distance learning version of the Diploma



The Education Committee was restructured with the aim of separating out the business of running of the Diploma from other important educational initiatives, such as the Acoustic Ambassadors scheme for schools. In 2008, terms of reference were drawn up for an Education Sub-committee concerned with the Diploma, which became the Diploma Tutors and Examinations Committee in 2010, and Certificate Management Committees. These were to meet before the Education Committee met to which they would submit reports and make recommendations.

In 2001, educational activities were given an impetus by the appointment of Peter Wheeler as Education Manager.

The high standard of layout and formatting of the Diploma and Certificate examination papers can be attributed to the diligent oversight of the late John Bowsher. During and after his period as Chief Examiner, John continued to proofread, typeset, print and distribute examination papers for the Diploma and Certificates until 2013.

In view of the constantly changing background of legislation, standards and guidance, Diploma examiners were instructed not to ask questions in the written examinations for the Diploma about new developments until they had been in force for 12 months, however, if relevant documentation was readily available, new developments were considered as fair game for coursework (CW) topics. Increasingly, Diploma coursework was used to encourage candidates to read outside the Diploma notes and, in so doing, provide examiners with the opportunity to relate CW questions to subjects of current or recent interest.

2014 to date

In 2014 it was agreed that coursework, lab reports and project reports for the Diploma should be submitted, marked and handled electronically but with a file size limit, although printing costs could be covered if markers preferred hard copies for marking.

In 2018, the Education Sub-committee became the Diploma Tutors and Examiners Sub-committee chaired by me as the Education Manager.

During these years, important contributions to education and training were made by the late Mike Fillery who, as well as tutoring the Diploma and certificate courses at Derby, chaired the CCENM Committee, and revised and updated the Diploma specialist module notes. I would also like to acknowledge the many contributions from Mike's colleague and successor at Derby University, John Pritchard, and Tim South at Leeds Beckett.

No more sixth form lectures were given after 1982, but the quantity and quality of other schools' activities increased with notable contributions from Richard Collman, Emma Shanks, Vicky Wills and Matthew Muirhead. The STEM Committee, formed in 2019 as a Sub-committee of Education Committee to oversee such activities, now reports directly to Council.

As well as offering notes on writing technical reports, the Diploma sought to offer other translational skills that are needed in professional careers such as the devising and making of presentations. With strong support from Luis Gomez Agustina at London South Bank University, a PowerPoint presentation with commentary was introduced as part of the Diploma project activities, which continues to this day.

After 2018, a series of blended learning video tutorials for the Diploma were created using funds allocated by Council in response to proposals made by the newly appointed Marketing Manager, Alex Shaida.

In common with higher education institutions, IOA Education has had to address the ability of candidates to exploit AI in coursework and report writing. Our policy is to discourage candidates from using AI but, if they do, to state that they have done so. Candidates are advised that excessive use of AI is likely to be marked accordingly.

Another Alex Shaida initiative has been the development of

video-based continuous professional development (CPD) courses for IOA members and non-members.

Some thoughts about the future

Fifty years after its creation the IOA Diploma has been studied by over 3,500 candidates with wide-ranging backgrounds. It continues to be the 'gold' standard for the educational requirements needed to apply for corporate membership of the Institute.

To increase Diploma enrolments, there are ongoing discussions about a further revision of the Diploma, reducing the GPA content and adding specialist modules.

The normal requirement for admission to the IOA Diploma is a degree in engineering, mathematics, physics, environmental health or a clearly relevant technological subject. Increasingly, recruitment for the Diploma will require the Institute and centres to accept candidates without degrees but offering relevant professional experience in acoustics (including IOA certificate courses). If an acoustics apprenticeship ever sees the light of day, the Institute should highlight a possible career path through the Diploma or an abridged version of it. This will benefit from continuing and increasing the mathematics support.

A possible new type of centre for delivery of IOA courses is a consultancy. This is being pioneered by Chris Barlow and Juan Battaner-Moro at KP Acoustics Research Laboratories who have, incidentally, resurrected the use of the facilities at Salford University to provide a centre in the Manchester area.

The continuation of online CPD videos will not only enable a significant training portfolio but also provide opportunities for featuring the IOA in social media.

A question yet to be resolved concerns the extent to which the IOA's increasing portfolio of online CPD courses should include any form of assessment.

There are many issues to be faced by the new Director of Education and I wish him or her every success in dealing with them. ☺

In this Acoustics Bulletin condensed version of the history, it has not been possible to mention everyone who has contributed to IOA Education and Training, but in the longer version for the IOA 50th Anniversary Supplement, I will aim to do so.



MASON UK LTD

Vibration Control Products
& Acoustic Floor Systems

We own the entire process from tree to installation.
Quality, Engineering and Traceability are paramount.

Mason's proprietary natural rubber formula is unique and unsurpassed in dynamic performance.

We manufacture most of our elastomeric products in Thailand, in our factory next to the main global source of natural rubber. Our products are independently verified to demonstrate exceptionally low dynamic stiffness and high durability, allowing us to certify all moulded products to bridge-bearing quality, exclusive to the market.

► *We are unique in sourcing direct from the rubber plantation*



◀ *Raw rubber (latex) being processed in the factory*



We are able to do this as we own the full fabrication process, from tree to product. All our factories have ISO 9001 quality accreditation, ensuring our processes are fully controlled and our extensive range of products, from bespoke building isolation bearings to simple rubber pads, are manufactured to the highest quality.

Taking control of the entire supply chain gives us the most robust and reliable production system and allows for 100% traceability. Quality assurance and testing form an integral part of our manufacturing process and allow us to provide warranties, validated by engineering method, which exceed the life of most structures.

► *Every bearing we make is tested to 150% rated load to assure zero problems on site*



ABOUT MASON

A world leader in noise & vibration control products for over fifty years setting the standard for consultants & architects. We provide complete engineering design and site validation for our product range including:

- Elastomeric & Spring Mounts
- Building Isolation Bearings
- Floating Floors
- Isolated Walls Mounts & Suspended Ceilings Hangers
- Building Services and Plant Isolation products

www.masonuk.co.uk

+44 (0)1252 716610 info@masonuk.co.uk Unit 6 Abbey Business Park, Monks Walk, Farnham, Surrey GU9 8HT

The Institute of Acoustics Diploma results 2023-24

*By Professor K Attenborough, HonFIOA
(IOA Education Manager)*

Candidates for the IOA Diploma in Acoustics and Noise Control in 2023/2024 were based at two accredited centres (KP Acoustics Research Labs and the University of Derby), and at four centres for tutored distance learning (Bristol, Edinburgh Napier University, Milton Keynes and Trinity College Dublin).

Written, closed book examinations were held at centres in the United Kingdom as well as international centres on 6 and 7 June 2024. There were 91 candidates (including 12 resits) for the General Principles of Acoustics (GPA) module examination, 17 for Regulation and Assessment of Noise (RAN), 39 (including one resit) for Noise and Vibration Control Engineering (NVCE), 56 (including seven resits) for Building Acoustics (BA) and 71 (including nine resits) for Environmental Noise Measurement, Prediction and Control (EN). 94 candidates registered for the project module. Although 28 are listed as having failed the project in the table of results, 12 of these 28 have deferred their project to 2024.

As in previous years, a merit threshold of 70% was applied to the written GPA paper and the conflated GPA mark. The examination scripts of candidates satisfying the conflated mark threshold but gaining between 68% and 72% on the written paper were examined at moderation, re-marked

where appropriate and judged individually as 'pass' or 'merit'. However, even if these criteria were satisfied, a merit was not awarded if a coursework assignment mark was carried over from a previous year.

Criteria based on the means and standard deviations from the previous 11 years were used to decide whether to moderate examination marks for the specialist modules. To obtain a merit grade on the specialist modules, candidates were required to have a conflated mark of at least 70% and a written examination mark of at least 70%.

The first GPA coursework assignment on **The impact of anthropogenic noise on marine mammals** resulted in a mean mark of 67%. The second GPA assignment on **Room acoustics, sound propagation and soundscape** resulted in a mean mark of 72%.

The specialist module coursework topics this year included: **Noise at work** (NVCE), **Gym noise and vibration** (BA), **Environmental impact of noise from sports pitches** (EN) and **Assessing the noise impact from onshore wind turbines** (RAN). An online presentation associated with the project proposal part of the project was required for the third time this year.

The numbers of candidates who gained merits (M), passes (P) or fails (F) in each module are shown for each centre in the following table of results. The 'fails' include those who were absent from the written examinations.

Seven exceptional candidates have obtained five merits. The prize for best overall Diploma performance, based on not only gaining five merits but also achieving the highest aggregate mark overall (GPA, Labs, BA, NVCE and Project), is to be awarded to Yong Lee Low (DL Milton Keynes).

The other candidates who are to be congratulated on achieving five merits are: James Edward Dennis (DL Bristol), Jillian Monkhouse (DL Edinburgh), Chris Downing (DL Milton Keynes), Wai Tung Ho (DL Milton Keynes), Johnathan Wood (DL Milton Keynes) and Dorothy Poulter (University of Derby).

Candidates to be commended on achieving four merits are Martin Higgins (DL Bristol), Sebastian Drury (DL Edinburgh), Najwa Adnan-Smith (DL Milton Keynes), Jacob Mathew (DL Milton Keynes), Paul Challender (KP Acoustics Research Labs) and Daniel Moiseiwitsch (KP Acoustics Research Labs).

Jacques Dalton (DL Dublin) will be receiving the prize for the best overall Diploma performance by an Irish student.

Conor O'Brien (DL Milton Keynes) has been awarded the 2022-23 ANC Prize for the project: **An investigation into the acoustic properties of horse skulls**.

I am grateful to all examiners and tutors for their cooperation and contributions and thanks again to Helen Davies, Fiona Pizzey and Katharyn Holmes for their administrative contributions during the 2023/2024 presentation year of the Diploma.

IOA Diploma Results Chart for 2023/24

Centre name		GPA	Labs	BA	NVCE	RAN	EN	Project
Distance Learning (Bristol)	Merit	3	1	1	2	0	2	2
	Pass	1	5	1	0	0	2	3
	Fail	3	0	0	1	1	2	1
Distance Learning (Dublin)	Merit	0	3	0	0	0	0	5
	Pass	2	1	3	0	1	6	1
	Fail	3	0	0	0	0	0	0
Distance Learning (Edinburgh)	Merit	5	3	4	2	1	2	3
	Pass	1	4	1	1	2	4	8
	Fail	1	0	0	0	0	0	1
Distance Learning (Milton Keynes)	Merit	8	9	10	13	0	4	10
	Pass	15	26	10	4	4	12	14
	Fail	23	4	8	8	4	12	20
KP Acoustics Research Labs	Merit	3	1	3	5	0	3	3
	Pass	7	8	1	2	0	6	6
	Fail	3	3	2	0	0	2	3
London South Bank University	Merit	0	0	0	0	0	0	0
	Pass	0	0	0	0	0	0	0
	Fail	0	0	3	1	0	0	0
University of Derby	Merit	6	1	4	0	0	2	2
	Pass	3	12	5	0	4	10	9
	Fail	4	0	0	0	0	2	3
Totals	Merit	25	18	22	22	1	13	25
	Pass	29	56	21	7	11	40	41
	Fail	37	7	13	10	5	18	28

Project titles 2023-2024

Distance Learning (Bristol)

- A noise assessment for Padel
- The full picture; should patron noise be included in planning applications between resident developers and venues?
- Analysis and improvement of cost-effective ASHP enclosures
- Investigation into the accuracy and applicability of different barrier insertion loss models on real world acoustic barriers
- Sound reduction of a small machine

Distance Learning (Dublin)

- An analysis of sound level metrics for Dublin Airport aircraft in reference to EU directive 2002/49/EC
- Enhancing a conference room's acoustics considering a sustainable approach
- To compare real time on-site noise measurements from a single wind turbine with computational noise modelling software
- Environmental noise – Class 1 sound level meter versus smartphone sound measurement applications
- Planned vs actual noise exposure resulting from Dublin airport's new runway
- Investigating the effect of road traffic noise on new residential developments using alternative layouts

Distance Learning (Edinburgh)

- Methods of reduction for the operating noise of domestic gas fired boilers
- 'All about that bass?' – the importance of low frequency content in noise control at concerts and festivals
- Investigation into durability of acoustic performance in pedestrian doors
- Using cyclostationarity analysis to identify amplitude modulation from wind turbines
- An investigation into noise exposure from car stereo systems
- Alternative propagation modelling of battery energy storage systems (BESS) via derivation of area sources from field measurements
- The Broch pub and its excessive noise levels
- Effects of distance on impulsivity and tonality of noise from dogs in commercial kennels
- Open air concert noise – novel approaches to the planning, operational constraints, monitoring and regulating, and the investigation of complaints during large-scale outdoor events
- Evaluation of road traffic noise impact and the assessment of sound reduction of glazing and venting options
- An investigation into noise and vibration source mitigation measures for high-speed railway

Distance Learning (Milton Keynes)

- Comparison of testing methods for airborne sound insulation testing as per ISO 16283-1: 2014 Acoustics – field measurement of sound insulation in buildings and of building elements
- Controlled pass-by measurements of a new internal combustion vehicle and new EV vehicle – comparisons between both with consideration of low-speed reversing movements
- Characterising a hemi-anechoic chamber
- Noise exposure on the London Underground: an observational study of the Victoria Line
- The varying methods of determining background sound level
- An investigation into the impact of impulse response balloon diameter on third octave band reverberation time measurements of a meeting room
- An investigation into the sound insulation properties of an existing house, through the application of different noise ingress calculation methods
- Examining and addressing problematic room acoustics, caused by reverberation times and reflection, within a small home office environment
- I-SIMPA evaluation for building acoustics modelling

P56

- Assessing the impact of drone noise in a rural and urban environment
- Exploring acoustic simulation in gaming engines to implement a VR interface
- Innovative door panel: maximize noise reduction of the existing doors
- Acoustic assessment of the generator room for residential building
- Mass with class
- Mitigation of HVAC duct noise in a sensitive environment
- Room acoustics considering people with aural diversity
- A critical review and sample survey to test the threshold of noise-induced sleep disturbance research based on internal noise measurements
- An investigation into the application of the methodology and planning concepts from the Wales Noise and Soundscape Plan 2023-2028 in the context of Leicester city centre urban redevelopment
- Optimising the urban soundscape of Rye Lane (Peckham)

- Investigation into measuring the C-weighting sound levels when monitoring outdoor music events
- An investigation into the viability of using small reverberant rooms for measurements of sound absorption coefficients of open-cell foam
- Airborne noise impact from Manchester Metrolink's light rail vehicles and a comparison with Hong Kong's light rail transit system
- Influence of traffic volume on vertical noise propagation profile of Singapore road traffic
- Optimising grille designs for acoustic performance based on different aesthetic designs in domestic air-to-water heat pumps

- Developing a metric for assessing sustainability, cost and efficacy of acoustic materials
- An investigation into sound source identification at regulated installations utilising low-cost equipment and minimal staff numbers
- An investigation into the attenuation of window partitions from external sound sources: between guidance documents and the real world
- An objective and subjective analysis of church acoustics
- Enhancing the town centre soundscape of St Helens
- An investigation into vibration characteristics of roller-skates and its effects on health

KP Acoustics Research Labs

- An investigation into unmanned aerial vehicle noise emissions and propagation in the horizontal plane during engine ground run operations
- Prediction vs measurement – a solar farm noise research project
- An investigation into how speaker positions effects low frequency response within a small room

University of Derby

- Investigating the effect of measurement duration on measured L_{A90} background noise levels
- Is artificial intelligence (AI) ready to take your job? An exploration of the viability of AI in the creation of noise impact assessment

The Art of Being a Consultant

Thursday 27 March 2025 – Bridge5 Mill, Manchester

The Art of Being an Acoustician

Friday 28 March 2025 – Bridge5 Mill, Manchester

Organised by the IOA's Early Careers Group (ECG), these events are aimed at young consultants, those new to the profession, and students who are considering a career in acoustics. Presentations by practicing industry leading consultants cover a wide range of issues.



- The assessment of a garden fence as an acoustic barrier to air source heat pumps (100710004)
- Comparison of noise levels generated by two different tram models operating in Warsaw
- Assessing the effectiveness of existing methods of predicting internal noise levels within grassroots music venues
- A critical evaluation of ProPG: Planning & Noise in relation to the effects of noise on new dwellings close to a busy road
- To determine the accuracy of the current standard for A-weighting correction across varying age groups
- Investigating L_{A90} variation together with context considerations for BS4142 assessments
- Acoustics of small-scale hydropower
- Exploring noise exposure for caregivers of young children in domestic environments
- A review of the impact of driving style on vehicle related sound resulting from speed cushions

Diploma awarded December 2024

Distance Learning Bristol

Bryan S
Dennis JE
Higgins M
Smith D

Distance Learning Dublin

Casey D
Crossan Brady C
Dalton J
McDonagh S
O'Hanlon F

Distance Learning Edinburgh

Cross D
Cruicksank A
Drury S
England R
Fraser J
Hawthorne P
McGrath J
Monkhouse J
Smale S
Wilson K

Distance Learning Milton Keynes

Adnan-Smith N
Afaque M
AlAttar F
Al-Najjar A
Baskar H
Brown J
D'mello N
Downing C
Harper M
Ho WT
Kahn A
Low YL
Martin L
Marzouk D
Mathew J
Mohan S
Senavattanagul N
Shuttleworth W
Siddiqui M
Wood J

KP Acoustics Research Labs

Challender P
Cook S
Evans L
Hughes O
Knight E
Moiseiwitsch D
Sarma Balakrishnan B
Traynor N
van Jaarsveld F

University of Derby

Butterworth D
Meadows K
Metcalf A
Mistry J
Poulter D
Reay-Bennett D
Rhodes M
Sambrooke H
Wiacek Z

The IOA Certificate results 2024

In 2024 two new centres, Acoustic Associates and Noise Training SW, were accredited to deliver the CCENM course. One of the centres (Blue Tree Acoustics) delivering both CCWNRA and CCENM was accredited to deliver CCBAM also. Another established centre, London South Bank University (LSBU), was able to offer a second delivery of the CCENM course in the autumn. Enquiries and registrations from overseas candidates are on the increase. It is pleasing also that an increasing number of certificate course graduates have chosen to enroll in the IOA Diploma 2024-25, thereby contributing a sixth of the total cohort. The list of successful candidates below includes several resit candidates.

List of successful candidates

Certificate of Competence in Workplace Noise Risk Assessment

Exam date: 8 March 2024

KP Acoustics Research Labs

Chappell R
Hanks C
Haywood A
Jones G
Sadler M

Exam date: 27 September 2024

Blue Tree Acoustics

Hurren L
Maslen H

KP Acoustics Research Labs

Campen T
Galos A
Greatorex T
Green J
McMurray C
Olsen J
Smith P

Shorcontrol

Campbell K
Duffy C
Lyons A

Certificate of Competence in Irish Building Acoustics Measurements

Exam date: 12 April 2024

KP Acoustics Research Labs

Carroll R
Floyd D
Horan D
Nyhan P
O'Neill S
Privat R

Certificate of Competence in Building Acoustics Measurements

Exam date: 19 April 2024

KP Acoustics Research Labs

Boulton A
Frost A
Lloyd L
Platt N
Robinson J
Stratford D

Exam date: 1 November 2024

Collins S
Devereux R
Hance G
Minnican F
Mynard J
Perry J
Rawlings T
Speed A
Tan Chau-Ho R
Walsh C 

Certificate Course in the Management of Occupational Exposure to Hand-Arm Vibration

Exam date: 19 April 2024

Institute of Naval Medicine

Ffoulkes J
Griffin J
Mowbray C
Parkinson L
Smithett Z
Tillett L

Certificate of Competence in Environmental Noise Measurement

Exam date: 17 May 2024

Bel Noise

Akhtar D
Anstock L
Berry A
Craig M
Dunn M
Fraser N
Radhi N
Rogers N
Storey T
Thomson J
Thomson S

Blue Tree Acoustics

Brian M
Ceclich D
Elford M
Heeley-Hill A
Smith D

Colchester Institute

Beresford R
Garrison M
Halford M
Hankin K
Hashemi S
Kersey J
Knock E
Mann L
Parkin L
Pickering S
Salih K
Tabois J
Taylor B

KP Acoustics Research Labs

Bolton L
Claydon J
Coughlan M
Dangerfield J
Dwyer P
Gladwin R
Lebbert N
LeMaitre M
MacLeod R
Naraine D
Platt N
Richards J

Singh Atwal G
Singh Atwal H
Singh Atwal R
Start T
Taylor J
West T
Williams L

London South Bank University

Ellingham R
Emsley M
Godfrey A
Kaczowka E
Matthews G
Mohanarajan A
Pearson J
Sandakumar A
Seaman J
Secomb M
Smith A
Taylor W

Shorcontrol

Eivers E
Holohan R
O'Sullivan O
Quigley F
Quinn G
Redmond D
Reynolds B
Walsh R

Ulster Environmental

Burke A
Farrell C
Gordan S
McAllister P
McAvoy M
McClure J
McSorley M
Nugent S

University of Derby

Armstrong L
Bain J
Bhatt S
Boothroyd F
Dhot J
Farrier A
Moore L
Shirley M
Smith P
Tyler M
Warren K
White R

University of Liverpool

Asokan A
Bagwan A
Campbell L
Coleman M
Dalwood F
Harrison N
Collins J
Leung D

McKeown J
Samual J
Smith D
Tyrell N
Ulyat J
Vasudevan V
Vivekanandan V
Wilson P

Exam date: 4 October 2024

Acoustic Associates

Albrow S
Isitt C
Johnson A

Colchester Institute

Chrisp J
Guddemi D
Lawn N
Scott J
Short S

KP Acoustic Research Labs

Barratt EJ
Morgan A
Panza Y
Young R

London South Bank University

Birkett C
Kohler S
Lindsay B
Owusu Koduah M


Noise Training SW

Bacon P
Ellis J
Jewell C
Kearle A
Rickard R
Watts S

Shorcontrol

Burke S
Cosgrave C
Downes U
Moran J
Roche C
Sharma A
Sobolewski CA
Tekogul AD

University of Derby

Bowring J
Evans J
Hassani B
Hornblow C
Hossain G
Noble S
Pearce P
Smith D
Syson D
Taylor J
Williams C
Woods S 

IOA 2025 courses update

By Helen Davies and Keith Attenborough, IOA Education

Forthcoming IOA Certificate Courses in 2025

Subject to recruitment, the IOA will be offering the following certificate courses in 2025. In addition to long-established courses (Workplace Noise Risk Assessment, Management of Occupational Exposure to Hand-Arm Vibration, Environmental Noise Measurement and Building Acoustic Measurements and the Certificate of Proficiency in Anti-Social Behaviour etc (Scotland) Act 2004 – Noise Measurements), we will introduce three new courses: an advanced course in report evaluation, a certificate course in soundscape assessment and an environmental vibration certificate course.

Details about each of the existing courses are given below. Unless indicated otherwise each certificate course lasts for five days and examinations take place on the last day.

Certificate of Competence in Workplace Noise Risk Assessment (CCWNRA)

The course aims to provide the skills needed to carry out workplace noise assessments as required by the Control of Noise at Work Regulations 2005. Demand for competent noise exposure assessments is increasing and this course provides the latest information and training to meet the demands of the legislation, including a background of basic acoustics combined with 'hands on' practical experience of industrial noise measurements and associated assessment of workplace noise exposure.

Exam date: 7 March 2025

Certificate Course in the Management of Occupational Exposure to Hand-Arm Vibration (CCMOEHAV)

The course seeks to enable an appreciation of the nature of hand-arm vibration hazards in the workplace, the need to protect employees from hand-arm vibration syndrome and to advise and assist employers to meet their legal duties in accordance with current guidance from the Health and

Safety Executive. After completing the course candidates should be able to explain the requirements of current legislation, identify situations where hazards exist and assess the risk, discuss basic techniques for control of vibration exposure and identify areas where vibration reduction is required, assess the effectiveness of vibration control measures, evaluate the daily vibration exposures of employees from information about measured vibration magnitudes and work patterns and explain the uses and limitations of personal protective equipment.

Exam date: 11 April 2025

Certificate of Competence in Building Acoustics Measurement (CCBAM)

The course provides a basic knowledge of the methodology for measuring and reporting sound insulation and aspects of room acoustics, together with relevant provisions of key standards and guidance.

Exam date: 2 May 2025

Certificate of Competence in Environmental Noise Measurement (CCENM)

This course seeks to provide a basic knowledge of the methodology of environmental noise measurement, including the use and accuracy requirements of sound level meters and analysers and to enable them be aware of the significance of measurement data against the framework of standards and legislation for environmental noise.

Exam date: 16 May 2025

New courses under development

Certificate Course in Soundscape Assessment (CCSA)

This course will enable attendees to understand the concepts of soundscape and undertake the assessment and data analysis required for a soundscape assessment.

Exam date: 16 May 2025

Certificate Course in Environmental Vibration Measurements (CCEVM)

This course provides a knowledge of the methodology of environmental vibration measurement including correct selection of vibration transducer and analyser, mounting and positioning of transducers and an appreciation of the role of measurement data within the framework of the appropriate standards and legislation.

Advanced Certificate of Competence in Report Evaluation (ACCRES)

This course provides the skills required to critically read and evaluate technical reports in acoustics. While the course is appropriate to a wide audience it is aimed primarily at those in senior positions in pollution control and environmental health practice and anywhere that technical reporting is important.

Holders of certificates from courses may apply for Tech IOA membership (further details are available from membership@ioa.org.uk).

IOA Diploma 2025-26

The IOA Diploma continues to be the 'gold' educational standard on the route to achieving MIOA. Applications for the 25/26 IOA Diploma will open in February 2025. Watch an introductory video here: <https://vimeo.com/349834021/481228fe90>

Accredited Diploma centres include London South Bank University (LSBU), the University of Derby and KP Acoustics Research Labs, who will offer the Diploma in Southampton and Manchester (Salford University). Please enquire directly for more information on course dates, delivery, course fees and registration.

Information on accredited centres and the IOA certificate and Diploma courses they are delivering is at <https://www.ioa.org.uk/education-training> ©

For more information on these courses please email: education@ioa.org.uk

Low-frequency sound at outdoor concerts – a necessary noise

The existing commentary on low-frequency noise from concerts is limited in the range of frequencies covered, the advice provided is ambiguous and can be applied in an unduly onerous manner.

By Dani Fiumicelli, Vince Parker and Ed Lawrence of Vanguardia, and Jonty Stewart, RPS

The A-weighted decibel provides a reasonable approximation of the loudness of many environmental noises e.g. for transportation and industrial sources, but can underestimate the impact of sounds with substantial low-frequency content^{1, 1a & 1b} such as the bass and sub-bass content of modern popular music played at outdoor concerts and festivals. The low-frequency content is necessary for effective entertainment because, for example, it contributes to the sensation of loudness and provides the intangible but vital impetus to dance i.e. the groove^{2,3 & 4}. However, excessive low-frequency bass thump from outdoor concerts and festivals audible beyond the venue can provoke adverse community responses.

Vanguardia (and others) have for some time been recommending that as well as the A-weighted Music Noise Levels (MNLs) the C-weighted MNLs are also considered as these can be more reactive to the

low-frequency content than A-weighted levels alone. This article includes analysis of data where C-weighted MNLs are linked to community response and examines how these can be used to provide a cap on the low-frequency impacts offsite, whilst permitting sufficient low-frequency content and flexibility for the sound engineers so the sound quality, entertainment value and cultural impact of the event are not overly compromised. The article concludes with recommendations of guideline C-weighted MNLs both in terms of the differential in relation to equivalent A-weighted values and the overall absolute noise level.

Low-frequency content of modern popular beat music The groove

Low-frequency sound has been a critical component of popular music since at least the start of the 20th Century. Modern music trends⁵ facilitated by advances in music technology, amplification and loudspeaker design and

construction mean that the very lowest sub-bass frequencies generated in recording studios by specialist monitor type equipment unsuitable for touring or use outdoors can now be economically and efficiently reproduced with a touring PA and at outdoor events using equipment able to withstand the rigours of a rock and roll lifestyle.

Low-frequency sound in modern popular music is normally associated with the repeated beats and rhythms of drums and bass instruments and the synthesized sounds from electronic instruments and other sources. Frequency analysis normally shows that energy is often greatest at low-frequencies in the range from 31.5 Hz to 160 Hz 1/3 octave, with peak energy in different bands depending on the music genre and the individual tune. The table and figure below provide representative typical source frequency profiles of several types of modern popular music.

References

- Persson, K., and Bjorkman, M. (1988): Annoyance due to low-frequency noise and the use of the dB(A) scale. *J Sound Vibration*, 127, 491-497. 1a, Persson, K., Bjorkman, M., and Rylander, R. (1985): An experimental evaluation of annoyance due to low-frequency noise *Jnl Low Freq Noise Vibn* 4, 145-153. 1b, Persson, K., Bjorkman, M., and Rylander, R. (1990): Loudness, annoyance and the dBA in evaluating low-frequency sounds. *Jnl Low Freq Noise Vibn* 9, 32-45
- Stupacher, J H, Michael J., Audio Features Underlying Perceived Groove and Sensorimotor Synchronization in Music, University of California Research Initiatives, 2015, Permalink <https://escholarship.org/uc/item/2sw3r2dw> Last viewed 1st October 2024
- Cameron DJ, Dotov D, Flaten E, Bosnyak D, Hove MJ, Trainor LJ. Undetectable very low -frequency sound increases dancing at a live concert. *Curr Biol*. 2022 Nov 7;32(21):R1222-R1223
- Bowling DL, Graf Ancochea P, Hove MJ and Fitch WT (2019) Pupillometry of Groove: Evidence for Noradrenergic Arousal in the Link Between Music and Movement. *Front. Neurosci.* 12:1039
- Michael J. Hove, Peter Vuust, and Jan Stupacher, Increased levels of bass in popular music recordings 1955–2016 and their relation to loudness, *J. Acoust. Soc. Am.* 145 (4), April 2019

For the music genre with the most low-frequency content (dance) in the example above (Figure 1), the Figure 2 (on page 64) presents non-weighted 1/1 octave band levels and demonstrates the effect on these values of applying A-weighting compared to C-weighting.

The issue

The low-frequency content of music noise from outdoor concerts is often the most common issue raised by complainants. This is because:

- low-frequency sound is usually a substantial element of the music;
- low-frequency noise propagates more efficiently than mid- to high-frequency sounds;
- low-frequency noise penetrates buildings more readily than mid- to high-frequency sounds; and
- an impulsive beat of low-frequency bass thump can add to the adverse response compared to steady sounds of the same level⁶.

The current code of practice⁷ does not offer formal guidelines for low-frequency concert noise at receptors beyond the event boundary. Instead, it notes that receptor levels in the 63 Hz and 125 Hz 1/1 octave bands between 70 dB and 80 dB are generally satisfactory. This can create tension between the regulators and the event organisers, as the regulators can prefer 70 dB or less and the events favour 80 dB or more. Although the code omits this important detail, the levels in the study on which the note in the code is based were measured at a distance of 2km from concerts at Wembley Stadium. So, if these values are used, they should be applied at 2km from a venue⁸. Clearly higher levels occurred at noise-sensitive receptor locations closer than 2km to Wembley Stadium during the study.

Another issue is that the comments in the code only cover sound in the 63 Hz and 125 Hz 1/1 octave bands. As the figure and table above show nowadays there can be significant energy in the 31.5 Hz 1/1 octave band.

Genre	LAeq dB	LCeq dB	LC-LA dB	31.5Hz 1/1 Oct dBZ	63Hz 1/1 Oct dBZ	125Hz 1/1 Oct dBZ	250Hz 1/1 Oct dBZ	500Hz 1/1 Oct dBZ	1KHz 1/1 Oct dBZ	2KHz 1/1 Oct dBZ	4KHz 1/1 Oct dBZ	8KHz 1/1 Oct dBZ
Pop	98	110	12	108	108	98	95	95	94	90	84	81
Alt & Rock	98	110	12	99	109	100	97	97	92	88	84	78
Urban	98	114	16	109	113	98	96	94	94	90	86	84
Dance	98	116	18	111	116	101	96	94	93	89	85	83

Above: Table 1

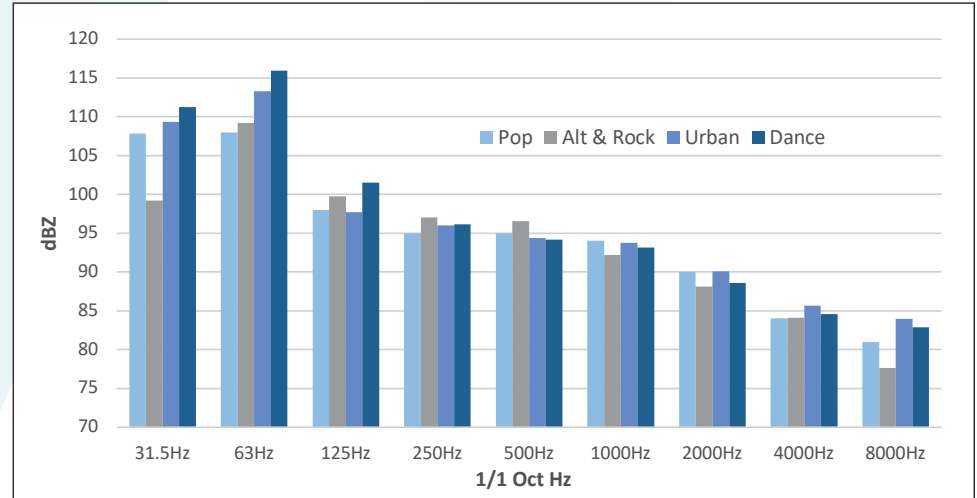
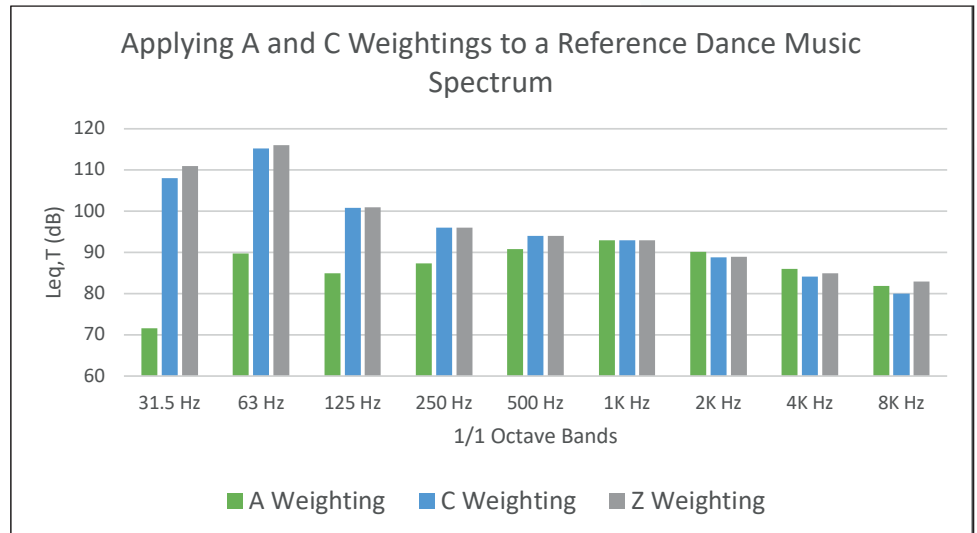


Figure 1: Representative 1/1 octave band spectra (dBZ) for types of popular music normalised to 98 dBA



Above: Figure 1a

Paradoxically, this means that rigid application of the comments in the Code of Practice could drive sound engineers to increase levels in the very lowest sub-bass frequencies to compensate for being unduly restricted at 63 Hz and 125 Hz 1/1 octave bands, as there would be no restriction below 44 Hz (the lower limit of the 63 Hz 1/1 octave band).

In the last 10 years Vanguardia have used C-weighted in conjunction with A-weighted measurements to control respectively low-frequency and overall levels of noise from outdoor concerts. On an empirical basis it has been found that restricting C-weighted levels to no more than 20 decibels above the equivalent A-weighted value with an [P62](#)

References

- 6 "Low-frequency noise, infrasound and vibration in the environment" (In Danish). Information from the Danish Environmental Protection Agency no. 9/1997; and A T Moorhouse, D C Waddington and M D Adams, The effect of fluctuations on the perception of low-frequency sound. Journal of low-frequency noise, vibration and active control, Vol. 26 No. 2 2007
- 7 Code of Practice on Environmental Noise Control at Concerts, The Noise Council, 1995
- 8 A study of Low-Frequency Noise From Pop Concerts, J.E.T Griffiths, J. Staunton and S. Kamath. Proc IOA, Vol15 Pt 7, 1993 (Cited in Ref 7)

upper limit of 90 dB $L_{Ceq,T}$, at the nearest sensitive receptors normally avoids excessive complaints, although a degree of complaint is likely whatever the control threshold, metric or weighting selected.

Complaints as indicators of impact

Defra-sponsored research into attitudes to environmental noise from concerts⁹ reports that:

- Whilst 9% of all respondents were fairly or very annoyed by the music noise, it should be noted that only 1% of residents actually complained about the noise disturbance.
- The most common reasons for not making a complaint were that they ‘had nothing to complain about’ (53%) or ‘event did not have sufficient impact to complain’ (33%). This finding is similar to many other areas of impact where simply being annoyed does not necessarily trigger a complaint.
- A significant percentage of the population will form an opinion on the music’s subjective annoyance irrespective of the actual level of music.

Consequently, the number of complaints as an indicator of impact and evaluation against annoyance can be misleading in regard to impacts on wider communities and the significance of any effects.

Local Authority complaint statistics¹⁰ invariably show that most noise complaints they receive are not evaluated as legal nuisances. A reason for this is because the subjective annoyance of specific individuals is not a relevant factor and, instead, a series of objective, albeit qualitative, tests apply the legal concept of nuisance to notional typical persons of ordinary sensitivity going about normal activities in the context of the nature and character of the locality, and takes account the duration, frequency of occurrence and timing of the noise.

Furthermore, experience of hundreds of outdoor concerts shows:

- there is a weak correlation between physical acoustic measures and the propensity to complain, for example, similar levels of the same music noise provoke wide variation in the numbers of complaints from equally affected but different areas, and complaints are often made at different locations with widely varying music noise levels;
- the number of complaints is usually a fraction of a percent of the large number of local residents invited to contact a dedicated telephone hotline and/or email address publicised by direct mailshot to thousands of households and on community-facing websites;
- it is not unusual for most complaints to be made at the lower MNLs further from the festival than at the higher MNLs closer to the event; and
- perception of sound, misconceptions of how sound propagates, and attitudes to the event/venue/artistes/audience appear to be strong triggers for complaint in many cases.

Complaints regarding noise are often linked to other elements such as:

- access to free/discounted tickets;
- traffic management, parking and litter;
- perceptions of festival goers and their behaviour;
- opinions on festival organisers’ motivations;
- opinions on use of public spaces for events;
- perceptions on damage to public spaces and facilities;
- no or low cultural or social value of the event to the complainant;
- dislike of the music played/ preference for other music types;
- antipathy towards regulatory authorities and their decision-making;
- expectation of control over the conditions in a locality;
- local adverse publicity and/or campaigns against the events; and
- social media posts encouraging complaint/disinformation.

This indicates that although complaints may reflect the response of suitably motivated individuals, they are a weak indicator of wider community noise impacts as they can be biased by highly variable personal subjective non-acoustic factors and external drivers unrelated to noise and, therefore, over-estimate the magnitude of impact.

A detailed social survey correlated to noise levels would be best as it would allow non-acoustic factors and personal and methodological biases to be identified and allowed for when establishing a dose response. However, such a study is not available. Therefore, notwithstanding the limitations discussed earlier, here is a case study examining complaint numbers against A- and C-weighted noise levels measured at locations representative of the nearest i.e. worst affected, residential areas to an event. This approach is consistent with the study that underpins the note on low-frequency noise in the current code of practice.

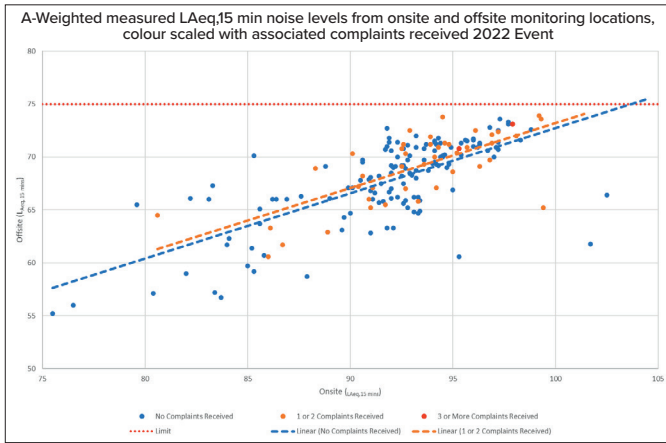
Case study

The figures (2, 3, 4 and 5) show the free-field A- and C-weighted MNLs measured at the nearest sensitive receptor off-site against the equivalent MNLs measured at the front of house (FOH) mixer location for the main stage onsite. The plotted graph is then coloured to highlight an instance where complaints were reported in that measurement interval (15 minutes). A trend line has been applied to instances where complaints were received and where there were no complaints. The data is from an event held between mid-day and 2300 hrs with multiple stages and a capacity of 40,000 persons, held in a major UK city over two consecutive three-day weekends in 2022 and 2023 i.e. six days each year with 12 days in total over the two years. The event has an overall A-weighted limit of 75 dBA $L_{eq,15\text{ min}}$ and a limit in the 63 Hz and 125 Hz 1/1 Octave bands of 75 dB at 2km from the venue. As a more practical means of managing low-frequency

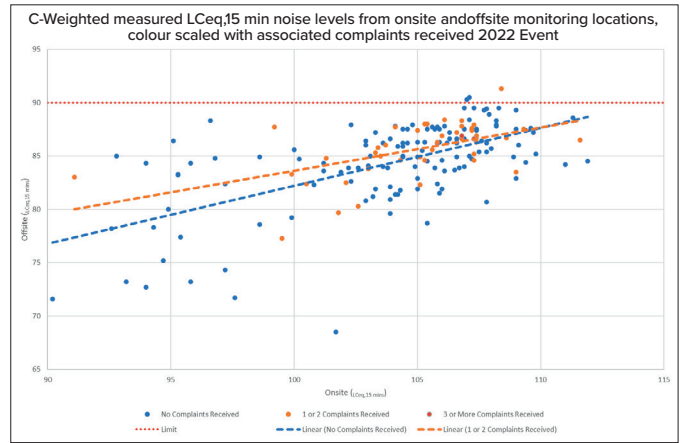
References

⁹ Research into attitudes to environmental noise from concerts, DEFRA report NANR 292 Final, 2011

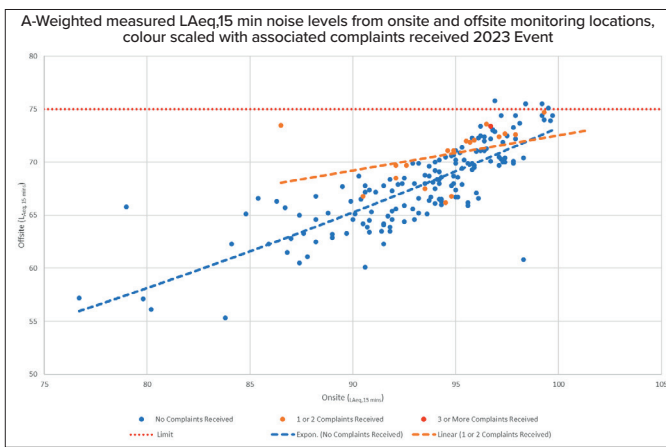
¹⁰ <https://www.cieh.org/news/press-releases/2021/cieh-releases-latest-noise-complaints-statistics-for-england/> Last viewed 1st October 2024



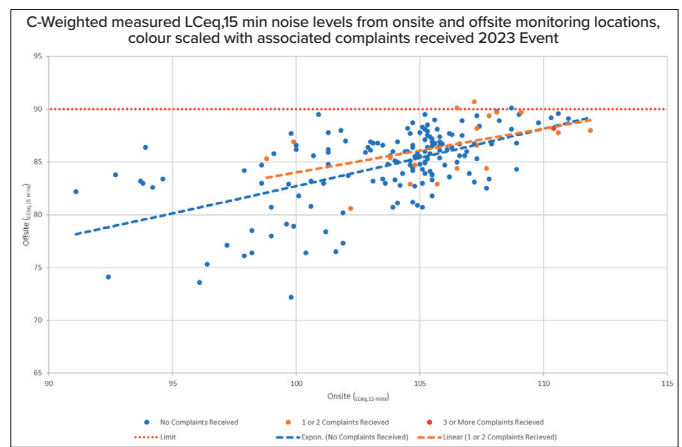
Above: Figure 2: A-weighted off site levels vs number of complaints for a music festival held in a major UK city over two consecutive three-day weekends in 2022



Above: Figure 3: C-weighted off site levels vs number of complaints for a music festival held in a major UK city over two consecutive three-day weekends in 2022



Above: Figure 4: A-weighted off site levels vs number of complaints for a music festival held in a major UK city over two consecutive three-day day weekends in 2023



Above: Figure 5: C-weighted off site levels vs number of complaints for a music festival held in a major UK city over two consecutive three-day day weekends in 2023

Date	No of times 90 dBC Leq, 15 min was Exceeded Between 12:00 to 22:30 hrs ¹	Average LCeq, 15 min During Headline Act	Number of Complaints
Day 1 Week 1	16	94	13
Day 2 Week 1	12	88	4
Day 3 Week 1	3	87	2
Day 1 Week 2	11	90	4
Day 2 Week 2	18	92	16
Day 3 Week 2	6	89	1

impacts Vanguardia have used an informal guideline of 90 dBC $L_{eq,15\text{ min}}$ at the nearest receptors approximately 50 metres from the park perimeter.

Whilst care has been taken to align MNLs with the noise complaints, not all complaints were received in the 15-minute interval they have been aligned to in the case study. There are inherent time delays at a live event with the handling of complaints and, in some cases, the complaint might relate to experiences earlier in the day. However, the uncertainty associated with this is not considered to unduly undermine the recorded data.

Above:
Note 1: Equivalent MNLs were below the licence limit of 75 dB in the 63 Hz and 125 Hz 1/1 Octave bands at 2km from the event

Data has been omitted where the FOH level at the mixer was below 75dB(A) or 90dB(C), and no complaints were associated with any of the omitted data points.

The data points in the figures below reflect periods as follows:

- no complaints were made (blue);
- one or two complaints were made (orange); and
- three or more complaints arose (red).

Table 2 (above) shows data from the 2024 series of events for C-weighted MNLs at the nearest receptors and the corresponding number of complaints.

Discussion

The figures above show that, as is often found in noise dose response studies and as indicated by the Defra-sponsored study⁸, the response of individuals to concert noise is highly variable from person to person. Consequently, complaints about noise from outdoor concerts and music festivals arise over a wide range of MNLs.

However, there is a trend in the data for a slight increase in complaints where the MNLs off site are in the range 85 to 90 dBC and a marked increase in complaint numbers when MNLs go over 90 dBC. Because complaints are a weak indicator of community impact and there is a rapid increase in complaints at MNLs above 90 dBC, using the higher end of the range i.e. 90 dBC $L_{eq,15\text{ min}}$ as an MNL control threshold is considered to better reflect typical community response to the noise rather than a lower value that is likely to be more representative of the subjective reaction of individuals influenced by personal and non-acoustic factors. P64

Furthermore, as indicated by comparison of the A- and C-weighted data in the figures above, Vanguardia have also found that managing music noise levels so that the difference between the simultaneously measured A-weighted and C-weighted levels at receptors is no more than around 20 decibels is also an effective way of controlling the impact of bass and sub-bass noise, subject to a lower limit of around 65 dBC and an upper limit of 90 dBC.

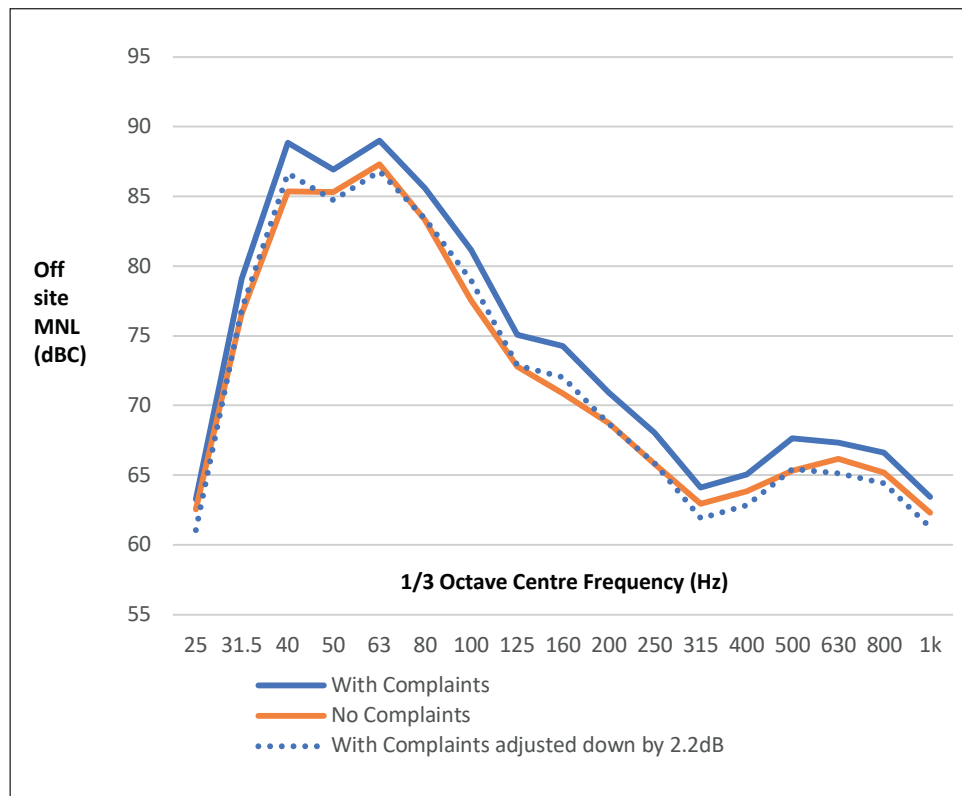
Conclusions

Low-frequency music sound i.e. bass and sub-bass has been a vital component of modern music for many decades and is featured to a greater or lesser extent depending on the type and genre of music. As a result, removing or over-managing the low-frequency content of music renders it ineffective as entertainment, thereby eroding the social and cultural value of an event.

Although the attenuation due to geometric spreading over distance is the same at all frequencies, low-frequency sound is attenuated to a lesser extent by barriers, terrain, ground effects, air absorption and structures compared to mid- and high-frequency sound. Consequently, low-frequency sound can travel further from the source and more readily penetrate buildings than other components of music at mid- to high-frequencies.

Although A-weighted measurements include the low-frequency content of music, a better means of allowing effective entertainment but providing a cap on bass and sub-bass noise for those affected off-site is to use the C-weighted decibel, which is more sensitive to low-frequency noise.

Consequently, it is recommended that as well as an A-weighted limit an additional C-weighted limit based on the A-weighted limit plus 20 dB, subject to a lower limit of around 65 dBC and an upper limit of 90 dBC, is applied under free-field conditions at noise sensitive premises beyond the site boundary. As this avoids significant adverse effects from low-frequency noise from outdoor concerts in most circumstances and reasonably practicably mitigates and minimises adverse effects in the context of outdoor music events that typically only occur occasionally throughout the year.



Above: Figure 6: Concentration of energy in the very low sub-bass 1/3 octaves – effect of adjusting specific frequencies (taken from events in 2024 at the venue used in the case study discussed earlier in this article)

The above proposals have been evaluated at multiple events over the last 10 years and found to be successful.

Limitations

The above conclusions are subject to the following limitations:

- At MNL levels above 85 dBC concentration of energy in the 31.5 Hz and 40 Hz 1/3 octave bands, i.e. peak or near peak levels in these frequency bands, can result in a greater risk of secondary effects of low-frequency noise-induced resonance in lightweight building elements such as windows and doors which can rattle or shake. Damage is highly unlikely as the induced vibration levels are below guidelines for such effects, but the subjective adverse response can be significantly increased. This can be mitigated by managing levels in these 1/3 octaves as shown in the figure above.
- As distance and/or screening from an event increases the non-geometric spreading, based

attenuation of sound at low-frequencies tends to be less than for mid- to high-frequencies. This can lead to the differential between A- and C-weighting becoming more than 20 dB. On the face of it this indicates a low-frequency problem, but in practice this normally occurs when the A- and C-weighted levels are low due to distance and/or screening and given the limited duration and occurrence of these types of events, the resulting impacts are typically minor. Furthermore, when this happens it is common that both the A- and C-weighted levels are approximately equally controlled by the low-frequency content of the sound and are therefore highly correlated so that even if the low-frequency content is reduced, the A- and C-weighted levels change by the same degree and the difference between them stays constant. Subsequently, a lower limit of 65 dBC to the application of the A-C differential of 20 dB is recommended. 🕒

Measurement and Instrumentation Group Acoustics 2024 report

By Simon Bull, Measurement and Instrumentation Group Chair

At Acoustics 2024, the IOA Measurement and Instrumentation Group Session on Friday 13 September comprised a packed morning of six papers.

Katherine Theobald of Kings College London gave a lively presentation on their study into the effects of drone vibration on medical supplies. The NHS is considering the use of drones to combat the problems of medicines not being where they need to be in a timely manner, such as snake anti-venoms, which have a short shelf life and though rarely needed, tend to be geographically widespread. Some blood plasma products and expensive cancer treatments also apply.

Despite thorough testing based on recreation of actual drone vibration in the lab, the team found it almost impossible to 'break' any of the medicines they were looking at. Katherine said that there needs to be more testing, as drugs companies must be sure of the outcome, but the initial results are very promising and could save the NHS huge sums of money whilst improving the timescales for some treatments.

Noise mitigation

In his presentation, Giles Parker of Sound Barrier Solutions, set out the most common mistakes people can make when specifying and designing sound barriers, such as specifications solely based on the surface density of a product, the lack of consideration of the sustainability of materials and the issues around wind resistance. He provided a thorough insight into an area of noise mitigation that is often misunderstood and sometimes treated as a bit of a hot potato!

Low frequency transmission performance of walls and barriers

Toby Charity and a team from the University of Salford looked at an indirect method for assessing the low frequency transmission performance of walls and barriers, using a modified paintball gun and an impact hammer. The issue they were trying to overcome was that of the variability found when measuring low frequencies in room-to-room transmission due to room modes and flanking. The technical level of the presentation makes it one to read if you are interested as the results showed much promise even through the testing was rather time-consuming compared with traditional methodologies.

Impulsiveness in environmental noise

Within measurement and instrumentation, there are a few slightly contentious issues and the identification of impulsiveness in environmental noise is one of them. Doug

Manvell, of DMdB, in association with Hottinger Brüel and Kjær, led a study on the effect of differing sample rates on the resulting identification of sounds as having an impulsive nature. After collecting 292 sample sounds containing impulses and testing them with varying sample rates using short Leq's and LAF metrics, the results were somewhat inconclusive. Doug and his team need more sample data to continue this study, and he asked delegates to send any data they have to him.

Sewer rats

The UK's network of water and sewage pipes is vast, and inspection is still a largely manual task requiring humans to review hours of video footage taken from robots controlled from the surface that are sent through the pipes. Yicheng Yu and colleagues from the University of Sheffield have developed an autonomous robot that uses beamforming to identify blockages, connections and potential defects in the outer wall of sewage pipes. The little rover sends out a 'chirp' that is reflected and captured by six microphones, which can determine the spatial profile within the pipe. A further longitudinal ultrasonic sensor allows further details to be determined. This technology has the potential to radically change the way in which pipework inspection is performed around the world.

Air source heat pumps

Max Radivan, has led a project at the University of Salford to compare various methods of assessment of the sound impact of air source heat pumps (ASHPs). The current guidance involves the use of a single value A-weighted sound power level at an assumed point source. The team used this method alongside a BS EN ISO 3746 – 2010 third octave band assessment and compared those to a modern MEMS particle sensor, which could create a 3D image of the particle velocities along with their direction. The results showed a clear advantage to being able to create a 3D model, although the specific technology did not perform very well at low frequencies.

AGM

The M&I Group AGM comprised a report from the Chair, John Shelton, on the work of the group through the previous year. The meeting then turned to committee membership, where four people were re-elected and the role of chair was handed over to Simon Bull of Castle Group Ltd. The whole AGM was completed in nine minutes and 16 seconds! 🎯

Irish Branch

By *Damian Brosnan*

The Irish Branch was treated to an excellent online presentation *Summary of revisions to ISO 9613-2:2024*, by Douglas Manvell of DMdB Sound Advice in November. 66 attendees tuned in.

Doug has 30 years' experience with environmental noise modelling software and was involved with the ISO working group responsible for the latest version of ISO 9613-2, released in early 2024. He has been working with commercial modelling software suppliers as they upgrade their packages to reflect the changes.

Doug summarised the main changes in the standard, starting with the treatment of line sources such as roads, railways and pipelines. In contrast with the 1996 version which left it to the user's discretion, the 2024 version now includes specified angular/distance factors. Smaller divisions result in increased accuracy and Doug showed delegates some model outputs onscreen. Interestingly, Doug said that the revised version results in shorter software calculation times.

The revised standard also provides for inclusion of higher orders of reflection, which is useful for canyon-like situations. The 2024 version additionally improves accuracy in the calculation of ground effect and screening attenuation in certain situations. For instance, an A_{gr} correction is now included for small distances/heights, and includes a modified formula for the calculation of mean height. Doug demonstrated a model relating to various source and receiver heights and distances modelled using the 1996 and 2024 versions. Discrepancies were clearly evident in certain

situations with differences reaching 3 dB in relation to short separation distance at tall heights over hard ground.

The informative wind turbine annex includes new additions designed to improve turbine modelling accuracy. The additions are similar in some cases to those recommended by the IOA Good practice guide, although not always identical. For instance, barrier attenuation of up to 3 dB is now allowed, in contrast to the GPG's 2 dB. While a correction for concave ground is included, the correction is subject to slightly different conditions. The annex also specifies turbine-specific meteorological corrections.

Additional informative annexes relate to stack directivity and $A_{foliage}$. These provide for greater accuracy, although the user has the option of sticking with the methodology set out in the main body of the standard.

Many software suppliers have already updated their programmes to include the 2024 changes. However, some are waiting for test cases to be defined for the ISO/TR 17534-3 quality assurance process. Until the test cases are defined and the assurance process begins, software users should be aware that the 2024 algorithms applied in the various prediction programmes merely reflect their interpretation of the standard by the various suppliers. We won't know how accurate these interpretations are until the assurance process finally gets underway.

The talk was followed by a short Q&A session, which revealed that members are particularly interested in the revised standard and its implications for their assessments.

London Branch

By *Jack Tunstall and Hilson Moran*



Current London Branch Committee from left to right: Luis Gomez-Agustina (LSBU), Vicky Wills (AtkinsRéalis), Jack Tunstall (Hilson Moran), Roslyn Andrews (Branch Chair / AECOM), Nigel Burton (Temple Group), John Sails (Sandy Brown), Ben Southgate (Branch Secretary / Sandy Brown) and Tony Garton. Not in photo: Haydar Aygun (LSBU)

The London Branch hosted its IOA 50th anniversary celebrations on Wednesday, 6 November, at the Slug & Lettuce in Aldgate.

The event began with a panel discussion chaired by the current London Branch Chair, Roslyn Andrews. The panel featured prominent individuals who have significantly contributed to the history

of the Branch and the Institute over the past five decades. Panellists included Steven Turner, Bridget Shields, Jim Griffiths, Tony Garton and David Trevor-Jones, who shared their personal experiences and reflections on their work in the field.

Many of the panellists have been longstanding members of the London Branch Committee. Steven Turner and

Jim Griffiths have served as Chairs, while Tony Garton has served as Secretary and continues to be an active committee member. Both Bridget Shields and Steven Turner have also made notable contributions to the IOA, having served as Presidents from 2012–2014 and 2020–2022, respectively.

The panel provided insights into the Branch's history, recounting that before the London Branch was formally established, the IOA held evening meetings in London. These were organised by the now-defunct Greater London Council (GLC) Scientific Branch, with Steven Turner, Paul Freeborn, and John Simson as key coordinators. The first meeting was held on 20 January 1977 at County Hall, attended by 40 people. While there were early discussions about forming a London Branch, these were initially rejected in favour of continuing the evening meetings. However, with

the abolition of the GLC, these meetings were suspended, leading to the formal constitution of the London Branch in 1987.

After the panel discussion, attendees enjoyed a lively and interactive quiz on the history of the Branch, which became highly competitive. Many of the questions drew from the panel discussion, testing how closely the audience had been listening. Some of the questions included:

- *The first evening meeting recorded was on 20th January 1977, with 40 people attending. What was the topic of the meeting?* The correct answer was 'Should night flights be banned or restricted?' which split the vote among participants.
- *What was the topic of the first meeting held by the newly constituted London Branch?* This question stumped everyone, but the correct

answer was 'Acoustic consultancy: Aural craftsmanship with scientific pretension' by Jeff Charles, for which he had been awarded the 1986 Tyndall Medal.

In addition to Branch-specific questions, a bonus general knowledge round included these:

What is the maximum A-weighted sound power level (L_{WA}) for household wheelie bins mandated by a European directive? The answer was 89 dB(A) L_{WA}.

What is the world record for the longest reverberation time (RT60) in seconds?

The correct answer was 75 seconds, recorded by Professor Trevor Cox in Scotland in 2014, based on the ISO definition of reverberation time.

Congratulations to Rob, the winner of the quiz!

The evening concluded with participants sharing their best and worst moments while working in acoustics over the past 50 years. Highlights included:

- firing a starting pistol inside the Methodist Church in London;
- learning to predict when bees are about to swarm;
- being asked by a builder (for the 50th time!) if they were a DJ;
- conducting train noise measurements at -30°F; and
- sound testing a 75-storey building with no lift.

The committee would like to thank the panellists for their fascinating insights and all those who attended for making the evening memorable. For those unable to join us, we look forward to seeing you at future events.

Midlands Branch

By Matt Torjussen

The Midlands Branch held a hybrid meeting at the University of Derby's Markeaton Campus on 20 November 2024, featuring presentations from recent IOA Diploma graduates.

Dorothy Poulter, an Environmental Health Officer at Peterborough City Council, presented her fascinating study on the impact of driving styles on vehicle-related noise from speed cushions. Her research addressed a gap in understanding how different vehicle types and driving behaviours affect noise characteristics near traffic calming measures. The study combined controlled pass-by measurements using a car and van, analysing how wheel placement (even vs. uneven) affected noise levels. Interestingly, while cars showed no increase in measured sound levels during uneven passes, vans demonstrated a slight increase, accompanied by a noticeable 'booming' sound from empty loading bays. The research highlighted that current guidance relies heavily on 1990s data, potentially not reflecting modern vehicle fleet characteristics, including the increasing prevalence of delivery vehicles and modified cars.

Daniel Butterworth explored variations in background sound levels (L_{A90}) and contextual elements within BS 4142 assessments. His research examined how measurement duration affects L_{A90} results, comparing 15-minute, one-hour and four-hour measurements across rural, suburban and

industrial locations. The study revealed that while shorter measurement periods showed greater spread in results, one-hour and 15-minute measurements often pointed toward similar representative values. A key finding was the inconsistent treatment of context in BS 4142 reports, despite its importance in the standard.

Kim Meadows presented an intriguing study examining noise exposure levels for caregivers of young children in domestic environments. Using workplace noise assessment methodology, she conducted a five-day study measuring noise levels during typical daily activities with her two pre-school age children. Surprisingly, the results showed daily personal noise exposure exceeding the lower action value of the Control of Noise at Work Regulations on one day, with peak values exceeding upper action values during particularly energetic play activities. The study highlighted that while traditional noise control measures might not be applicable in this context, awareness of exposure levels could help caregivers manage potentially harmful noise exposure.

The Midlands Branch extends its thanks to all three for their excellent presentations, and to the University of Derby for hosting the event. Members with ideas for future branch meetings or who would like to present their own work are encouraged to contact the Branch committee – fresh perspectives and topics are always welcome.

P68

- Acoustic, Fire, Structural and Physical test laboratory
- Site acoustic pre-completion testing

The Building Test Centre
Fire Acoustics Structures

T: 0115 945 1564

www.btconline.co.uk
btc.testing@saint-gobain.com

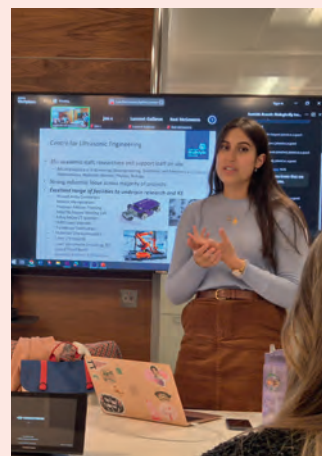


Scottish Branch

By Lily Nikolova, WSP

WSP hosted the November 2024 Scottish Branch hybrid meeting in their Glasgow office, which saw over 25 attendees joining in-person and online. Dr Lara Diaz Garcia, a research associate at the Strathclyde University Centre for Ultrasonic Engineering, gave delegates a glimpse into the whimsical world of bioacoustics engineering where her team studies nature's way of enabling the precise detection of discrete frequencies, directivity and weak signals, and applies it to the development of new

cutting-edge systems. A notable successful example of applying this included the development of acoustic sensors inspired by a nocturnal moth's monaural directional hearing, and their verification using a 3D model of the moth's ear structure, micro-CT scans of its properties and other advanced techniques. We would encourage anyone who missed the presentation to catch up on it via the recording on the IOA's portal. Thank you to Emily Tilbury of Metrica for organising the event.



Above: Dr Lara Diaz Garcia at the IOA Scottish Branch November meeting

Welsh Branch

The Welsh Branch of the IOA celebrated its 50th anniversary at the iconic Principality Stadium in Cardiff last September. The event took place in a premium room offering a stunning view of the pitch. Attendees noted the irony of needing to 'test' the acoustic qualities of the large glazed doors, keeping them shut due to the noise from seats being pressure-washed in preparation for an upcoming event.

This milestone event provided an excellent opportunity for networking among colleagues from consultancies, regulatory bodies, a representative from the Welsh Government, and Mark Elliott, the newly appointed President of the Chartered Institute of Environmental Health. It also marked the first gathering hosted by the new Welsh Branch Chair, Tomos Jenkins, an independent acoustic consultant and Environmental Health Officer, who took over from Rosie Pitt in early 2024. Thanks are expressed to Rosie for her contributions as the previous chair, and we wish her well in the future.

Tomos formally introduced himself, expressed gratitude for the warm welcome into his new role and shared his mission to grow the network in Wales by hosting in-person and online events. Through his existing and expanding network, Tomos plans to engage more regulators to become IOA members and attend events, highlighting the value of collaboration between consultants and the regulators within the acoustic sector.

Presentations

- **Nick Jenkins and Matthew Bevington, Natural Resource Wales (NRW):** (*Noise and the Permitting Requirements*)

Nick and Matthew discussed the expectations for acoustic reports when seeking environmental permits for both installations and waste sites. The presentation emphasised NRW's roles as a regulator and advisor, focusing on the benefits of early engagement in achieving successful outcomes. Key topics included BS4142:2014 + A1:2019 and the Method Implementation Document, along with common issues encountered. Attendees appreciated the tailored content and exchanged contact details for future collaboration.

Nick said: "We are grateful to the IOA and Tomos for giving us an opportunity to discuss and remind members of our permitting process and explain why we ask some of the questions we do. We deal with some very experienced noise consultants who know their subject extremely well, but we ask that where assumptions are made in a noise impact assessment, that they are robust and satisfactorily justified."



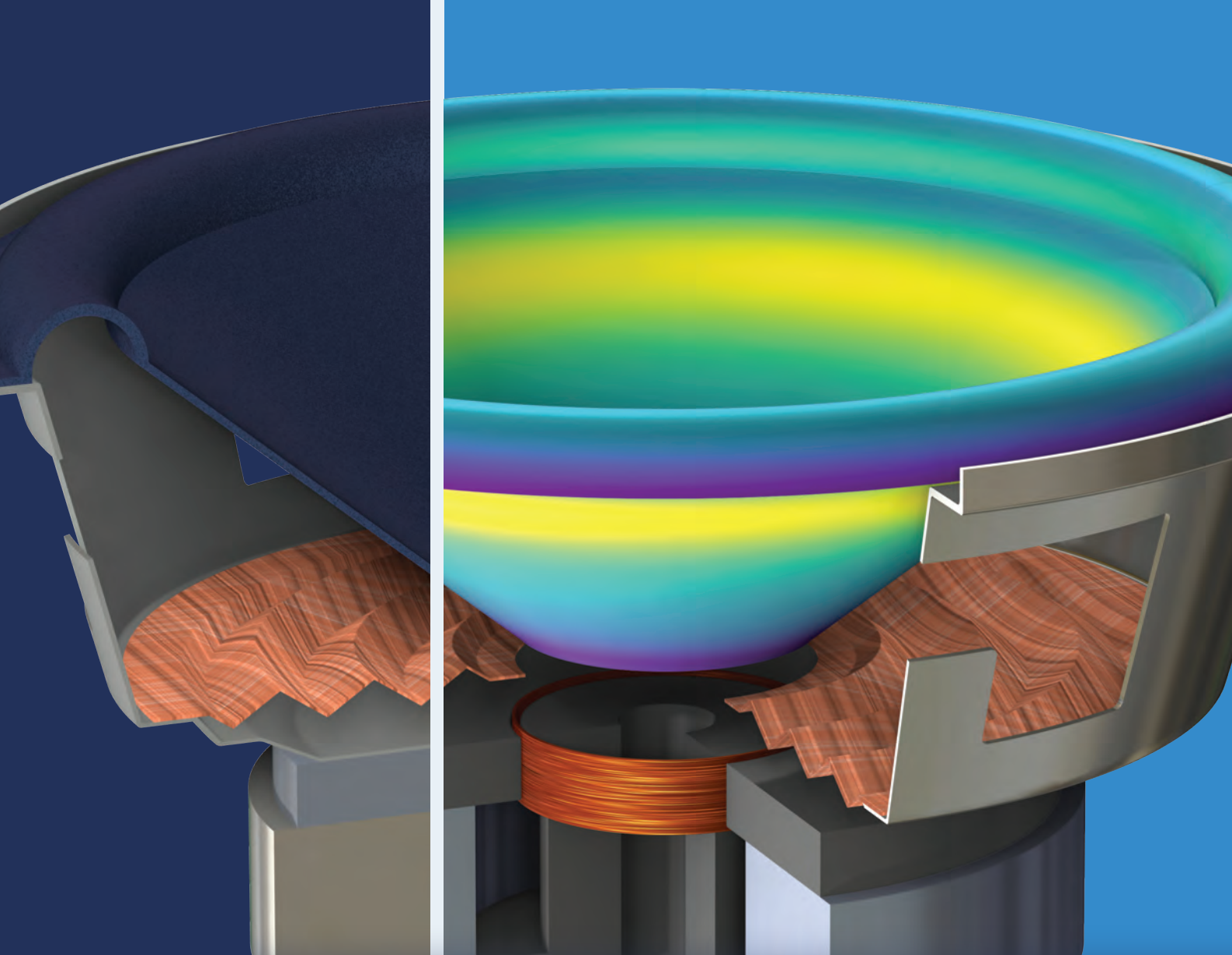
Welsh Branch members celebrating the IOA 50th anniversary at the Principality Stadium in Cardiff last September

- **Tomos Jenkins, Acoustic and Environmental Health Consultant:** (*Ensuring Compliance at Live Events*)

Tomos provided insights into the current state of the live events industry, noting that attendance numbers have returned to pre-pandemic levels. He discussed the rise of electronic music at outdoor events, its implications for low-frequency content, and best practices for compliance. Tomos highlighted relevant case law that regulators rely on regarding license applications and statutory nuisance investigations, drawing from his decade of experience as a noise regulator and his recent role as an independent consultant specialising in live events. He also mentioned an upcoming consultation on a new Good Practice Guide for Noise Control at Outdoor Concerts and Similar Events, published by the IOA and CIEH.

The event concluded with a tour of the Principality Stadium, showcasing its acoustic significance during live performances and international rugby matches since its opening in 2000. Attendees explored the royal seats, players' changing area, and press room, learning about the unique demands of touring artists, including the request for a 'room in a room' dressing area. The group and tour guide discussed the players' preferences regarding roof open/closure on match days, considering how it enhances the home crowd's cheer.

The 50th anniversary event was not only a celebration of the profession but also a valuable opportunity for knowledge exchange and networking within the community, reflecting the growth and ambition of the Welsh Branch. Mark Elliott, CIEH President, said: "It was a great pleasure to attend the 50th Anniversary of the Welsh Branch of the Institute of Acoustics. The IOA and CIEH have a long history of partnership working and the importance of the understanding of the interaction of sound in the environment and the human state never been so acute. Together, we can create an improved environmental and public health future for the communities we assist." 🎯



Take the Lead in Acoustics

with COMSOL Multiphysics®

Multiphysics simulation drives acoustics innovation by providing insight into every design aspect that influences product performance. The ability to account for coupled physics phenomena lets you predict, optimise and virtually test a design under real-world conditions – even before a first prototype is built.

» comsol.com/feature/acoustics-innovation

Institute Sponsor Members

Council of the Institute of Acoustics is pleased to acknowledge the valuable support of these organisations

Founding Key Sponsors



Acrefine Engineering Services Ltd	Couch Perry Wilkes Acoustics	L-Acoustics	Siderise Group
Aecom Infrastructure & Environment UK Ltd	dB Attenuation Ltd	Mason UK Ltd	SITMA
AMC Mecanocaucho	dB Consultation Ltd	National Physical Laboratory	Sound Reduction Systems Ltd
ANV Measurement Systems	Direct Acoustic Solutions Ltd	Noise Solutions Ltd	Spectrum Acoustic Consultants
Apex Acoustics	Echo Barrier Ltd	noise.co.uk Ltd	Stantec UK Ltd
Arup Acoustics	Emtec Products Ltd	Nova Acoustics Ltd	WSP UK Ltd
Bickerdike Allen Partners	Farrat Isolevel Ltd	Pliteq	Zenita Ceiling & Grid Solutions Ltd
Cahill Design Consultants Ltd	GERB Schwingungsisolierungen GmbH	Quantum Acoustics	
Campbell Associates	Getzner UK Ltd	RBA Acoustics	Applications for Sponsor Membership of the Institute should be sent to Membership at the Milton Keynes office. Details can be found on the IOA website.
Collecta Ltd	Gracey & Associates	Rockfon	Members are reminded that ONLY Sponsor Members are entitled to use the Sponsor IOA logo in their publications, whether paper or electronic (including web pages).
Christie & Grey Ltd	Hann Tucker Assoc	RSK Acoustics Ltd	
Clement Acoustics Ltd	Hayes McKenzie Partnership Ltd	Saint-Gobain Construction Product UK	
CDM Stravitec	Hilson Moran Partnership Ltd	t/a Saint-Gobain Ecophon	
CMS Danskin Acoustics	ISOMASS Ltd	Sandy Brown Ltd	
	KP Acoustics Ltd	Sharps Redmore Partnership Ltd	

Committee meetings 2025

DAY	DATE	TIME	MEETING
Tuesday	28 January	10.30	Membership
Tuesday	4 February	All day	Engineering Interviews
Thursday	6 February	11.00	Publications
Tuesday	18 February	10.30	Engineering Meeting
Thursday	20 February	10.30	Diploma Tutors and Examiners
Thursday	20 February	13.30	Education
Tuesday	25 February	10.30	Meetings
Tuesday	4 March	10.30	Diploma Examiners (London)
Thursday	6 March	10.30	Executive
Thursday	13 March	10.30	Council
Tuesday	1 April	10.30	CCWPNA Examiners
Tuesday	1 April	13.30	CCWPNA Committee
Thursday	10 April	10.30	Membership
Thursday	24 April	10.30	Meetings
Thursday	1 May	11.00	Publications
Thursday	8 May	10.30	CCHAV Examiners
Thursday	8 May	13.30	CCHAV Committee
Tuesday	13 May	11.00	CPD Committee
Wednesday	14 May	10.30	Research Co-ordination
Thursday	22 May	10.30	Executive
Tuesday	3 June	All Day	Engineering Interviews
Thursday	5 June	10.30	Council
Thursday	12 June	10.30	Engineering Meeting
Tuesday	17 June	10.30	ASBA (Edinburgh)
Tuesday	8 July	10.30	Distance Learning Tutors WG
Tuesday	8 July	13.30	Education
Wednesday	9 July	09.30	CCBAM
Wednesday	9 July	10.30	CCENM Examiners
Wednesday	9 July	13.30	CCENM Committee
Tuesday	15 July	10.30	Membership Meeting
Thursday	17 July	10.30	Meetings

Institute Council

Honorary Officers

President

Professor David Waddington MIOA
University of Salford

President Elect

Paul Shields FIOA
University of Derby

Immediate Past President

Alistair Somerville HonFIOA

Hon Secretary

Fiona Rogerson MIOA
Arup Acoustics

Hon Treasurer

Dan Saunders MIOA
Clarke Saunders Associates

Vice President Engineering

Mark Scaife MIOA
Cahill Design Consultants Ltd

Vice President Groups and Branches

Hilary Notley FIOA
Defra

Vice President International

Jo Webb HonFIOA
Salford University

Ordinary Members

Dr Chris Barlow FIOA
KP Acoustics

Daniel Goodhand MIOA
Goodhand Acoustics

Angela Lamacraft FIOA
Sustainable Acoustics

Dr Yoyou Lui FIOA
AECOM

James McIntyre FIOA
Scottish Environment Protection Agency (SEPA)

Reena Mahtani FIOA
Stantec

Richard Perkins HonFIOA
Mott MacDonald

Peter Rogers FIOA
Sustainable Acoustics

Matt Torjussen MIOA
ANV Measurements Systems

Chief Executive

Allan Chesney
Institute of Acoustics



Gracey & Associates

Setting Hire Standards ✓

We have been hiring sound and vibration measuring equipment to UK industry and businesses for almost 50 years.

We believe we enjoy a reputation for great service and we always strive to put our customers' needs first.

We stock an extensive range of equipment from manufacturers like: Bruel & Kjaer, Norsonic, Svantek, NTi, Vibrock, Davis, Casella and Larson Davis.

Our web-site offers a great deal of information, and our team are just one phone call away from helping you with your hire needs.

We look forward to hearing from you.

Contact us on 01234 708835 : hire@gracey.co.uk : www.gracey.co.uk

XL3

ACOUSTIC ANALYZER

Building Acoustic
Measurements made simply
and with confidence



NTi Audio UK
Stevenage, Hertfordshire, UK
Ph +44 1438 870 632 uk@nti-audio.com
www.nti-audio.com



The One Stop Shop

For Noise & Vibration Instrumentation



Building Acoustics
Environmental Noise
Groundborne Vibration
Sound Power and Intensity
Laboratory Systems
Remote Monitoring
Ultrasound



- Sound Level Meters
- Vibration Meters
- Multi-Channel Systems
- Remote Access
- Microphones and Accelerometers
- Noise Sources



Sale of Rion and Norsonic hardware and software
Hire of Rion and Norsonic hardware and software
Calibration of all major brands of sound and vibration instrumentation