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Cover image: The Auditorium Acoustics Conference 2025 in Bristol was a runaway success and exceeded expectations on many levels. There were three main themes; the refurbishment of existing concert halls, stage acoustics and active acoustics. More than 160 delegates from around the world attended giving it a truly international flavour.
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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.

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

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Dear members

As we approach the end of 2025, I'm pleased to share thoughts on a new report that puts acoustics right where it belongs – at the centre of the UK's future. The Sound Economics 2 (SE2) report is more than a celebration of our achievements. It's a clear message: acoustics matters, and we must make sure everyone knows it.

What is Sound Economics 2?

Published in September and launched at an event in early October, SE2 follows up a similar report published in 2019 and provides a detailed study on the UK acoustics industry. It shows how our work supports the economy, improves lives and helps solve national challenges. If you haven't read the first report from 2019, don't worry – SE2 stands on its own and gives a fresh, wide-angle view of our profession. (See page 25).

Headline findings

The numbers are impressive. The UK acoustics industry now contributes **£5.2 billion** each year, employs **20,000 people**, and adds **£95,000 per person** to the economy – over 30% more than the UK manufacturing average. Our research base is strong too, with **£230 million** in active grants across **70 universities**. And let's not forget: noise pollution remains one of the UK's **biggest environmental health risks**. Acoustics is not just useful – it's essential for health and wellbeing.

What the report misses

SE2 is a significant step forward, but it doesn't tell the full story. The report focuses mainly on manufacturing and design, particularly within the defence sector and does not fully reflect the contributions of **consultancy**, **architecture**, **building and planning design**, **music and entertainment**, and **environmental acoustics** – areas where many IOA members are actively engaged.
It also does not address **workforce diversity** or **regional variations in pay**. And because acoustics still lacks its own official **Standard Industrial Classification (SIC) code** – we are often grouped under 'Environmental Consultancy Activities' – national statistics cannot accurately track or represent our industry.

How SE2 Builds on SE1

The first Sound Economics report (SE1) gave us a valuable starting point: it estimated **£4.6 billion in revenue** and **16,000 employees** across the UK acoustics sector. SE2 shows how far we've come, with improved data, broader coverage and a stronger connection to national priorities such as **defence**, **healthcare**, **artificial intelligence** and **clean energy**. In short, SE2 provides the evidence we need to speak with confidence – and be heard.



Why this matters to us

SE2 confirms what many of us already know: acoustics is everywhere. From **quiet submarines** and **ultrasound scans** to **smart insulation** and **voice recognition**, our work touches almost every part of daily life. Yet, we remain a **'hidden' industry** – present in everything, but rarely acknowledged. That must change.
The report encourages us to **speak up**, **collaborate across sectors**, and ensure acoustics is considered **early in design and planning**, not as an afterthought. For IOA members, this means **sharing our expertise**, **mentoring the next generation**, and **helping shape the future of sound in society**. P06

What the IOA will do next

To turn SE2's findings into real progress, I propose that the IOA – working with **professional institutes, industrial partners, academia** and others – focus on three key areas:

1. Skills, careers and digital tools

We'll support training in **digital skills and AI**, and help young people discover careers in acoustics through our **STEM outreach work**. We will also lobby for acoustics to become a **mandatory part of training and qualifications** for professionals involved in acoustics design, advisory, and control – such as **architects**, **environmental health officers (EHOs)**, **regulatory professionals at the EA and SEPA** and **health and safety practitioners**.

Our new **Executive Director for Education and Digital Strategy** is leading exciting programmes that combine **online and in-person learning**. Our goal is to ensure that everyone working in acoustics – at any stage of their career – has access to meaningful opportunities for **learning and professional growth**.

2. Policy, standards and design

We'll work closely with **Government** and allied **professional bodies** – including the **ANC**, **IMechE**, **ICE**, **IET**, **IHT**, **AES**, **RIBA** and **RTP** – to ensure that **acoustics becomes a mandatory part of early design decisions in buildings**, transport and manufacturing. Early integration avoids costly changes later and leads to better outcomes for everyone.

We'll also work to **raise public awareness** of how acoustics affects **health**, **safety** and **quality of life**, helping people understand the value of sound in shaping the environments we live and work in.

3. Better data and stronger advocacy

We'll push for the creation of a **dedicated Standard Industrial Classification (SIC) code** so that acoustics can be properly tracked, supported and recognised in national statistics. We also plan to establish a **National Acoustics Observatory** – a central hub for **data**, **research** and **policy insight**. This will help us demonstrate the value of acoustics in **trade**, **defence** and **innovation** and ensure our voice is clearly heard in **national decision-making**.

Looking ahead to 2026

As we move into a new year, let's build on the momentum SE2 has given us. Let's be bold in promoting acoustics, generous in sharing our knowledge and united in our goals. This growing recognition supports our journey toward **Chartered Status**, which we expect to launch in early 2026 – a milestone for our profession.

On behalf of the IOA Council, thank you for your dedication, your shared expertise, and your passion. I wish you a peaceful, joyful festive season.

Warm regards,



David Waddington, IOA President



Right: Paul Shields, David Waddington, Peter Rogers, Stephen Turner and Alistair Somerville at the September 2025 SE2 launch

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Breaking barriers in acoustics education

IOA presents at the University of Oxford and continues to sharpen its education strategy.

By Mary-Jane Newton and Simone Graetzer



Above: Simone Graetzer at the AIEOU conference at the University of Oxford

The IOA recently took part in the inaugural convening of *AI in Education at Oxford University (AIEOU)*, held at the University of Oxford.

The event brought together educators, researchers and technologists to explore how artificial intelligence is reshaping teaching and learning across disciplines.

Acoustics: a multidisciplinary challenge

Our talk, *AI in Multidisciplinary Fields: Enhancing Acoustics Education*, opened by reflecting on the unique position of acoustics. The field sits at the intersection of science, engineering, perception and creativity. It shapes environmental soundscapes, underpins audio technology and musical performance, and plays a central role in hearing and health.

From aerodynamics and architectural acoustics to electroacoustics, underwater sound, vibration engineering and eco-acoustics, the subject spans an extraordinary range of applications. This diversity makes acoustics both intellectually rich and practically vital. But it also makes it challenging to teach: students face abstract physical principles, advanced mathematical models and technical language that can be daunting or inaccessible without the right support.

This is precisely where the IOA plays a vital role. As the UK's professional body for acoustics, we promote education, training and research for learners at all levels, from students to senior professionals. With acoustics touching so many fields and industries, the need for education that is **accessible, inclusive, equitable, open and focused on understanding** is especially pressing.

AIEOU and its core values

AIEOU is a cross-functional working group at the University of Oxford, aiming to promote a research-informed, ethical, human-centred approach to the use of artificial intelligence in education. Mary-Jane Newton has contributed to the group as research collaborator in the past year. The following five values formed the framework of the inaugural event:

Accessibility: removing sensory, language and cognitive barriers through AI-enabled captioning, translation and adaptive content. P10

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Inclusion: creating meaningful learning experiences with virtual labs, simulations and visualisations.

Equity: using adaptive learning systems to personalise teaching and support learners from underrepresented backgrounds.

Openness: sharing tools and datasets openly to encourage collaboration and innovation.

Understanding: using AI tutors and assistants to provide real-time feedback and tailored explanations.

One of the event organisers summed up the spirit of the meeting: *"AI will only be transformative for education if it lowers barriers, broadens participation and deepens understanding."*

IOA case studies

We presented four case studies that illustrate how AI is beginning to make acoustics education more engaging and inclusive:

Accessibility – lecture audio (Rodrigo Sanchez-Pizani, King's College London)

This is an open source AI application that improves recorded lecture audio for hybrid and flexible learning to support better audiovisual (AV) and acoustic design in learning spaces. Rodrigo Sanchez-Pizani has developed a system called RAfAEL or Real Audio for Analysis in Educational Lectures. He argues that recorded lecture quality *"is not a niche issue; it's a significant matter for universities. Its widespread use makes it a major generator of media and content."* RAfAEL uses an audio classification tool to identify speech. It has at its centre a deep neural network (DNN) model to estimate the clarity and intelligibility of recorded lecture audio to ensure quality, including a speech transmission index (STI) predictor. The model uses a multi-head architecture to predict perceptual features including clarity, definition and reverberation directly from raw audio. Rodrigo will be adding more components to this system including a noise evaluation module. He introduced his system at a recent IOA London Branch meeting.

Accessibility – digital sound level meters (Max Ellis, University of Salford)

Conventional sound level meters (SLMs) are essential tools for monitoring and gathering noise statistics but prohibitively expensive for students. Max Ellis from the University of Salford has been contributing to a framework for next-generation 'smart' SLMs. He argues that AI can provide easy-to-use additional SLM functionality; the proliferation of low-cost sensing technology and machine learning (ML) has created opportunities for students to engage with end-to-end AI-driven acoustical applications. According to the Cambridge English Dictionary, the term 'machine learning' refers to 'the process of computers improving their own ability to carry out tasks by analysing new data, without a human needing to give instructions in the form of a programme, or the study of creating and using computer systems that can do this'. Students can use low-cost Internet of Things (IoT) devices from Arduino, Raspberry Pi, or even NVIDIA, alongside open-source audio datasets such as Emo-Soundscapes to predict perceived annoyance ratings without the need for costly, time-consuming listening tests. Max says that: "*IoT devices are generally constrained by processing capacity and memory, limiting the complexity of deployable models. Ground-truth data for prediction of (perceived) Sound Quality Metrics requires subjective rating studies, which may not always be feasible within the timescale of a module. Future iterations could integrate cloud-based processing, industry collaborations and multi-sensor fusion approaches to enhance educational realism.*" By using low-cost IoT devices and lightweight AI models, students can now build their own digital sound measurement systems – an affordable way to engage with the fundamentals of acoustical engineering.

Inclusion – simulation and visualisation (James Hipperson, University of Salford)

Scientific or 'physics-informed' ML (SciML/PIML) is a new and rapidly developing area of research. Conventional ML architectures typically have an unconstrained parameter space, resulting in poor predictions or 'hallucinations', especially when the training data is deficient. SciML/PIML aims to combine techniques and principles from the physical sciences to avoid this. We can develop physics-informed ML models – or ML models that incorporate physical principles into the loss function or more fundamentally – to simulate and visualise acoustic phenomena for students. These tools give students without access to specialist labs a way to conduct virtual experiments, as well as learn about programming and the mathematics of acoustics and ML.

In his PhD research, James Hipperson from the University of Salford is exploring the intersection of ML and acoustics. He says that in developing his plane wave neural network (PWN), *"I deepened my understanding of the Fourier transform and Helmholtz equation, directly utilising the property that plane waves form a complete set of basic functions for single frequency wavefields."* Some early results will be published soon.

Openness – open-source materials (Clarity Project, Engineering and Physical Sciences Research Council)

The Clarity project (**https://claritychallenge.org/**) is an example of open-source course materials and specifically open-source ML frameworks and datasets for acoustical and audio engineering, speech technology and computer science courses. The project provides pyClarity – a Python package – tools, datasets and tutorials for speech signal processing and for evaluation and prediction of speech intelligibility for different hearing profiles, open-source versions of conventional speech intelligibility enhancement and prediction metrics and algorithms. Access to open-source educational resources is crucial to making education accessible, equitable, sustainable, transparent and collaborative, and speech technology is an exciting area of application. The project also provides a series of Python Jupyter notebooks on Google Colab to help students learn how to use the tools made available within this package. Support includes Git version control tutorials, differentiable tools ready to be incorporated into ML models, open-source versions of conventional metrics and P12

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> “By combining domain expertise in acoustics with ethical, human-centred use of AI, the IOA is aiming to build a future-ready skills pipeline.”

algorithms and large datasets of simulated and real audio recordings. These resources make it possible for learners worldwide to engage with cutting-edge speech and AI research.

The case studies were very well received and the organisers of the conference have already asked the IOA to attend next year.

Studying acoustics at the IOA

The examples above represent only a fraction of the innovative work taking place in acoustics education. For example, this year there are around 60 candidates enrolled with the IOA headquarters for the Diploma in Acoustics and Noise Control, delivered through the IOA and its partner institutions. Many of the candidates are outside of the UK, completing the course through distance learning. We are working hard to examine all modes of delivery options. These include aligning the IOA digital classroom, technological innovation and human-centred educational values so that we can build a future where every learner has the opportunity to learn in ways that match their individual needs.

In practice, this means creating an engaging online learning environment where students can communicate with tutors, collaborate with peers and apply their learning to real-world contexts. The online classroom should integrate seamlessly with our tutorials and hands-on learning in lab schools. Our approach is supported by a multi-year roadmap for improving online learning, which includes expanding multimedia resources, enhancing accessibility and embedding new digital tools to strengthen learner engagement. By pursuing this long-term vision, the IOA aims to ensure that the Diploma in Acoustics and Noise Control remains globally relevant, accessible and of the highest professional standard.

Looking forward

The IOA will continue to contribute to initiatives like AIEOU, ensuring that the next generation of acousticians is equipped not only with technical expertise but also with the creativity and inclusivity needed to meet the challenges of a fast-changing world.

Our education strategy consists of two strands, improving the range and standard of educational content and expanding internationally. Fundamental to our ability to deliver is quality and digital presence. The IOA is garnering increasing global interest, particularly from Asia and the Middle East. This reflects not only the demand for high-quality, flexible education in acoustics but also the UK’s longstanding leadership in the field. The acoustics industry contributes £5.2 billion to the UK economy annually, with productivity 30% above the manufacturing average (UK Acoustics: Sound Economics report, 2025[1]). This economic impact supports the case for investing in AI-enhanced education to meet growing demand for skilled professionals and to support the nation’s competitive edge. Aligning with national priorities in defence, clean energy and healthcare – sectors where acoustics plays a critical role – the IOA’s strategy supports the UK’s broader innovation and sustainability goals. From sonar and aerospace applications to noise control in urban environments and medical diagnostics, acoustics underpins many areas of active government investment. As the UK reviews its infrastructure for AI and science education, the IOA’s case studies and partnership with AIEOU represent a model for how specialist education can advance national objectives. By combining domain expertise in acoustics with ethical, human-centred use of AI, the IOA is aiming to build a future-ready skills pipeline.

The UK has been at the forefront of acoustics research, policy and professional standards for decades, with the IOA playing a pivotal role in shaping practice both nationally and internationally. Drawing on this heritage of excellence, we are well positioned to support learners worldwide who look to the UK as a benchmark for expertise and professional credibility in acoustics.

The next issue of Acoustics Bulletin will set out the strategy in full and report on the initiatives now taking shape!

1. https://www.ioa.org.uk/sites/default/files/UK-Acoustics-Sound-Economy-2025-report.pdf.

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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're now just over three quarters of the way through the year and we at the head office continue supporting members who are looking to become professionally registered. Our last set of interviews for this year was on 7 October, so look out for the profiles of any successful applicants in the next edition. We're currently working with a group of members and will share more updates on their progress when we can.

We're working closely with the Engineering Council following the review of our license to complete the minor amendments I mentioned last time. These changes won't directly impact the process you're working through, although there have been some wording changes in the code of conduct.

The example PRI report we send to every applicant is crucial as it helps prevent multiple submissions. Please don't compare the process with colleagues from other PEIs. Due to the unique nature of our position in acoustics, we do have some variations in the evidence requirements. This is mainly because there are so few Master's programmes in the sector, so we need to explore how your knowledge has been gained through a greater emphasis on the content of your PRR.

We'll review submissions and send them to volunteers for review, but only once we believe they're close to being the final draft. If you're asked to rework your submission, it's because we want to ensure that only applicants with a strong chance of success are put forward and we don't want to waste your time or the volunteers' time.



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

When drafting the report, consider the software you selected for modelling. Explain why you chose it, identify any shortfalls, outline your expected results and describe how you validated the outputs. These are all part of the A and B competencies and will help you avoid multiple rewrites.

Since the IOA doesn't offer accredited training programmes, all applicants must submit an initial professional development (IPD) report. This narrative explains your journey from a qualified acoustician to a practising engineer. We provide an example report with all applications, so review its contents and add your personal information.

Emma Lilliman ensures everyone receives interview dates that suit them. Due to limited resources, we strive for quick responses, but high candidate inquiries simultaneously can cause backlogs, especially during holidays. Please bear with us as we try to get comments back to you for re-drafting.

Neil Ferguson assists candidates without recognised qualifications with academic equivalence support. Check the Engineering Council website (**http://www.engc.org.uk/courses**) to verify if your qualifications meet the required specification. However, don't worry if your specific qualification isn't listed; we can still guide you through the process using individual assessment (discussed later).

We host various interview events throughout the year, based on the number of candidates registering and our next set are scheduled for early February 2026. If you're interested in taking the next step to becoming a professionally registered engineer, contact us at **acousticsengineering@ioa.org.uk**

Send a copy of your CV and copies of your qualifications, including certificates and transcripts, as we require all your further and higher education certificates, not just your highest attainment.

The 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).

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.

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 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.

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



Auditorium Acoustics – Bristol 2025

The Auditorium Acoustics Conference 2025 in Bristol was a runaway success and exceeded our expectations on many levels. There were three main themes; the refurbishment of existing concert halls, stage acoustics and active acoustics. More than 160 delegates from around the world attended giving it a truly international flavour.

By Raf Orlowski, Anne Minors and Evan Green

Above: The Avon Sonic Orchestra and Avalon Wind Quintet

Below: Bob Essert, outlining the acoustic design challenges of the Beacon Concert Hall

The focus of the conference was the newly refurbished Beacon Concert Hall whose acoustic design and challenges were described by Bob Essert. This was followed by presentations on other refurbished halls in Wolverhampton, Cornwall, De Bijloke (Gent) and Troy, New York – a surprising but uplifting paper was on acoustic improvements to a hall for Scouts carried out by the Scouts themselves!



Day one

An invited and well received paper was given by Fiona Smyth of Cambridge University on the historic developments in acoustics from 1901 to 1951. Another invited paper was by Michael Barron who gave a tribute to the exceptional auditorium designer, Sir Harold Marshall.

The next session explored new directions in auditorium research as well as discussing the usefulness of existing metrics. The new directions involve investigating the influence of the visual field on sound perception in concert halls. Fascinating papers were presented on this subject by Professor Tapio Lokki and Dr Paul Bavister – the influence of colour on our aural perception was striking.

Brian Katz led an open discussion on the future understanding and relevance of spatial metrics such as lateral fraction and interaural cross correlation with the outcome of many diverse opinions and suggestions.

Stage acoustics was one of the key themes of the conference and papers ranged from reducing the sound exposure of musicians by stage design to the construction of orchestral shells and stage floors. The finale was the arrival of a jazz trio on stage where the delegates were invited to listen to the differences in sound quality as various configurations of stage monitors were experimented with. It was in any case a great pleasure to listen to the trio which enabled delegates to wind down after a full day of talks and discussions before the conference dinner.

The conference dinner was held in the elegant surroundings of St George's Hall, which is a 200-year old Georgian building and is itself a concert hall with acclaimed acoustics for music.

Day two

The second day began with presentations on acoustic proximity by Eckard Kahle and the perception of anisotropic reverberation by Raphael Penot.

Meanwhile a rehearsal took place next door on the stage of P18

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Right: Raf Orlowski, Auditorium Acoustics 2025 conference Chair

the 1,700 seat Beacon Hall with the specially assembled 26-piece Avon Sonic Orchestra conducted by Mark Gateshill and the Avalon Wind Quintet. Once the delegates had arrived in their chosen listening places on the three levels of the hall, the musicians played a varied programme of orchestral pieces by Mozart, Elgar and Copland together with wind pieces by Arnold, Milhaud and Gershwin to demonstrate the acoustics. There was time to move seats on the same level between movements and to change level for a repeat performance of the programme. There was also the opportunity to ask the musicians for their experience of the hall, especially those who had played on the previous Colston Hall stage before the remodelling. The wind players commented on the ease with which they could play and all commented on the clarity of the sound. For the audience the volume of sound relative to the number of string players was notable.

Panel discussions

Back in the Lantern Hall, a panel discussion took place between Louise Mitchell, CEO of Bristol Music during the project, Dougie Scarfe CEO of Bournemouth Symphony Orchestra and Charles Hazlewood, Founder of Paraorchestra. They, in turn, enlightened the conference with insights into masterminding and successfully delivering an acoustics-led refurbishment project, the impact that a project can have on an orchestra and their playing, and by catering for all musicians, able and less able-bodied alike. A final point was how the project is supporting an authentic and enthusiastic musical community in Bristol.

Papers

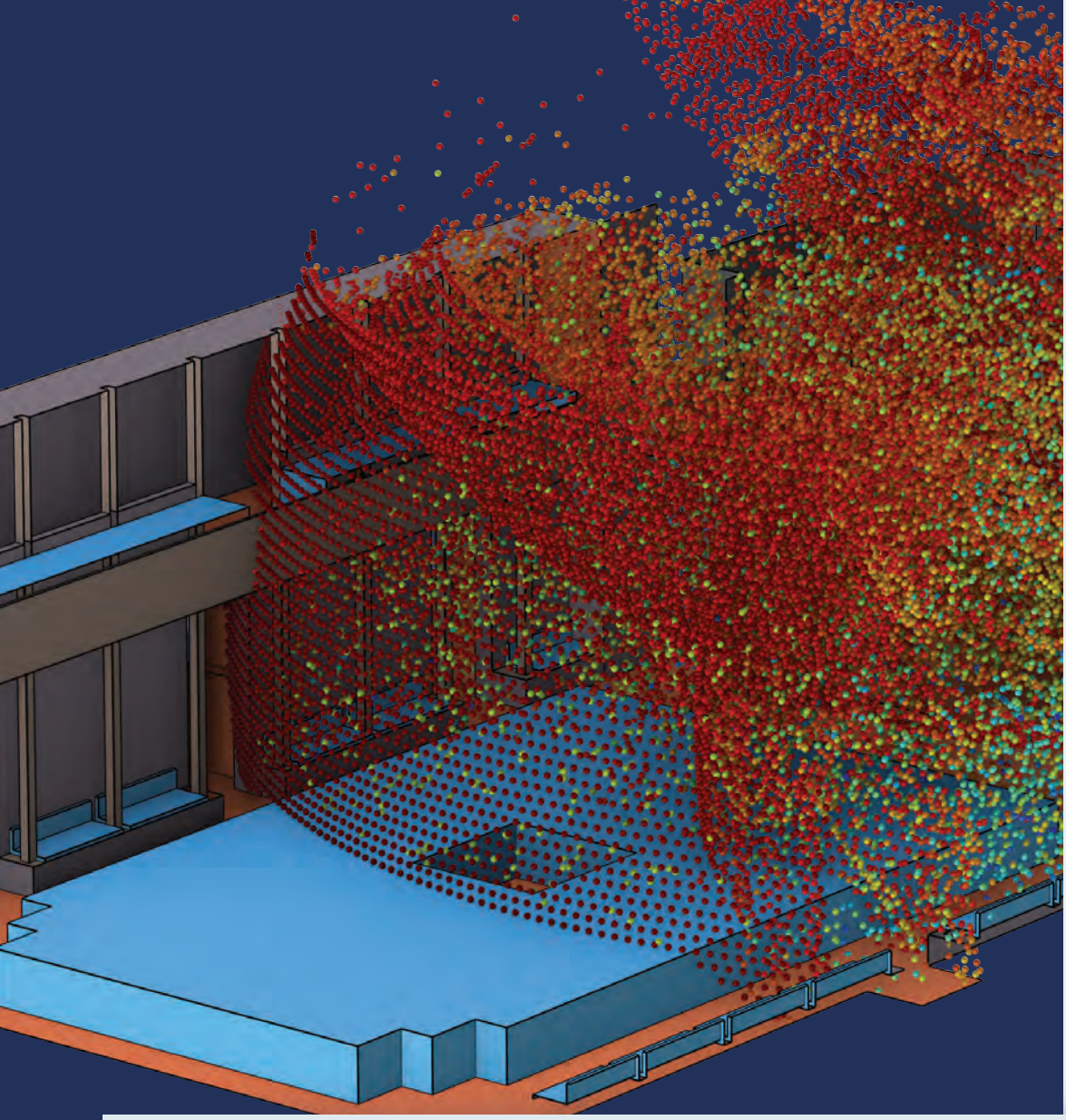
Two papers on worship spaces explored the acoustics of specific church spaces on the performance of choral music. In Bath Abbey, Michael Barron concluded that either a raised stage, reflectors or a canopy would improve the performance conditions for choral concerts, and indeed a canopy by Hugh Creighton had previously been installed in the 1960s but later removed. Charlotte Ferdinand explored different spaces within Noirlac Abbey and discussed how the synchronisation of choirs can be affected by the reverberance of the church.

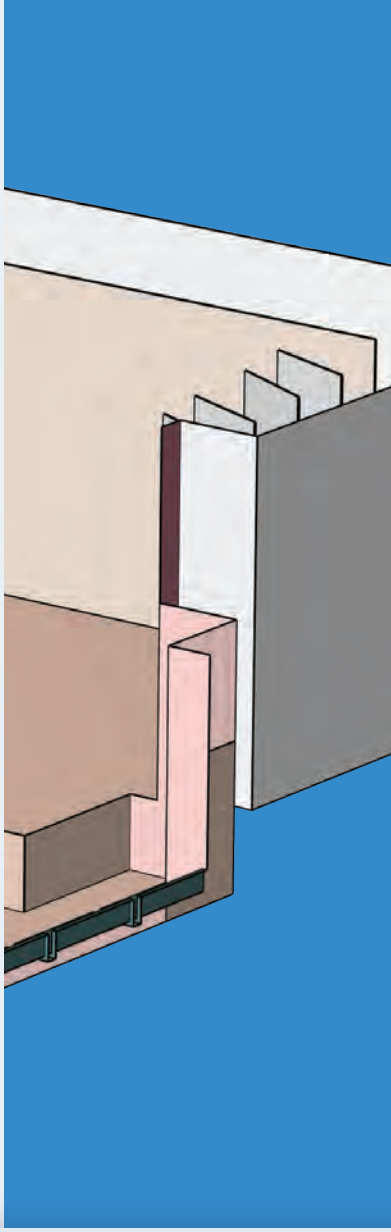
Simulation and measurements session

A session on simulation and measurements began with Serafino DiRosario outlining recent developments in the herisSon software for measurement and analysis of spatial impulse responses, with applications in two auditoria. This was followed by a round robin comparison of room acoustics modelling software applied to a classical theatre presentation by Thomas Toulemonde, identifying some of the challenges of applying geometrical acoustics (GA) software to this room type. Yan Jurkiewicz presented recent work balancing grazing incidence losses with reflector efficiency connecting to Kahle Acoustics' work on reflector design. P20



Right: Musical demonstration of Beacon Hall by Avon Sonic Orchestra and Avalon Wind Quintet





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Above:
Experience Studios gave a useful comparison of room acoustic simulation software as applied to two stadia to guide the choice of finishes to affect the crowd reaction

John O'Keefe completed the session by pulling together several ways to parametrise 3D curved surfaces and used them to drive multi-objective optimisation of curved reflecting surfaces.

Room acoustic application session
The room acoustic application session consisted of six papers demonstrating the spectrum of acoustical challenges that designing new buildings holds, be it the physical size of a space, its aesthetic and stylistic architectural treatment, or the ability to communicate information within it. Practitioner delegates could relate to the examples of designing museum displays with audio content in open plan museums from Lucy Zalberg, and making a 5,000-seat space more able to support intelligible speech from Kapil Thirwani. Experience Studios gave a useful comparison of room acoustic simulation software as applied to two stadia to guide the choice of finishes to affect the crowd reaction. The shaping of spaces for music and the effect on the players was at the heart of a paper on practice rooms by MultiConsult. Two examples of opera houses, one with 360 seats in Poland and the other with 2,100 seats in Egypt, the latter with a very large proscenium, had distinct differences in their approach to shaping and finishes as well as architectural style. The subject of adaptation of the acoustic design to architectural direction was discussed in each case by Andrzej Klosak and Fabrizio Filippi respectively.

Day three

The previous Auditorium Acoustics conference in Athens had shown an increasing interest and application of active acoustics systems (sometimes called reverberation enhancement) in performing arts spaces. For the Bristol edition of the conference, the third and final day was therefore dedicated to the science and application of such systems. Together with Amadeus Active Acoustics, Martin Audio and SWG Events, a temporary active acoustics system consisting of 32 loudspeakers and 12 microphones was installed in the Lantern Hall specifically for the conference. To begin the final day, Cees Mulder gave a whistle-stop tour of the different methods by which active acoustics has been implemented since the 1950s, culminating in a demonstration of a 'DIY' multiple channel amplification of reverberation (MCR) system using the installed microphones and loudspeakers. During the Q&A we finally learnt that the (now unused) 'assisted resonance system' in the Royal Festival Hall, London was conceived to counteract the excessive bass absorption and how the system conveniently used the Helmholz resonators installed in the ceiling that were originally intended to reduce bass reverberance in case it was excessive!

Active acoustics system design
Following this, Müller BBM, Brekke & Strand, Kahle Acoustics and Akukon provided insights into recent projects incorporating active acoustics systems and how the natural acoustics of each project was adapted to accommodate and work with the active acoustics. Technical insights into active acoustics system design were provided by L-Acoustics (how to simulate the interaction between active acoustics and natural acoustics), Meyer Sound and Amadeus Active Acoustics. Of particular interest



Delegates at conference

was the discussion of strength and loudness using active acoustics and the relevance of linear or double-sloped decays with active systems.

During the afternoon session multiple demonstrations had been organised using the temporary active acoustics system. Aalto University began with a demonstration of a system for academic research using time-variance to enhance stability and incorporating an automatic optimisation of the sound colouration. Following this was a demonstration of the Amadeus Active Acoustics system with a live saxophonist and violin (thank you to Peter Exton) illustrating the acoustical variability that can be achieved with active acoustics.

Based on the research by Raphael Penot (and IRCAM), the Amadeus system was then used to carry out a live experiment into the audibility of spatial reverberation balance (anisotropy). Various settings of the active acoustics system were tested with live solo violin on stage and with the reverberation spatially biased towards the stage, rear of the hall, ceiling and sides (lateral reverberation). Through discussions with the delegates, it was concluded that these changes to the sound field had audible yet highly complex subjective outcomes, indicating that this aspect of the sound field is a contributing factor to acoustical and musical quality, and certainly warrants further research.

Vaulted Harmonies documentary

The conference concluded with a specially edited screening of the *Vaulted Harmonies* documentary on the history of Notre Dame Cathedral in Paris produced by the Sorbonne University. This used 32 channels of audio, reproduced using the active acoustics system, to create a truly immersive and convincing acoustic experience.



Above: At a rehearsal of the Avon Sonic Orchestra delegates could move seats between movements to experience differing acoustics

Closing

Wrapping up the conference, Lucca Dellatorre and Serafino DiRosario gave a tribute to Professor Angelo Farina who passed away earlier this year. This was followed by an open discussion to round out the conference with key points raised being the update to ISO 3382 (definition and measurement of room acoustic parameters) and the suitability of the existing set of room acoustics parameters to determining overall acoustical quality.

As always, alongside the presentations, many fascinating discussions took place during the breaks and around the posters and sponsor displays.

The Auditorium Acoustics committee is looking forward to the next edition, which is currently earmarked to take place in 2027.





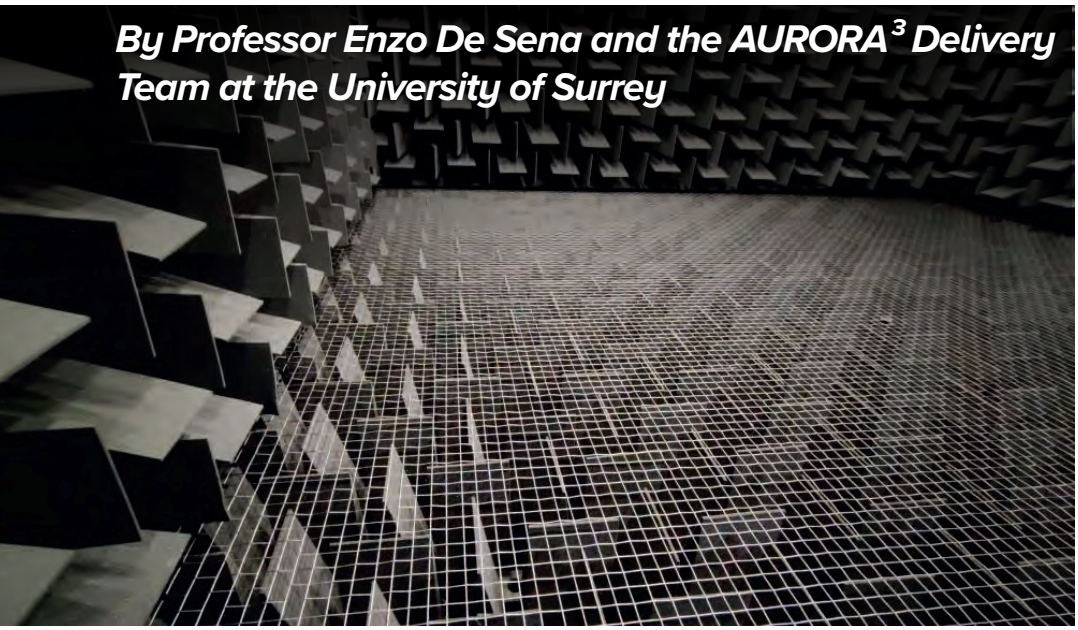
Below: Jazz session with 'Adjustments', a Norwegian jazz piano trio

AURORA^3: Anechoic and Universal Research Observation Rooms for Audio, Acoustics and AI

AURORA^3 will deliver next-generation UK infrastructure for reproducible audio and acoustics data collection under controlled, realistic acoustic conditions.

AURORA^3
Anechoic and Universal Research Observation Rooms for Audio, Acoustics, and AI

By Professor Enzo De Sena and the AURORA^3 Delivery Team at the University of Surrey



Above: Figure 1. Detail of sound-absorbing wedges and mesh floor in anechoic chamber (illustrative image; AURORA^3 facilities under construction) (Image courtesy of IAC-UK)

Audio and acoustics technologies are concerned with how we generate, capture and perceive sound. Examples include hearing aids and assistive listening, smart speakers and voice assistants, teleconferencing, public address and building acoustics, musical instrument and loudspeaker design, and virtual/augmented reality (VR/AR) experiences. These technologies are being transformed by advancements in machine learning, where progress critically depends on the availability of abundant, high-quality data, both in the form of audio recordings and of human responses to sound.

To collect this data, we need infrastructure where the acoustics can be carefully controlled and where the conditions of real-world environments can be reproduced. This is important, for example, when testing how a hearing aid performs in a classroom compared to a train station, or how a speech recognition system works in an office compared to a living room. It isn't only noise conditions that change in these situations, but also – and crucially – reverberation, the persistence of sound due to repeated reflections within a room.

Existing infrastructure makes it hard to collect such data quickly and reproducibly across varied acoustic conditions. Researchers either rely on limited sets of rooms (limited generalisability), travel to multiple sites (slow and costly), or turn to acoustic simulations that may not capture real-world complexity. Human studies often default to headphones or fixed listening rooms, which, while valuable, can lack ecological validity for everyday environments such as living rooms, offices, and classrooms. This is the problem addressed by AURORA^3.

AURORA^3 facilities

AURORA^3 is a national infrastructure facility that will enable fast, accurate and reproducible data collection across a wide range of acoustic conditions. Funded by a £2.2M investment by the Engineering and Physical Sciences Research Council (EPSRC) and hosted at the University of Surrey, AURORA^3 is currently under construction and will be completed within a year. AURORA^3 will combine state-of-the-art audio equipment and facilities for rigorous, yet precise control over a wide range of acoustic conditions:

- a variable acoustics room equipped with adjustable wall panels that can transform the acoustics of the room at the push of a button – from the lively reverberance of an empty hall to the acoustic dryness of a small bedroom – and a moving wall for modifying the room volume, a world first; and

- an anechoic chamber providing a controlled environment for reverberation-free and low-noise acoustic measurements, while also featuring an immersive loudspeaker array allowing researchers to recreate complex sound fields and soundscapes beyond what is physically possible in the variable acoustics room – for example, a train station, an opera house or a church.

Together, these facilities will enable full acoustic environment control, supporting physical and perceptual data collection and offering a one-stop-shop facility for comprehensive evaluation across the entire research pipeline, from fundamental research to applied research and development.

Benefits

Technologies developed using AURORA^3 will be more robust in different real-world environments and will be able to better model the underlying physical and perceptual phenomena involved in audio and acoustics. This will unlock benefits across a range of applications, such as:

- more immersive VR/AR experiences for teleconferencing, entertainment, virtual prototyping and the metaverse;
- more accurate and robust automatic speech recognition and speech enhancement for voice assistants; and
- smarter hearing aids that better understand and adapt to the acoustic scene.

Delivery team, partners and community

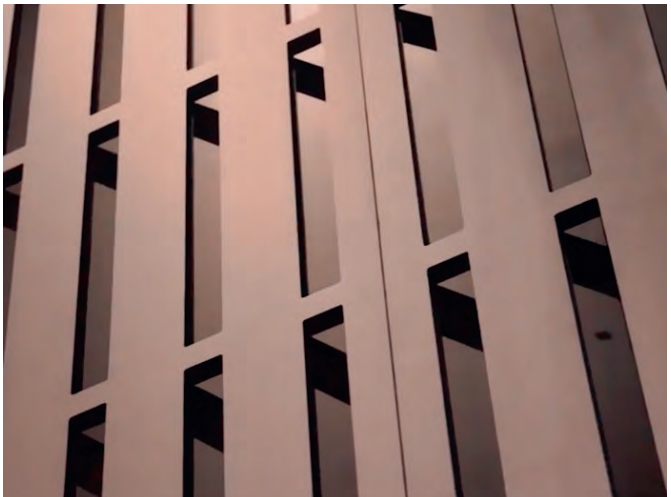
The delivery team includes experts at Surrey's Institute of Sound Recording (IoSR) and Centre for Vision, Speech and Signal Processing (CVSSP), supported by a consortium of 30 external institutions from academia and industry. Together, their expertise spans virtual acoustics, spatial audio, psychoacoustics, room acoustics, biomedical acoustics and AI.

The delivery team's vision for AURORA^3 is to bring the A^3 (audio, acoustics and AI) community together, produce high-quality data resources, and foster a mindset that encompasses considerations of inclusion, rigorous inquiry and pathways for realising societal and economic benefit. As part of the community-building effort, the AURORA^3 team will run a seminar series, pump-priming activities, and annual training workshops, alongside visiting researcher and secondment opportunities.

Get involved

AURORA^3 will be open to researchers from academia and industry alike, nationally and internationally, with reduced fees for those who commit to sharing collected data openly. The team will provide construction updates via LinkedIn (**linkedin.com/company/aurora3-uk/**). For enquiries about access, collaborations or partnerships, please contact the AURORA^3 team at the University of Surrey (**aurora3@surrey.ac.uk**).

Below: Figure 2 Detail of adjustable wall panels in variable acoustic room (illustrative image; AURORA^3 facilities under construction)
(Image courtesy of FlexAcoustics)



Upcoming ANC Event

Best Practice for Environmental Measurement

The importance of gathering robust data

Join us for a focused one-day event exploring the why, what and how of environmental data measurements.

Wednesday 26 November, 10am – 4pm

WSP, Chancery Lane, London WC2A 1AF

This event will highlight the critical role of accurate and consistent environmental sound measurement, drawing on real-world insight and practical approaches from across the industry.

Copies of the ANC Green Book "Environmental Sound Measurement Guide" will be available for delegates at a reduced price.

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More details and a booking form will be available at:
association-of-noise-consultants.co.uk/events

EARLY CAREERS GROUP

Meet the IOA Early Careers Group

It's been a busy year for the IOA Early Careers Group (ECG) and we have hosted several events on topics that you might come across in your acoustics career.

By Zachary Simcox, Early Careers Group Chair

From environmental and building acoustics, to music venues and festivals, and cutting-edge research, the ECG aims to be the place for members to network and find out what's going on in the world of acoustics.

These events wouldn't be possible without the efforts of our committee members so in this article, we introduce you to two them.

Marianne Garrett (IOA Environmental Sound Group representative)

"I entered higher education without direction or grand plans, only an interest in experimental music production. I was introduced to the field of acoustics in the final year of my undergraduate degree where I wrote my thesis on poor acoustic design in large-scale music performance venues.

"In 2022 I graduated with a MSc from the ISVR at the University of Southampton, where I realised that I wanted to pursue a career that would allow me to positively influence the health and wellbeing of others. I now work as a senior environmental protection officer (specialising in acoustics) across three local authorities in the West of England and contribute to the wider industry as an IOA Environmental Sound Group member."



Marianne Garrett, the ECG Environmental Sound Group representative



Diogo Pereira, the ECG Publications Committee representative

Diogo Pereira (IOA Publications Committee representative)

"I graduated in audio engineering at Solent University followed by a master's in applied acoustics and now work at Bickerdike Allen Partners. I am passionate about acoustics as it combines my interest in physics, maths and music (and inherently some noise!)

"I am a Corporate Member of the IOA, Secretary of the Early Careers Group (ECG) and Publications Committee representative. I've always been keen to help develop the area of acoustics, with now special attention on the output of IOA publications for the early career community.

"Throughout my career in acoustics I have worked in both building and environmental acoustics projects, with special emphasis on vibration assessments for heritage collections and very sensitive receptors. As well as this, I have also conducted noise and vibration surveys, modelling and assessments, assisted in expert witness projects, carried out sound insulation testing and room acoustics design. No day is the same!"

Get involved!

We're always looking for enthusiastic members to join the ECG. This can be as simple as attending our events to meet other members.

If you have ideas for events or would like to host a webinar, we'd love to hear from you.

Want to join as a committee member?

Talk to your local Branch or working group Chair (their details can be found on the IOA website). Alternatively, email **earlycareers@ioa.org.uk** and we can guide you through the process.



Keep an eye on the IOA events page for the latest ECG events, and we'll see you there!

Launch of the Sound Economics 2 Report

On Tuesday 7 October 2025, members of the UK acoustics community gathered at the Royal Academy of Engineering for the launch of the Sound Economics 2 (SE2) report. Hosted by the UK Acoustics Network, the event brought together researchers, consultants, policymakers and industry leaders to reflect on the scale, impact and future of acoustics in the UK.

Professor Richard Craster (Imperial College London), welcomed guests, setting the tone for a programme that was both celebratory and forward-looking. Dr John Lincoln, Director of Harlin Ltd and lead author of SE2, presented the headline findings, highlighting the economic contribution of acoustics and its strategic relevance.

A compelling case study on acoustic leak detection in buried pipes was shared by Joanna Watts, PhD researcher at the University of Sheffield, demonstrating real-world innovation. Professor Kirill Horoshenkov (University of Sheffield) then outlined what's next for the sector, before the President of the Institute of Acoustics, Professor David Waddington (University of Salford), spoke on the IOA's proposed action plan to implement the report's recommendations. The evening concluded with networking and discussion.

Main findings

The SE2 report presents a compelling picture of a thriving and strategically important industry:

- The UK acoustics sector contributes **£5.2 billion annually** to the economy.
- It employs **20,000 people** across **780 companies**, 98% of which are SMEs.
- Each acoustics professional contributes **£95,000 in gross value added (GVA)** – over 30% higher than the UK manufacturing average.
- Productivity has grown by **64%** since 2018, with a **compound annual growth rate (CAGR) of 8.6%**.
- **Average employee benefits** – the total employment cost to the employer – have risen by **7% CAGR**, reaching **£68,500**.
- The sector is supported by **£230 million in active research funding**, across **250+ grants** and **70+ institutions**.
- Key application areas include **submarine sonar, ultrasound diagnostics, smart insulation, voice recognition**, and **environmental noise control**.
- The global acoustics market is projected to reach **£44 billion by 2030**, with UK firms well-positioned to lead in areas such as insulation, sonar, and audio technologies.
- The report also highlights the sector's regional diversity, with **Scotland leading in productivity** (£141,000 GVA/employee), and strong activity across the **North West, South East**, and **East Midlands**.

Comparisons with SE1

The SE2 report builds on the original Sound Economics report (SE1) published in 2019, offering a more detailed and expansive view of the UK acoustics industry. SE1 estimated:

- £4.6 billion in revenue;
- 16,000 employees;
- £65,000 GVA per employee; and
- £150 million in research funding.

SE2 shows clear progress:

- revenue has grown by **13%**;
- employment has increased by **25%**;
- productivity has risen by **64%**; and
- research funding has expanded by **53%**.

SE2 also offers broader sectoral coverage and stronger alignment with national strategies, including the UK's **2025 Industrial Strategy** and **Strategic Defence Review**.

Closing reflections: the President's speech

The launch of SE2 was marked by a short but impactful speech from Professor David Waddington, President of the IOA. He addressed the audience with clarity and conviction, beginning by thanking the sponsors, the authors of SE2, and all those attending.

He emphasised the significance of the report, saying: "The Sound Economics 2 report re-affirms what many of us have long known: Acoustics is vital to the UK's economy, health and innovation."

But he also acknowledged the challenges: "Our profession remains under-recognised, and better data, visibility and policy support are urgently needed."

In response to SE2's findings, the President outlined three strategic priorities for the IOA:

Skills and careers
"We'll support skills and careers, including digital and AI training for all stages of professional life."

Policy and design integration
"We'll work to embed acoustics in mandatory early design decisions – in buildings, transport, and manufacturing – avoiding costly late-stage changes, or non-optimum outcomes."

Data and advocacy
"We'll push for a dedicated SIC code – at the moment we often have to use the Environmental Consultancy Activities code – and launch a National Acoustics Observatory to improve data, research, and policy visibility."
(SIC codes are used to classify industries for official statistics; without one specific to acoustics, our sector is hard to track and support.)

He concluded with this call to action: "Together, we can ensure acoustics is not just heard – but understood, valued, and embedded at the right time in the decisions that shape our future."

This speech captured the spirit of the evening – celebrating progress, acknowledging gaps and committing to action. It was a fitting end to a launch that marked a new chapter for UK acoustics.

Download the Sound Economics 2 report at **https://www.ioa.org.uk/news/uk-acoustics-sound-economics-2-just-out**



The Institute of Acoustics Consultation Response to BS 8233:2025 'Sound insulation and noise reduction for buildings — Guide' September 2025

The IOA has submitted the following consultation response to BSI on the Draft of BS 8233:2025. As this Standard is central to the work of many members, we are publishing our response here in full so that members can see how their input has been represented.

Introduction

The Institute of Acoustics (IOA) is the UK's professional body for those working in acoustics, sound, noise and vibration. The IOA has some 3,000 members from diverse backgrounds, with engineers, scientists, educators, lawyers, occupational hygienists, architects and environmental health practitioners among their number. 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, electroacoustics, engineering dynamics, noise and vibration, hearing, speech, underwater acoustics, together with a variety of environmental aspects.

British Standard 8233 *Guidance on sound insulation and noise reduction for buildings*

(BS 8233) is a document that our members use regularly at various stages of a project. It is a fundamental part of residential planning policy and is relied upon for the design and construction of a wide range of non-residential buildings. In fact, it is one of the most important and widely referenced standards for UK acousticians. IOA members refer to it for the purposes of consultant advisers to developers and in the capacity of regulatory and enforcement professionals.

The IOA's aim is to provide the BSI Technical Committee B/564 – Noise Control on Building Sites (B/564) with a response which aids their future deliberations to produce a standard which is robust, fit-for-purpose, and can be practicably applied. We can best do that by acknowledging where there are differences in member views and then faithfully presenting those views to B/564. The IOA is fortunate to be able to draw on a wealth of experience in all relevant professional disciplines for this purpose.

It is expected that B/564 will consider and test the risks/benefits of their drafting edits to take account of:

- impact on public health and wellbeing;
- robustness of underpinning research;
- practicability of application;
- compatibility with other existing guidance;
- appropriate criteria/parameters to cover the standard's scope and purposes; and
- impact on developers/noise-sensitive receptors.

The IOA recognises that there are strong and opposing views held on some of the proposed changes and that this is understandable and acceptable. It also considers it inappropriate to treat issues as binary and only present one view as the 'IOA view' if a simple majority of members held those views. Presenting or not presenting a view based on numbers does not recognise that good guidance and standards are arrived at by due consideration of experience and views from all standpoints. Therefore, although member views may be described as a 'minority 'or 'majority' view, this is reporting the contextual output from member consultation exercises and should not be interpreted as adding weight or otherwise to that position.

Background

BS 8233 has been a key document for building design in the UK since its introduction in 1987. It draws on other standards and guidance, such as BS EN 12354 Building acoustics.

Estimation of acoustic performance of buildings from the performance of elements,

BS EN 1793 *Road traffic noise reducing devices. Test method for determining the acoustic performance*, and the *Calculation of Road Traffic Noise* (Department of Transport, Welsh Office, HMSO), providing guidance for most building and built environment types. The document's status was changed from a code of practice to guidance in 2014.

The Draft for Public Comment version of BS 8233:2025 (referred to hereafter as the 'Draft Standard'), released for consultation on 6 June 2025, remains a guidance document. As such, it offers general recommendations and does not allow for claims of compliance. It retains a similar structure, dealing with planning considerations first (Chapter 4), considering external sound (Chapter 5), before introducing a new chapter on building design objectives (Chapter 6). It retains chapters on sound insulation (Chapter 7) and sound from building services (Chapter 8). The 2025 draft places the guidance for specific types of buildings after these chapters

(Chapter 9) and contains new chapters on uncertainty (Chapter 10) and sustainability (Chapter 11).

This Draft Standard proposes significant changes. While some have been widely discussed in the acoustics community for the past 12 to 18 months, others have received less attention.

Most notably, the Draft Standard suggests altering the recommended approach for assessing dwellings, which includes introducing parameters not widely used in the UK. These specific changes have been publicised[1] and debated for some time.

The IOA has sought to consult members on these key amendments, specifically via an online survey from 7 March to 15 April 2025 on the anticipated major changes prior to the release of the Draft Standard, and again formally on 24 and 26 June and 2 July 2025. The responses have collectively been used to inform members' opinions of the changes, and these views have defined this formal consultation response.

General

The major proposed change in the Draft Standard is the adoption of the L_{den} and L_{night} parameters in place of the $L_{Aeq,16h}$ and $L_{Aeq,8h}$ parameters for the assessment of noise affecting dwellings.

The Draft Standard introduces a two-stage approach of first classifying the building and curtilage into a sound exposure category before recommending a façade sound insulation value dependent on this sound exposure category or alternatively a design internal level for habitable rooms. The stated basis for this change is that it arises from a review of research published over the last 20 years considering the health-based effects of noise.

This is a change from the current 2014 version, which contains guideline noise levels originating from research originally summarised in the World Health Organization document: *Guidelines for Community Noise* (1999). Contextually, it is noted that World Health Organization *Environmental Noise Guidelines for the European Region* (2018) recommends that 'all [Guidelines for Community Noise] indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid.' (p28).

In addition to these changes, the Draft Standard contains the following additional significant changes (in order of appearance in the draft *Standard*):

- the re-introduction of the speech-privacy factor in offices;
- guidance on sound insulation between cellular rooms in offices;
- the addition of new guidance for the design of acoustic absorption within rooms (including a new Annex I);
- expanded guidance on sound from building services;
- guidance on the sound insulation of open windows for overheating;
- overhaul of the calculation methods in Annex G, to align with BS EN 12354-3:2017 *Building acoustics. Estimation of acoustic performance of buildings from the performance of elements — Airborne sound insulation against outdoor sound*, to include a partial level formula for the derivation of noise intrusion via separate transmission paths, to provide calculation examples using the sound exposure categories, and to introduce formulae to define maximum open area to be used as the Equivalent Area when relying on an open window for overheating; and
- a new Annex J, explaining the basis for defining the sound exposure categories, the guideline dwelling façade sound insulation performance and other pertinent points relating to noise and health in dwelling design.

Such a significant overhaul of a regularly used standard requires careful thought and consideration of the implications of the changes from all users, and the IOA has taken responsibility for this consultation very seriously.

The following sections address the overall opinion of the changes as expressed by members during the survey and consultations.

The online survey asked the following questions in response to the Harvie-Clarke/Fenech paper[1]:

1. Do you support the proposed shift in BS 8233 to a two-step process starting with external sound levels?
2. What is your view on the use of Lden/Lnight in the revised standard?
3. What is your view on removing references to activities and room locations?
4. What is your view on removing the guidance for assessing regular individual night time noise events?
5. Are there any other aspects of the changes you would like to comment on?

Of the 119 individual responses from the survey, 103 were consultants, seven had a role as an engineer, 10 were defined as regulatory officers and one was an academic.

The three consultation events held following the release of the Draft Standard were in a different format to enable live debate. Over three sessions, a short synopsis of the changes was read out before attendants were placed into small breakout rooms with hosts asking the group a similar set of questions and populating a form based on the general overall response of the group. In total, 76 people attended the sessions.

A summary of opinions on each question has then been determined by examination of the responses, to inform the response in this document.

Sound exposure categories

The sound exposure categories are proposed to classify the noise exposure of a site. They vary depending on the transportation source and use parameters L_{den} and L_{night}.

Categorising the noise exposure of a site is not new. From the days of *Planning Policy Guidance 24: Planning and Noise* (PPG 24) (withdrawn in 2012) through to *ProPG: Planning and Noise*, which adopts a risk-based approach, such categorisation has always been accompanied by guidance on what each classification means in practice.

Overall, membership was divided on the proposal of categorising a P28

References

1 Harvie-Clark, J. and Fenech, B., 2024. Aligning residential acoustic design guidance with the health evidence: a new proposal for the UK. Proceedings of INTER-NOISE 2024, Nantes, France, 25-29 August 2024. Apex Acoustics and UK Health Security Agency.

site, with a small majority opposing the change.

Most members believe the guidance around the use of categories requires further refinement/explanation to be viable in the UK context.

There is also concern that a categorical approach to sound exposure may constrain meaningful engagement, with the risk that developments falling into upper exposure tiers could be dismissed without case-specific consideration. This was seen by some as a regressive step. This was of particular concern where developments are exposed to sound from air traffic of more than 40 dB L_{night}. The Harvie-Clarke/Fenech paper[1] suggests that:

For annoyance from aircraft noise, we have used the ERRs (exposure response relationships) in the WHO ENG2018 for this paper, however it is expected that the nationally-representative ERRs from a socio-acoustic study in England will be published in due course, which may be more relevant to a British Standard.

Given the Draft Standard relates to building design and noting that the proposed sound exposure categories are formed from guidance more catered to reduce emissions, additional guidance sufficient to understand how the categories in building design are separate to how they are used in policy and masterplanning is recommended.

Some members were also unclear on the precise method to establish the exposure from these sources, particularly where sites are exposed to multiple transportation sources or additional sounds from non-transportation sources.

Use of L_{den} and L_{night}

The daytime $L_{Aeq,16h}$ and night-time $L_{Aeq,8h}$ parameters are proposed to be replaced by the 24-hour annual average parameter L_{den} and the night-time annual average parameter L_{night}.

These parameters are used in the sound exposure categories, whilst the internal targets and recommended façade sound insulation values are based solely on L_{den}.

A small majority of members indicated they understood the shift toward an evidence-based approach for defining criteria. However, a notable minority expressed continued comfort with the previous $L_{Aeq,T}$ thresholds, often remarking that these "feel about right", without necessarily being able to point to specific supporting evidence to substantiate this perception.

There are concerns over the unfamiliarity of the proposed metrics, as these parameters are not currently used in the UK except in national and local policy aimed at reducing noise exposure. Their use originated in the *Environmental Noise Directive* (END) Action Plans, which in the UK have since been replaced by Action Plans prepared under the *Environmental Noise* (England, Scotland, Wales, Northern Ireland) *Regulations* (ENR). It is noted that L_{den} and L_{night} are not defined in the *terms, definitions and symbols section.*

There is no clarity in the Draft Standard on how a practitioner may determine the exposure (e.g. is there an appropriate short-term survey method or is the proposed approach only achievable using prediction methods with annual average input data?). This should be clearly explained within the Draft Standard, and if these parameters are only achievable using prediction methods, it would leave a significant number of sites as outliers due to their exposure to mixed sound sources.

The reason these parameters are proposed is understandable, but the means to use them should be more clearly explained and thought should be given as to how the L_{night} parameter is proposed to be used.

Inclusion of a single internal ambient design target

The 2014 version of the Draft Standard contains desirable internal ambient noise levels for living rooms, dining rooms and bedrooms in the form of annual average $L_{Aeq,T}$ for sources without a specific character. These noise levels were of a similar form in the 1999 version of the Draft Standard and were based on the recommendations of the World Health Organization document: *Guidelines for Community Noise* (1999) and re-affirmed in World Health Organization document: *Environmental Noise Guidelines for the European Region* (2018).

The Draft Standard recommends a single L_{den} internal noise level, applicable to all habitable rooms, with separate guideline noise levels for dwellings exposed by road traffic, railway traffic or air traffic. For road traffic, the internal noise level is based on the Class D rating from ISO/TS 19488: 2021 *Acoustics — Acoustic classification of dwellings*. The corresponding noise levels for railway traffic and air traffic have then been based on the difference proposed in the external sound exposure for these sources compared to road traffic.

The single noise level is proposed to reflect inclusive working/living practices, and this flexibility was seen as a positive by some members. However, the majority of members oppose the single classification of a habitable room. A common comment was the feeling that a single classification constrained good acoustic design. Others queried the point of the Lnight external sound exposure categories when they are not reflected in any corresponding internal design target. It is recommended that the internal noise levels are revisited to consider these comments.

Individual night-time events

The 2014 version of the Draft Standard contained the following text:

Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.

The Draft Standard makes no mention of regular individual noise events in section 9.1.1 (the section covering dwelling sound exposure, façade sound insulation and internal ambient noise levels). There is an explanation of the omission in Annex J, whereby it states:

Single-event noise indicators and their distribution over time are more appropriate than long term averaged metrics to investigate such physiological effects. Nevertheless, the relationship between single-event noise indicators and long-term health outcomes at the population level remains tentative. P30

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Given the strength of the health evidence based on L_{den} and L_{night}, and the lack of evidence linking maximum sound levels with long term health effects, this British Standard does not specify maximum sound level criteria for transportation noise sources.

There is strong support for incorporating event-based metrics like L_{AFmax} into the Draft Standard. While views differ on the robustness of the evidence, many acknowledge that the absence of conclusive data on long-term health effects does not necessarily justify omitting a target noise level altogether.

The Draft Standard acknowledges that individual noise events can elicit awakenings, albeit that translating this into a meaningful evidence-based criterion is difficult.

In light of member sentiment, it is recommended that further consideration be given to how the Draft Standard might more effectively account for individual night-time events. This should include exploring options that are both robust and health-informed, even in the absence of conclusive evidence linking such parameters to long-term health outcomes.

Other notable comments

Whilst not specifically commented on by members, the new guidance on internal sound insulation and office acoustic design is both welcome and necessary and reflects a real-life approach with advice that was missing in the 2014 version of the Draft Standard.

The façade sound insulation recommendations specify a minimum performance of 30 dB $D_{nT,A,tr}$. This translates to a free-field level difference of around 27 dB, which is unlikely to be achieved in most situations with non-acoustic ventilators sized to satisfy the continuous or intermittent extract fan system design in Approved Document F: Ventilation. This, therefore, is likely to mandate acoustic ventilators as standard for dwellings, which does not appear to be a sustainable approach where sites are classified as Category 1 (circa. ≤ 53 dB $L_{Aeq,16h}$ / 47 dB $L_{Aeq,8h}$ for road traffic). It is recommended that this mandatory minimum standard is removed.

There is concern that the Draft Standard includes the annual average L_{den} and L_{night} parameters and does not discount the use of strategic noise maps as the basis of defining the sound exposure for a site. Due to the limitations associated with the ENR strategic noise mapping (only includes high trafficked roads, busy railways and major airports/agglomerations, noise levels are calculated at a height of 4m, single diffraction edge screening only, no inclusion of local/other sources, fixed grid of 10m x 10m), site-specific assessments are considered essential. The Draft Standard should be more explicit in this regard.

Whilst better guidance on room acoustic absorption is welcome, some members have queried the reasoning behind defining the room absorption area. This is particularly so given that the Draft Standard refers to other guidance documents that cover most building typologies/situations. It is recommended that this guidance is revisited, to be consistent with the referred guidance documents, which are supported by an evidence base.

Some members were disappointed with the lack of guidance around an approach for non transportation sources. Whilst there may be a lack of health-based evidence, members felt some guidance formed from opinion was better than none.

Some members commented on the lack of objective criteria in the external amenity area section (9.1.3). It is acknowledged that, to an extent, the sound exposure categories cover this. A link to an objective measure may be beneficial.

Conclusion

We welcome the opportunity to comment on a Draft Standard so fundamental to our working life.

The IOA will always support research which contributes to understanding the impact of noise exposure on health and wellbeing. Therefore, we would expect any revision to standards to be evidence-based. Some members specifically expressed their support for the evidence based approach to this *Standard's* revision, but the process and implementation require better explanation, and some aspects (e.g. room classification and single event noise levels) should be overhauled if they are to align with members opinion. Furthermore, the *Standard* must consider the practical implementation of what is being recommended, and ensure the guidance is both repeatable and reproducible in real-life situations.

Given the fundamental role of BS 8233 and the level of opposition to certain changes, BSI may wish to consider a second consultation process once comments have been reviewed and addressed.

If officials would like to explore further any of the points raised, relevant members of the IOA would be delighted to meet with them.

Alistair Somerville
Immediate Past President



This response has been prepared by James Healey, Chair of the Building Acoustics Group, assisted by Ben Burgess of the Building Acoustics Group, alongside members of the IOA who are experienced practitioners in this area. The IOA members consultation process has been overseen by Daniel Goodhand. This response has been approved by the IOA's Governing Council.

The response that IOA sent to BSI can be downloaded here: **https://www.ioa.org.uk/news/consultation-response-bs-8233-sound-insulation-and-noise-reduction-buildings**



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Bursary Fund update

Two Bursary Fund applications were approved in the Summer funding round, including Nathaniel Taylor's. He will use his bursary to support his postgraduate studies in acoustics.

By Reena Mahtani FIOA, Chair of the Bursary Fund

The Summer round of funding closed in August with a record four applications received, three to study the Diploma and one to attend a conference to present a research paper. We are happy to confirm that two Diploma applications have been approved. In this issue of Acoustics Bulletin we hear from Nathaniel Taylor about his experience of applying to the Bursary Fund and we will hear from the other applicants in a future issue.

Nathaniel has studied a BSc in Music and Sound Production and works part-time to fund his studies. He has chosen to study the Diploma in Bristol, and this is what he had to say about his reasons for applying:

"I am grateful to have been given the opportunity to maximise my time studying acoustics and noise control with the IOA. Due to the scarcity of funding for postgraduate study, this bursary is extremely valuable to those wishing to enter the field of acoustics whilst balancing external part-time work."

"The application process was accessible and well documented. It is exceptionally refreshing to be able to apply for a fund that's purpose is to facilitate new entries into the field as well as further research. I'd like to thank the board members for their support. I am eager to immerse myself in the course and the wider acoustics industry!"



We sadly had to decline funding of two applications. The first one was declined because the applicant was not a member of the IOA – this is a basic requirement to access the Bursary Fund. Regarding the second application, this was declined due to the applicant's research institution not being approached for funding in the first instance. This is normally the expectation for researchers and it is detailed in the rules of the programme to ensure our approach is consistent and fair to everyone.

How to apply

The Autumn round of funding is currently open until the end of November 2025. The application form is available on the IOA website, under the 'can we help' header. If you or someone you know could benefit from financial assistance from the Institute, please consider applying. The programme is open to any member of the Institute, including students.

When preparing the application, please pay careful consideration to the personal statement. The review panel needs to understand the circumstances of the applicant, why the Institute should fund the activity and if other means of funding such as a university or research centre have been considered. There is more information about the application process on the website, and if you have any questions, please feel free to send an email to **ioa@ioa.org.uk**

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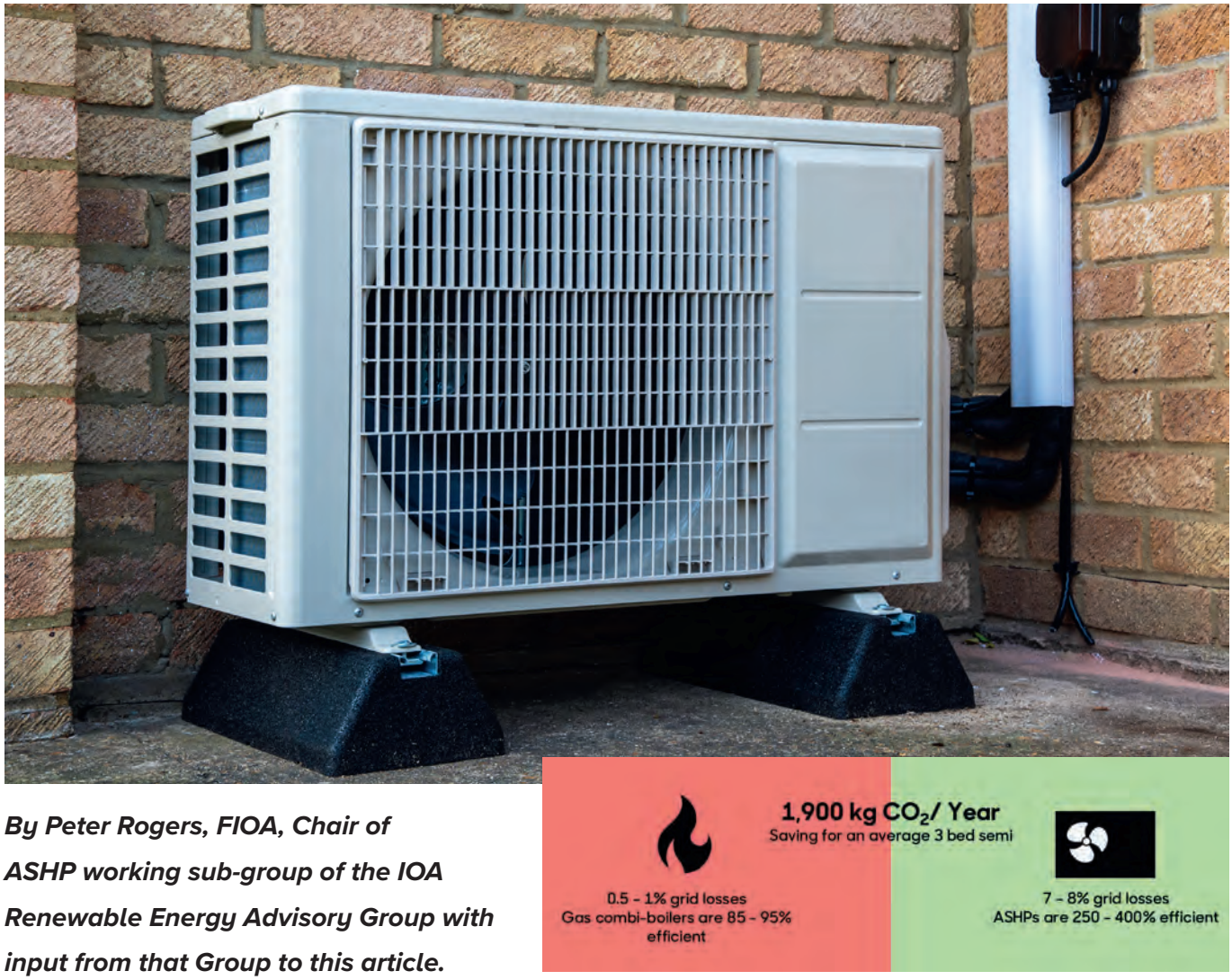
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Breaking the deadlock: a new approach for heat pump noise assessment

The UK's net zero ambitions rely on accelerating heat pump adoption, yet noise regulations and inflexible assessments stall progress. The IOA proposes a five-tier, risk-based framework to enable proportionate evaluation, reduce costs and maintain community amenity. This pragmatic approach seeks to restore confidence and support government rollout goals.



By Peter Rogers, FIOA, Chair of ASHP working sub-group of the IOA Renewable Energy Advisory Group with input from that Group to this article.

The intersection of sustainability and acoustics becomes critical when considering the UK's path to net zero by 2050, a route that runs directly through the nation's homes. With a target of 600,000 air source heat pump (ASHP) installations annually by 2030, six times the current rate, decarbonising domestic heating represents an essential component of a sustainable energy future. Yet this critical transition away from fossil fuel heating is being impeded by unexpected obstacles: noise concerns have undermined public confidence through unfavourable media coverage, whilst an inflexible acoustic assessment approach is stalling viable installations and frustrating installers, homeowners and local planning authorities with additional costs.

The Institute of Acoustics Renewable Energy Advisory Group (REAG) has been examining this challenge and the industry's role in defining a clear, socially equitable pathway. Recent meetings, including one hosted by London Branch, concluded that revision of the existing joint guidance with the Chartered Institute of Environmental Health (CIEH) is needed. The existing guidance had successfully offered middle ground between MCS 020 and BS 4142. The working group has now developed what REAG considers a proportionate proposal for updating this guidance. The objective is to assist rollout aspirations without compromising community amenity and quality of life. To achieve this, a hierarchical, risk-based assessment framework has been proposed that could unlock thousands of installations. This approach was detailed in a working group paper at Acoustics 2025, offering professionals and policymakers a pragmatic evolution rather than radical departure from current practice. This article sets out the direction ahead of stakeholder discussions and formal consultation, inviting IOA member comments in recognition of the fast-moving policy landscape and the need for timely, pragmatic solutions.



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The binary trap

The current regulatory landscape presents installers with stark choices. Permitted Development Rights (PDR) allow straightforward installations without planning permission when meeting MCS 020 a) acoustic requirements. This cost-free route features simplified calculations demonstrating compliance with a 37 dB(A) limit outside neighbouring properties.

However, previous research demonstrated (shared at IOA conference) that MCS 020 a) methodology may be excessively conservative, predicting sound levels 5-7 dB higher than the detailed ISO 9613-2 standard[1,2]. Although it should be noted that there are different assumptions in the two approaches, and alignment to in-situ measurements is yet to be determined. This conservatism creates unintended consequences hampering ASHP rollout; installations failing the simplified assessment by even 1 dB face a regulatory 'cliff-edge' requiring full planning permission.

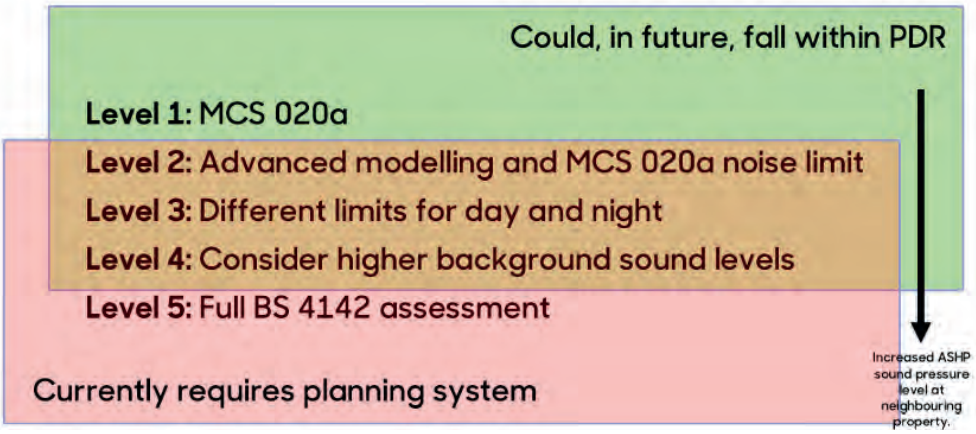
This second pathway demands formal noise impact assessment, typically invoking BS 4142, costing >£1,000+ plus planning fees and delays. For many homeowners and installers, this burden proves prohibitive. Government research confirms many abandon projects at this stage[3]. The binary system lacks proportionality, with no middle ground for installations marginally failing MCS 020 a) yet demonstrably having acceptable acoustic impact. An optimised approach applying the science and professional experience is therefore needed. P36

References

1 Harvie-Clark, J, Hill, J, Dobinson, N, Hinton, R (2025). A Risk-Based Framework for Acoustic Assessment of ASHPs - From Domestic to Commercial Applications. In: Proceedings of Forum Acusticum 2025. Málaga, Spain.

2 BS ISO 9613-2, Acoustics — Attenuation of sound during propagation outdoors. Part 2: Engineering method for the prediction of sound pressure levels outdoors.

3 Department for Energy Security & Net Zero. (2023). Review of Air Source Heat Pump Noise Emissions, Permitted Development Guidance and Regulations. DESNZ Research Paper Number 2023/046.



Above: Slide by Matt Torjussen, Salford Acoustics Research Centre ©Institute of Acoustics 2025

A proportionate solution – why BS 4142 isn't the only way

Members may question why full BS 4142 assessment shouldn't be the default for all, as many Local Authorities insist on. This raises fair questions driven by reasonable professional considerations, but three key issues emerge:

1. The standard's scope states it addresses 'sound of an industrial and/or commercial nature', a category not covering domestic heat pumps. Currently, domestic fossil fuel boilers and extract fans require no such assessment.
2. The standard acknowledges that 'where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.' Fixed criteria in quiet environments align with BS 4142's own principles, preserving consideration of context and common sense.
3. The economic obstacle is obvious; professional surveys add significant costs to the planning fees that are potentially disproportionate for all applications.

The proposed hierarchical framework offers five graduated pathways for assessment through planning, each aligned with the level of acoustic risk that exists:

Level 1 retains existing MCS 020 a) methodology as the baseline for straightforward, low-risk installations. This remains the simplest, most cost-effective pathway for installations not qualifying for PDR.

Level 2 introduces crucial refinement, decoupling calculation method from target criterion. Installations marginally failing Level 1 could demonstrate compliance with the same 37 dB(A) target using more accurate ISO 9613-2 sound propagation modelling. This single change would immediately enable many stalled installations through simple calculation submissions to local planning authorities, potentially overseen by qualified acousticians as desktop checks.

The justification for maintaining 37 dB(A) without character corrections draws from Scottish practice where NR 25 commonly applies as internal plant noise limits. Accounting for 12 dB attenuation through open windows and the approximation NR ≈ dBA -6, the external 37 dB(A) limit equates to approximately NR 19 internally – providing a prudent 6 dB margin for tonal character.

Introducing two options – MCS 020 a) and modelling to demonstrate compliance has the potential to add confusion to the process. During the MCS consultation, installers fed back that they want as simple process as possible. An alternative would be to use the outcomes from modelling and in-situ measurements to provide a sufficiently robust case to review, and if necessary, refine MCS 020 a).

Level 3 introduces time-differentiated limits, acknowledging that acoustic environments and human activities differ between day and night. Drawing on European practice, this pathway permits 45 dB(A) daytime whilst maintaining 37 dB(A) at night. Modern ASHPs typically feature 'quiet mode' or night-time setback functions, giving installers flexibility to optimise performance across diurnal cycles without compromising night-time amenity.

Heat pump 'quiet modes' tend to reduce the heating capacity by 20-30%. Additional, popular flexible electrical tariffs often require off-peak usage for consumers to access the best prices which in turn influences consumer behaviour and operational times of the heat pump. Requiring 'quiet modes' and therefore reduced heating capacity during such times may not be a popular approach and would certainly be hard to manage.

Level 4 addresses installations in higher ambient sound environments. Where background levels demonstrably exceed 37 dB(A) at night – justified through site-specific surveys – proportionately higher ASHP sound levels may be acceptable. This approach broadly aligns with BS 4142 principles whilst avoiding unnecessary urban restrictions where units will be acoustically less prominent. Qualified acousticians would propose suitable targets backed by assessment, with additional costs but enabling higher noise units where necessary.

> "Clear, transparent, proportionate regulatory frameworks are technical necessities and tools for rebuilding public confidence."

Level 5 remains a full BS 4142 assessment path for complex, sensitive or high-risk installations – including tranquil or designated quiet areas, conservation areas or locations where acoustic environment preservation is needed. Even this pathway could benefit from standardisation through ASHP-specific protocols, educing local planning authority inconsistency.

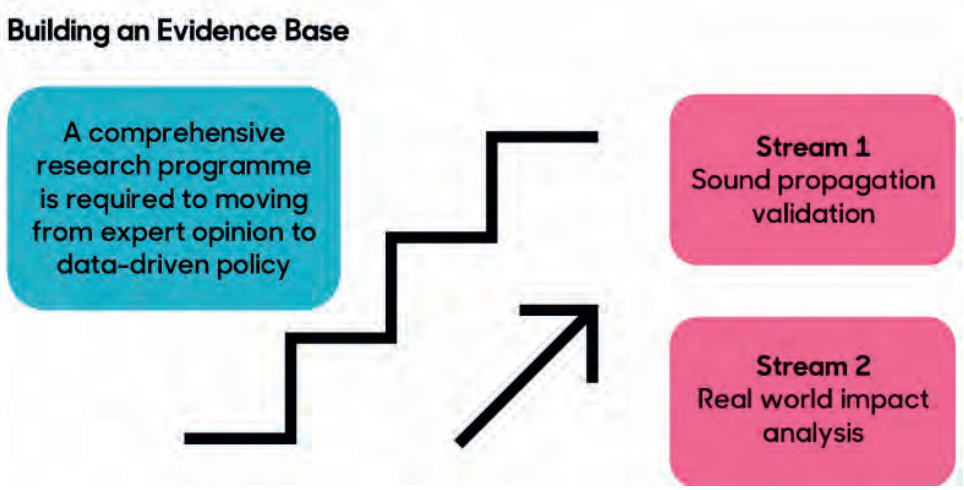
Evidence and implementation

This framework draws on operational models from Scotland, where fixed absolute criteria like NR curves apply routinely without notable complaints, reflecting wider European practice where fixed thresholds facilitate efficient assessment whilst maintaining amenity.

Robust implementation requires comprehensive evidence. The working group outlined a two-stream research programme where more work is needed to understand how ASHP sound impacts neighbours: validation of sound propagation models through systematic comparison of MCS 020 a) and ISO 9613-2 predictions, then benchmarked against measured sound propogation for real-world scenarios, coupled with real-world installation audits examining compliant sites and complaint-generating locations. This 'bottom-up' and 'top-down' approach seeks to provide definitive evidence for policy adoption.

Beyond neighbouring properties

The framework also addresses an important equity issue – acoustic impact on occupants themselves. Whilst MCS 020 a) protects neighbouring properties, it provides no guidance for residents where ASHPs are installed. For owner-occupiers, internal impact assessment could be optional best practice, empowering informed decisions. However, for rental properties where tenants lack agency over installation decisions, consideration is recommended to protect vulnerable residents from placements prioritising convenience over wellbeing, aligning with UN Sustainable Development Goal 10 on reduced inequalities.



Above: Slide by Matt Torjussen, Salford Acoustics Research Centre ©Institute of Acoustics 2025

The wider context

Technical and regulatory challenges exist within broader social landscapes. Evidence is striking; 'are heat pumps noisy?' is searched online 480 times monthly in the UK – double Germany's rate and orders of magnitude higher than France or Spain[4]. This culturally specific anxiety, amplified by negative media coverage, creates expectations manifesting as genuine adverse experiences through documented nocebo effects[5].

Clear, transparent, proportionate regulatory frameworks are therefore technical necessities and tools for rebuilding public confidence. Demonstrating that appropriate units in suitable locations present manageable acoustic impact and providing credible, authoritative guidance backed by professional bodies, such frameworks can counter misinformation and enable objective public discourse about this vital technology.

The possible path forward

The acoustics profession has an opportunity, indeed responsibility, to contribute constructively to national decarbonisation objectives whilst maintaining appropriate environmental protection. The proposed hierarchical framework offers pragmatic paths removing unnecessary barriers without compromising the public amenity.

The working group's proposals will be now used to inform guidance drafting for consideration by CIEH, and support by government departments responsible for planning and energy policy. The approach represents proportionate, evidence-based thinking characterising modern environmental regulation sophisticated enough to address genuine risks, yet practical enough to facilitate essential societal transitions. The current binary system hinders progress toward critical climate objectives. Acoustics need not be a barrier to heat pump rollout, with appropriate framework evolution, it can enable progress. The question is whether the profession, working with policymakers, will move decisively to grasp and support this opportunity to demonstrate how the acoustics industry technical expertise serves both environmental protection and urgent societal need to deliver net zero in the face of global energy insecurity. This is sustainable acoustics in action, delivering UN SDG's 3, 10, 11 and 16 in the process.

If you have views either way on this please set those out to the author at **progers@sustainableacoustics.co.uk** who will refer those into the group's discussions.

References

4 Educating the UK About Heat Pumps 2024, **https://jlcreativeltd.com/blog/educating-uk-about-heat-pumps**

5 Thorne, P S; Osterberg, D; Johannsen, K. Wind Turbines and Health - Environmental Health Sciences, 2019. **https://ehsrc.public-health.uiowa.edu/wp-content/uploads/2019/01/IEC_Wind_Health_Paper_2019_FINAL.pdf**

Brian Hemsworth, BSc, CEng, FIOA

Brian Hemsworth, BSc, CEng, FIOA, a key figure in the world of railway noise research, development and consultancy during a career spanning more than 40 years, died peacefully on 31 July 2025 at the age of 82.

By Paul Shields and Rick Jones, with the help of Brian's family

Brian was a devoted husband to Barbara, a loving father to his three children and a proud grandfather to six. Family was especially important to Brian and he was often accompanied to national and international events by Barbara. He made a huge contribution to the field of railway noise over a lengthy career and he will be very much missed by his wider acoustics family.

Career

After leaving school in Doncaster, Brian attended The University of Southampton to study astronautics and aeronautics, obtaining a BSc in 1965. This led to an initial career in the aviation industry, but he soon joined the British Rail Research Department in 1972. While initially working on fundamental research into mechanisms of rolling noise generation, he was required to attend public meetings in 1974 along a proposed rail route through Kent to the Channel Tunnel, to answer concerns regarding its noise impact. This was no doubt the first example of his career-long ability to engage and reassure concerned non-specialists, ranging from members of the public to senior politicians.

The 1974 proposal for the Channel Tunnel rail route was shelved in 1975, but the interest in line-side noise control that it generated led to research into noise barriers for fast passenger trains, which Brian was directly involved with.

By 1978 Brian had already become established as a leading voice in his field, providing the railway input to the Noise Advisory Council's Guide to Measurement and Prediction of Leq. This publication was an early encouragement from the Council for that index to be adopted to replace previously-used environmental noise indices, an aspiration that has largely come to pass.

During the 1980s Brian developed and managed several leading railway noise and vibration research projects. He also worked directly on the resurrected Channel Tunnel Rail Link project and it became apparent when considering the noise impact of the proposed route that existing approaches to noise prediction and compensation for affected communities were inadequate. As a result, the government developed the Noise Insulation Regulations for Railways (1996) and the associated 'Calculation of Railway Noise 1995' (CRN), with significant input from Brian.

In the early 1990s Brian became Head of Acoustics at BR Research and continued to lead a wide range of noise and vibration research and consultancy activities. However, as railway privatisation approached in 1996, he set up his own independent consultancy company and quickly found himself in great demand. Among other roles, he worked as the Noise and Vibration Manager at the European Rail Research Institute (ERRI) in Utrecht overseeing a range of major research projects under the EC's 4th Framework research programme. A further EC initiative led to the 'Harmonoise' project that developed and validated methods for predicting noise levels from road and rail traffic, the findings of which were implemented through the follow-up 'Imagine' project, with Brian as its technical manager. Brian also chaired the noise strategy working group of the cross-industry think tank, the Railway Forum, as well as temporarily relocating to Australia to provide expert advice on three separate rail projects. He was also subcontracted during the early days of the HS2 project to help with the understanding and control of its noise impacts.



Above: Brian receiving his Distinguished Services to the Institute Award in 2017 *(image courtesy of Andrew Jellyman)*

In parallel with his day job, Brian became an associate lecturer at the University of Derby in 1980, a role he held for over 30 years, contributing a popular annual module of lectures on rail noise to the IOA Diploma course on Acoustics and Noise Control.

In recognition of his major contribution to railway acoustics, Brian was awarded the Institute's Engineering Medal in 2006. He was a valued and longtime member of the IOA Midlands Branch and his coordination activities with external organisations such as the Railway Permanent Way Institute, have introduced a less well known facet of ground borne vibration to the populous that would not have been possible without his unique knowledge and network of contacts.

Brian's service to the acoustics industry, the science and the Institute has been significant in many circles, and he will be remembered as an admired and trusted colleague by many acousticians across industry and academia.

Donations in his memory will benefit **Padley@YMCA Derbyshire**. If you'd like to donate online, light a candle or leave a memory of Brian, please visit **www.murraysfunerals.co.uk** (click on Tributes and Donations).

IOA EVENTS FOR 2025-26

REPRODUCED SOUND 2025:
PASSION, PROCESSING, AND PERCEPTION
Organised by the Electroacoustics Group
18-20 November 2025
The Old Swan, Harrogate

See exactly what to expect at Reproduced Sound 2025 here:
Reproduced Sound updated Mark Bailey - Google Drive
https://drive.google.com/drive/folders/1KgKARTik8re3QbWDoWk9WGJueqqttJlR

Edited other videos:
https://drive.google.com/drive/folders/1fOneIBAMLroK9lRpR4tn5GORdJ5lX1FH

Other event

2026
ICUA 2026
INTERNATIONAL CONFERENCE ON UNDERWATER ACOUSTICS
15-18 June 2026
University of Strathclyde Technology & Innovation Centre, Glasgow
The call for papers has been issued please visit
https://www.ioa.org.uk/civicrm/event/info?reset=1&id=1022

For more information on upcoming IOA events, please visit the IOA Events page at https://www.ioa.org.uk/events



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Current parliamentary and policy news



Mary Stevens supports the IOA to bring acoustics to the attention of policy makers and here, she reports on key consultations on acoustics and noise, including proposed extensions to Part O for lofts and flats in Wales, Scotland's reviews of permitted development rights and offshore wind noise impacts, and the UK Government fast track call for evidence on licensing reform.

Above: Notable in the Welsh Government's proposed updates to Part O is the extension of regulations to cover loft conversions

The new parliamentary term has got underway with consultations of significance to the acoustics community announced by Wales, the Scottish Government and England. In Scotland, revisions to permitted development are proposed that look to align more closely with the changes recently put forward for England and Wales. In Wales, there is a proposal to extend building regulations in Part O to cover flats and loft extensions. Following the discussions of issues around the nighttime economy in Parliament, in October the Government issued a fast track call for evidence covering the agent of change and event licensing.

Over 30% of Europeans exposed to unhealthy noise

The European Environment Agency's annual update on the state of Europe's environment includes recent data on transport noise reported under the Environmental Noise Directive (END). This shows that from 2017-2022 a slight decrease in the population affected by harmful noise, i.e. exposed to levels above the reporting thresholds defined in the END, is estimated. However, 2022 data still shows that around 150 million people, or over 30% of Europe's population, may be exposed to these noise levels. This rises to over 50% in many urban areas. Road traffic is still the primary source of noise pollution in both urban and rural areas. Railway and aircraft noise affect fewer people but the report says that they are significant contributors to local noise issues. It is estimated that long-term exposure to noise pollution from transport in the EU currently contributes to about 66,000 premature deaths, 50,000 cases of cardiovascular diseases and 22,000 cases of type 2 diabetes each year. The report also states that the EU is unlikely to achieve its 2030 zero pollution action plan (ZPAP) target on noise without further action, including regulatory or legislative change.

Full report can be found here **https://www.eea.europa.eu/en/europe-environment-2025/thematic-briefings/environment-and-human-health/environmental-noise-and-impacts-on-human-health**

Wales propose inclusion of loft conversions and flats in Part O

The Welsh Government is consulting on changes to building regulations covering the consideration of ventilation and overheating. The review of the Building Regulations Part L:2025 (conservation of fuel and power), includes changes to Part F (Ventilation) – which includes noise from ventilation equipment and open windows, and Part O (overheating), which covers ventilation and external noise impacts. Notable in the proposed updates to Part O is the extension of regulations to cover loft conversions and new windows and doors in flats.

The consultation is open until 27 November 2025 and members are preparing a response: **https://www.gov.wales/building-regulations-part-l-2025-review**

Fast track call for evidence on agent of change

Protecting established music venues and the nighttime economy from noise complaints from new developments has recently been raised by politicians in the House of Commons and House of Lords. The issue has been discussed in debate on the Planning and

Infrastructure Bill and a number of MPs have raised questions about the issue. In response the Government promised a consultation on reform. In October they issued a fast-track call for evidence, inviting views and evidence on proposals for a review of the licensing system. It focused on pubs, clubs, music and other venues licensed under the Licensing Act 2003. The review included questions covering pavement licensing, temporary event notices and giving more weight to the Agent of Change principle. Announced as a 'four week blitz', and inviting punters, landlords and communities to comment, Prime Minister Keir Starmer said: "This review is about cutting red tape, boosting footfall and making it easier for venues to put on the kind of events that bring people together. When our locals do well, our economy does too." The IOA convened a working group to draft our input to the review, which closed on 6 November 2025.

Full review can be found here: **https://www.gov.uk/government/calls-for-evidence/reforming-the-licensing-system**

Scotland consults on permitted development changes

The Scottish Government has consulted on potential amendments to permitted development rights intended to simplify planning processes and encourage new home provision in cities and rural areas. Measures covered are similar to the consultation undertaken for England and Wales, to which we responded. For air source heat pumps, proposals include requiring installation to comply with the current Microgeneration Certification Scheme Standard (MCS) 020. Changes are also considered to allow up to two ASHP on detached homes and to allow use for heating and cooling, but not solely cooling. They do not consider there to be sufficient data or a clear methodology that would allow permitted development for more than one ASHP to be installed on flatted buildings or terraced or semi-detached properties, so a planning application would still be required to assess issues including potential cumulative noise. Changes are also proposed to allow change of use under PDR from commercial to residential buildings in both urban and rural areas.

The consultation closed on 27 October 2025 **www.gov.scot/publications/permitted-development-rights-support-provision-new-homes-consultation/**

Scotland: response to consultation on marine plan for offshore wind

In responding to the Scottish Government consultation on an Updated Sectoral Marine Plan for Offshore Wind Energy, the IOA consider the draft plan allows for suitable provision for the mitigation of airborne and underwater noise, and that existing practices for monitoring and regulating noise impacts are sufficient. Our response suggests amending the draft to cover mitigation methods for piling noise that may impact people. It also notes several similar statements are made on the potential for underwater noise to have displacement or barrier effects on marine mammals and recommends broader terminology is adopted to account for the range of potential effects that marine mammals could be subject to. The Scottish Government has now published social impact research commissioned to inform the draft plan. This finds studies of noise impacts tend to focus on onshore wind, and that 90% of residents reported to be annoyed by noise live within 900km of a windfarm. It therefore concludes that offshore windfarms likely are too far away to cause noise disturbance to residents.

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

Infrastructure planning consultation includes onshore wind

A consultation is now open seeking views on changes to guidance, public sector services and secondary legislation to streamline infrastructure consenting for Nationally Significant Infrastructure Projects (NSIPs) in England and Wales. It also seeks views on the removal of statutory pre-application requirements for onshore wind projects under the Town and Country Planning Act 1990 guidance, stating this approach intends to ensure that onshore wind projects are treated in the same way as other development proposals.

IOA Renewable Energy Advisory group co-ordinated a response to the consultation which closed on 27 October 2025. **https://tinyurl.com/NSIPEngandWales**

Members contribute to BS 8233 revision response

Our response to the consultation on British Standard 8233 *Sound insulation and noise reduction for buildings*, represents the range of views expressed by our members – 119 of whom engaged in our response, via an online meeting and survey. The standard is frequently used by members, as it applies to the design of new buildings and refurbished buildings undergoing a change of use. The revised standard proposes significant changes including changing the recommended approach for assessing dwellings, sound in offices, sound from building services and guidance on sound insulation of open windows for overheating. BSI expressed their appreciation of the work that contributed to our submission to the revision process.

Our full comments can be found here: **https://www.ioa.org.uk/news/consultation-response-bs-8233-sound-insulation-and-noise-reduction-buildings**

Construction products standards amended

Amended standards for construction products have been published in line with the The Construction Products (Amendment etc.) (EU Exit) Regulations 2019 (S.I. 2019/465)

Notice of Publication 0123/25: Designated Standards - Construction Products. Included in the standard are EN 13950:2014 Gypsum board thermal/acoustic insulation composite panels, EN 14496:2005 Gypsum-based adhesives for thermal/acoustic insulation composite panels and plasterboards and EN 14388:2005 Road traffic noise reducing devices.

Notice of Publication 0123/25: Designated Standards - Construction Products



About the author:
Mary Stevens supports the IOA to bring acoustics to the attention of policy makers

A DAY IN THE LIFE OF

Hasina Rahman (nee Begum)

The population comprises people with many different backgrounds, creating a rich diversity of culture. Why then, is the acoustics profession and engineering more widely, not as diverse as the situations it faces?


Hasina Rahman

It is essential that the acoustics profession, and the IOA with it, strives for a membership representing everyone. The IOA does this by creating an environment in which people can openly be themselves and gain the support they need to achieve their full potential. We cannot improve the diversity of our profession by working alone – we need to work together to understand the challenges faced by our peers and how we can work together to overcome them or remove them entirely.

In this third article of our EDI series we meet **Dr Hasina Rahman**, an early career researcher at the University of Warwick (WMG). Her EPSRC-funded project, SUSTAIN, works on the impact of residual stress on the mechanical properties of recovered and partially recrystallised steel.

Whilst at Warwick, she has also worked on the process engineering of high-volume manufacture thermosetting carbon fibre composites in automotives. Another project concerned intelligent sorting of plastics using chemometrics and machine learning algorithms to facilitate the upcycling of waste plastic and promote a more sustainable and circular economy.

She wants to empower and inspire the next generation of scientists and believes that significant change begins at the grass roots and through creating platforms for open discussions in smaller, less-progressive communities. She aspires to be a voice for the underrepresented, breaking barriers and succeeding as a Muslim woman in engineering. “Growing up, there were never any women in Engineering that looked like me. I want to change that, so that hopefully, young girls can look at me and say I want to be just like her, or better yet, even better than her!”

1. **What first sparked your interest in science?**
I am the second youngest of eight siblings and my oldest brother, who is also a scientist, worked on hydrogels for contact lenses. As a child, he took me to many science museums and libraries and encouraged me to read science books filled with wonderfully weird and wacky experiments that always asked the question "why?"

2. **Aerogels have been known about since the 1930s – how did you decide that this was the field you wanted to focus your career on?**
I specifically focused on silica aerogels as my PhD research project. I have a keen interest in polymers and appreciate how versatile they are, with a vast range of properties suited for many practical applications. Silica aerogels combine precursors to form a network of silicone polymers, which then undergo a supercritical drying process to produce an aerogel. I chose aerogels because of their wide applications. Acoustic insulation using aerogel blankets was something I had never heard of before, but found new and exciting, combining multiple disciplines like chemistry and acoustics. The bonus was learning that NASA had already implemented aerogels in their space technologies. The fact that aerogels are used in such diverse industries is what really encouraged me to pursue this fascinating topic.

3. **How long have you been working in this discipline?**
For engineering as a whole, seven years, but about four years in aerogels (the duration of my PhD).

4. **What gives you the most job satisfaction?**
Seeing a tiny idea from the lab scaled up and become a commercial product available on the market. I also love talking to anyone curious about my work. It's rewarding knowing that the research I share is groundbreaking and helps people understand how scientists and engineers really work, rather than the fictional portrayals they see in books and on TV.

5. **Where do you go for advice?**
Anyone I feel that can help me. I like gaining different perspectives, as it helps me weigh the pros and cons in my head before making an informed decision. I seek advice on a human level, but sometimes I also cross-check with the internet – especially now that we have so many generative AI tools.

6. **What is the most challenging aspect of your job?**
Communicating my work in a way that reflects the same passion and importance I feel for it. I constantly try to find ways to make my work relatable to the layperson.

7. **How do you get your job out of your hair?**
By doing something completely different that requires very little brain power or explanation – like cycling or trying a new recipe at home. I also enjoy taking my 15-month-old son to soft play; being silly with him helps me fully switch off and just enjoy the moment.

8. **How much contact do you have with other scientists, specifically acousticians?**
I was part of the UK Acoustics Network Plus (UKAN+), which did an excellent job of bringing acousticians from academia and industry together. By taking an active role in outreach and equity, diversity and inclusion (EDI), I built my own network within UKAN+ and keep in touch with many acousticians. Additionally, due to the nature of academia, I meet scientists and engineers almost every other day.

9. **What is your desert island book/film/luxury?**
Book: *A Thousand Splendid Suns* by Khaled Hosseini.
Film: *The Imitation Game*
Luxury: Definitely a good leather bag.

10. **What makes your day shine at work?**
Helping people and learning about their cutting-edge research. It makes me appreciate the excellent work that individual researchers and engineers, are doing to design something groundbreaking for the world to use.

11. **What is the most important quality an engineer/researcher should have?**
For an engineer, it's being able to do maths quickly and precisely. In engineering, we say: *"measure twice, cut once" because numbers, measurements and dimensions are critical, whether designing a tool or cutting samples".*
For a researcher, it's adaptability. Since completing my PhD in acoustics and mechanical engineering, I have worked at the University of Warwick for three years, covering projects in carbon fibre composites, thermoplastics, polymers, circularity and now steel manufacturing – with a maternity break in between. This shows how quickly I've had to learn new skills and adapt to different research areas, demonstrating the versatility required in research.

12. **What is the best bit of professional advice you have been given?**
My undergraduate form tutor once told me: *"Don't ruin your present trying to think about your future."* It has always stuck with me and something I try to remind myself of.

13. **What piece of advice would you pass on to someone new to your field?**
Take every opportunity you can – you never know which door it will open. Speak to a wide range of people across multiple disciplines to broaden your perspective. P44

"Growing up, there were never any women in engineering that looked like me. I want to change that, so that hopefully, young girls can look at me and say I want to be just like her, or better yet, even better than her!"

14. **How do you manage your stress levels, i.e. how do you relax?**
With a cup of tea, a biscuit, and a good chat with my husband at the end of a long day.

15. **What do you dislike about your job?**
The lack of empathy shown towards women returning to work after maternity leave – something I experienced when I returned in June 2025. After listening to other women, I've realised this is an endemic issue with no clear resolution.

16. **Who has been the most influential person in your life?**
My mother. She wants me to excel in life and I seek her advice often. It's not always easy explaining things in another language (my mother tongue is Bengali), but her support has been invaluable. I wouldn't be where I am today without her.

17. **What keeps you awake at night?**
Job security. Being a scientist or engineer in higher education means contracts are usually tied to project funding, so I'm constantly on fixed-term contracts. It's exciting but also insecure, as I have to plan my next step months before a contract ends. This is especially stressful now that I have my own family.

18. **How do you see your career evolving?**
I hope to grow at an international level and be recognised globally as an expert in my field.

19. **What do you see as your next steps professionally**?
I would like to become a senior research fellow working towards an associate professorship. Ideally, I'd like to combine my PhD acoustic work with my current composites or steels research.

20. **If you had the chance, what would you change about your career – have you taken any wrong turns?**
I would have taken more opportunities to learn about machine learning and AI. With technology advancing so rapidly, these skills would be invaluable, particularly for achieving a better work-life balance by enabling more remote research work alongside childcare.

21. **What would you consider to be the biggest scientific advancement during your career**?
Definitely AI – it's everywhere.

22. **How did maternity leave impact your work?**
My return to work after maternity leave was very bumpy. My fixed-term contract was due to end in March 2025, but my maternity leave wasn't ending until June 2025, leaving a four-month gap of unemployment that maternity rights did not cover. HR didn't communicate this to me before I went on leave, and I later found out that fixed-term contracts override maternity rights. It was devastating as a first-time mother to be applying for jobs while on leave.
Fortunately, I secured a role in steel processing and characterisation just two days before my previous project ended on 31 March 2025. It was an incredibly stressful time and given the strong focus on workplace equality, I would have expected this issue to be addressed by now.

23. **What question would you like to put to the next acoustician in this series of articles?**
What change do you think is needed to encourage more female acousticians in this discipline?

If you know someone who might like to take part in this 'Day in the life' series of articles, please contact the editor at **nickyr@warnersgroup.co.uk**

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Predicting change, the new ISO 9613-2:2024

The 2024 revision of ISO 9613-2 updates the long-standing 1996 outdoor sound propagation standard to improve consistency, software implementation, and applicability to tall sources. Incorporating recommendations from ISO/TR 17534-3:2015, it refines ground, barrier and meteorological corrections, addressing known issues while expanding scope. However, the changes can alter calculated sound levels by –3 to +11 dB at long distances, raising questions about compatibility with previous calculations. Ongoing ISO review aims to resolve these discrepancies and enhance reliability.

By Simon Shilton, Acustica Ltd, Andy Pagett, AECOM, and Richard Jovic, Environment Agency

On 31 January 2024 ***BS ISO 9613-2:2024 – Acoustics. Attenuation of sound during propagation outdoors.*** *Engineering method for the prediction of sound pressure levels outdoors*[1], was published, which revised and replaced the original 1996[2] version of this widely used engineering method. The updated version includes the modifications developed for reasons of quality assurance where the method is implemented in software, as described in ISO 17534-1:2015[3] and ISO/TR 17534-3:2015[4], plus some additional amendments to expand the scope of application, for example to high sources such as wind turbines.

So, after almost 20 years why were the recommendations within ISO/TR 17534-3 developed, and after almost 30 years why was it considered necessary to revise the methodology? How was the methodology revised in 2024, and what effect could this have on calculations of outdoor sound propagation? These are the key aspects we wish to address, but it may first be useful to look back o the origins of the ISO 9613-2 methodology.

Outdoor sound calculation methods

As sound propagates outdoors between a source and a receiver it can be influenced by distance, by topography, by interaction with the ground and by atmospheric effects. There are a significant number of theories and numerical methods for the various aspects of outdoor sound propagation, however the majority of standardised calculation methods are largely empirical, often described as engineering methods. Commonly used engineering methods used in the UK for outdoor sound propagation include the Calculation of Road Traffic Noise 1988 (CRTN88)[5], the Calculation of Railway Noise 1995 (CRN95)[6], Common Noise Assessment Methods for Europe 2020 (CNOSSOS-EU) in Annex II of EU Directive 2002/49/EC on environmental noise[7], BS 5228-1:2009[8] and CONCAWE 1981[9].

These engineering methods tended to be developed based on a mixture of acoustic theory combined with empirical factors. The methods were typically designed to provide answers equivalent to the measured levels when replicating the situations used for the verification process. It is not considered particularly contentious to suggest that no engineering method has yet been designed to simulate every real-world situation.

Calculation models are created when the numerical methodology is supplied with the input datasets it P48

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needs to undertake the calculation. Historically these began with paper, ruler, pen and slide rule or calculator, have developed into computer software or spreadsheet applications, and are increasingly finding themselves as tools within geographical information systems (GIS) or even geospatial databases. The type of model to use will typically depend on the complexity and size of the situation to be analysed. Many UK researchers or engineers will use spreadsheet models, or one of the range of computer software systems available when working with specific sites for housing, industry, roads or railways. These software tools combine data on the sources, the receivers and the propagation path – typically terrain, topography, buildings, barriers and meteorology.

ISO 9613

Development on ISO 9613 commenced in 1983 with the formation of ISO WG24. The aim was to enable noise levels in the community to be calculated from sources of known sound emission. ISO 9613, Part 1 Calculation of the absorption of sound by the atmosphere[10], was published 3 June 1993, and is essentially an updated version of ANSI Standard SI.26 of 1978. The standard provides a formula for the calculation of sound absorption and a series of lookup tables of pre-calculated values. Recently, there has been a general move within engineering calculation methods, including CNOSSOS-EU and ISO 9613-2:2024, to use the formula with exact octave band centre frequencies rather than the lookup tables.

ISO 9613, Part 2 General method of calculation was published 5 December 1996. It was mainly based on the integration of the Netherlands guidelines on noise from industry April 1981[11], the joint Scandanavian 'Nordforsk Project' general prediction method[12], and the guidelines developed for the control and regulation of noise in Germany[13,14]. This was said to provide the new method with practical experience based on prior use in the countries of origin[15].

ISO 9613-2:1996

The ISO 9613-2:1996 method is general in the sense that it may be applied to a wide variety of sources, and covers most of the major mechanisms of attenuation for ground-based point sources. It does not apply to sound from aircraft in flight, or to blast waves from mining, military or other similar operations. The method aims to determine the average sound level $L_{Aeq,l}$ under meteorological conditions favourable to propagation. That is moderately downwind propagation, or equivalently, propagation under well-developed, but moderate ground-based temperature inversion, such as commonly occurs at night. These conditions were chosen for stable propagation and also to provide an appropriate condition for a specific community level which is seldom exceeded.

The meteorological conditions favourable to propagation are described as: wind direction within the angle ±45° of the direction connecting the centre of the dominant sound source and the centre of the specified area; with the wind blowing from the source to the receiver; with wind speed between one and five m/s, measured at a height of three to 11 metres above the ground; with no strong temperature inversions near the ground and no heavy precipitation. Inversion conditions over large water surfaces are not covered.

This assumption of favourable, moderate downwind propagation is consistent with CRTN88 and CRN95, and should be accompanied by the same warning, that any attempt at validating measurements with calculations, or vice versa, relies on measurement locations which are downwind of the source being studied.

The method also provides for the long-term average sound level to be calculated using a small correction C_0 (0 to +5dB) based on elementary local weather statistics. This long-term average normally covers a variety of weather conditions, such as over several months or a year. It is suggested that meteorological conditions favourable to propagation for 50% of the time period of interest would result in C_0 of +3 dB, and that experience suggests values in excess of 2 dB are exceptional; there are no further details on how to derive values for C_0 for the calculation of long-term sound levels.

The method consists specifically of octave band algorithms, for eight bands with nominal centre frequencies from 63 Hz to 8 kHz, for calculating the physical effects on sound propagation of geometrical divergence, atmospheric absorption, ground effect, reflection from surfaces and screening from obstacles. The effect of atmospheric turbulence is included implicitly and additional information concerning propagation through housing, foliage and industrial sites is included in an annex. There is also a simplified version of the method which may be used for the calculation of overall A-weighted sound pressure levels, provided propagation is over porous, or mostly porous, ground.
The equivalent continuous downwind octave-band sound pressure level at a receiver location, L_{fT}(DW), is calculated for each point source, and its image sources using the equation:

$$L_{fT}(\mathrm{DW}) = L_w + D_c - \mathrm{A}$$

Where:

- L_w is octave band sound power level for the point source
- D_C is the directivity correction in decibels, for omni-directional source in free space D_C = 0 dB
- A is octave band attenuation, in decibels, due to propagation from source to receiver P50

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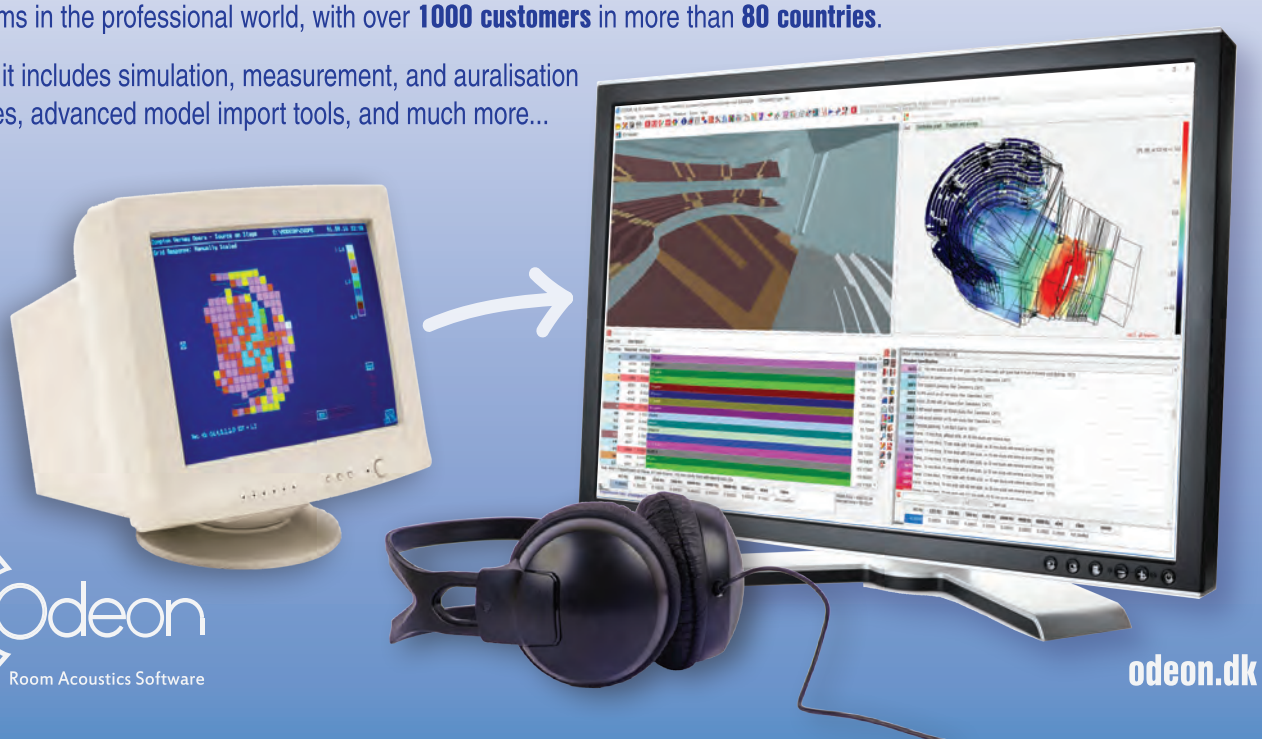
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The attenuation term A is given by:

$$A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}$$

Where:

- A_{div} is attenuation due to geometrical divergence
- A_{atm} is attenuation due to atmospheric absorption
- A_{gr} is attenuation due to ground effect
- A_{bar} is attenuation due to barrier(s)
- A_{misc} is attenuation due to miscellaneous other effects, such as foliage (forests), industrial sites and housing

The long-term average A-weighted sound pressure level L_{AT}(LT) is calculated from:

$$L_{AT}(\mathrm{LT}) = L_{AT}(\mathrm{DW}) - C_{\mathrm{met}}$$

Where:

- L_{AT}(DW)) is the equivalent continuous A-weighted downwind sound pressure level
- C_{met} is the meteorological correction:

$$C_{\mathrm{met}} = 0 \quad \text{if } d_{\mathrm{p}} \leq 10(h_{\mathrm{s}} + h_{\mathrm{R}})$$

$$C_{\mathrm{met}} = C_0[1 - 10(h_{\mathrm{s}} + h_{\mathrm{R}})/d_{\mathrm{p}}] \text{ if } d_{\mathrm{p}} > 10\,(h_{\mathrm{s}} + h_{\mathrm{R}})$$

Where:

- h_{s} is the source height, in metres;
- h_{r} is the receiver height, in metres;
- d_{p} is the distance between the source and receiver projected to the horizontal ground plane, in metres;
- C_0 is a factor, in decibels, which depends on local meteorological statistics for wind speed and direction, and temperature gradients.

The estimated accuracy for the equivalent continuous A-weighted downwind sound pressure level, LAT(DW), for a broadband source is provided in Table 5, below:

This was estimated by comparing calculated values with an extensive database of measurements. The accuracy for propagation distances less than 500m varies with distance and height above ground, and there was insufficient evidence to support an estimate of accuracy >500m[15]. The estimates are for downwind conditions averaged over independent situations. They should not necessarily be expected to agree with the variation in measurements made at a given site on a given day. The latter can be expected to be considerably larger than the values in Table 5. The estimated errors in calculating the average downwind octave-band sound pressure levels, as well as pure-tone sound pressure levels under the same conditions may be somewhat larger than the estimated errors given for A-weighted sound pressure levels of broad-band sources in Table 5. There are also a substantial number of limitations (non-meteorological) in the use of individual equations, as described in the text.

Issues with ISO 9613-2:1996

While the 1996 edition of ISO 9613-2 was derived from three existing methods, there have been a number of critiques of the method, both at the time of publication from Attenborough[16], and Witte & Ouwerkerk[17], and subsequently from Paryzch[18], Ray[19], Wilson[20], Brittain[21,22], Economou[23], and Attenborough[24]. In addition to the general observations that all receivers are assumed to be downwind of all sources, which is unrealistic for models with a number of distributed sources, and that geometrical divergence at -6 dB per doubling of distance assumes neutral atmosphere, whereas the rate of divergence downwind or under moderate inversions is often much less, the following areas tend to lead to ISO 9613-2 over predicting insertion loss:

Barriers located far from source or receiver — ISO 9613-2 gives an insertion loss of 4.8 dB for a source and receiver each 2,000m from the barrier and all at the same height. At these distances, rays of sound will usually arc over the top of the barrier and the insertion loss will therefore be negligible. For barriers not relatively close to a source or receiver, ISO 9613-2 ignores arcing of sound over the top of barrier.

More than two barriers affecting propagation — ISO 9613-2 includes provisions for only two barriers. For one barrier, the end paths (diffraction by the vertical end of a barrier) from ISO 9613-2 are clear, but for two barriers the end paths are not as well defined. ISO 9613-2 does not address more than two barriers and as the number of barriers increases, the combinations of end paths increase dramatically. The number of barriers is the number through which a line from a source to the receiver passes. Witte & Ouwerkerk[17] showed P52

Table 5:
Estimated accuracy for broadband noise of L_{AT}(DW) calculated using equations(1) to (10)

Height, h *)	Distance, d *)	
	0 ‹ d ‹ 100 m	100 m ‹ d ‹ 1000 m
0 ‹ h ‹ 5 m	± 3dB	± 3dB
5 m ‹ h ‹ 30 m	± 1dB	± 3dB
*) h is the mean height of the source and receiver *) d is the mean distance between the source and receiver		
NOTE – These estimates have been made from situations where there are no effects due to reflection or attenuation due to screening		

References

16 Keith Attenborough, "Aspects of the new ISO standard for outdoor noise prediction," Acoustic Bulletin, UK, (January/February 1996).

17 R. Witte and M. Ouwerkerk, "Comments on ISO 9613-2," INTER-NOISE 96, Liverpool, (1996).

18 Dave Paryzch, "Handling of barriers in ISO 9613-2," Special Session on ISO 9613-2, Proc. NOISE-CON 2004, Baltimore, 2004.

19 Elden Ray, "Applications of attenuations and reflections in ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation," Special Session on ISO 9613-2, Proc. NOISE-CON 2004, Baltimore, (Noise Control Foundation, Poughkeepsie, New York, 2004).

20 Keith Wilson, "Atmospheric effects in ISO 9613-2," Special Session on ISO 9613-2, Proc. NOISE-CON 2004, Baltimore, 2004.

21 Frank Brittain, "Noise Modeling Using ISO 9613-2 For Designing Facilities To Meet A Not-To-Exceed Community Noise Limit", Proc. Noise-Con 2004, Baltimore, 2004.

22 Frank Brittain and Marlund Hale, "Some Limitations of Ray-Tracing Software for Predicting Community Noise from Industrial Facilities", Proc. Noise-Con 2008, Dearborn, Michigan, 2008.

23 P. Economou and P. Charalampus, "A Comparison of ISO 9613-2 and Advanced Calculation Methods Using Olive Tree Lab-Terrain, an Outdoor Sound Propagation Software Application: Predictions Versus Experimental Results", Proc. Of Institute of Acoustics, Vol.34 Pt. 1. 2012.

24 Keith Attenborough and Timothy Van Renterghen, "Predicting Outdoor Sound, Second Edition, CRC Press, 2012.

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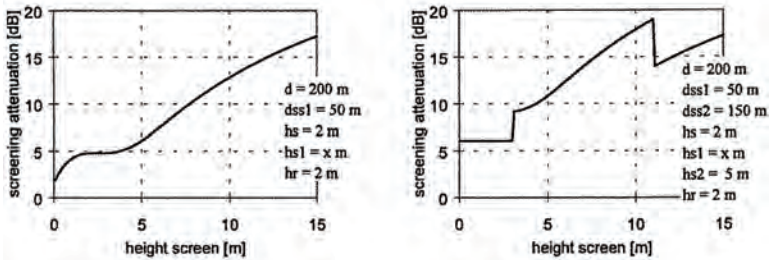
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how the transition from single to double diffraction causes sharp discontinuities of about 5 dB, potentially leading to a situation where reducing the height of one barrier results in an increase in attenuation. Figure 1 (right). Figure 2 shows how a potentially dominant end path for two barriers will be missed[22] by most ray-tracing software due to ISO 9613-2 using straight ray paths to determine barrier effects for downwind propagation which actually have curved ray paths.

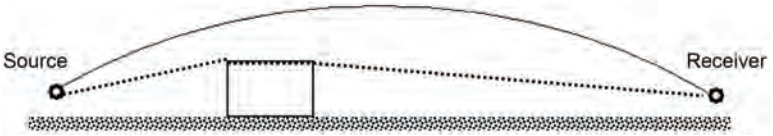
Speed bump barriers — using the barrier formula in ISO 9613-2, a barrier with the height of a speed bump that does not block the line of sight often has a substantial and unrealistic insertion loss[18].

Very Low Barriers — the methodology for barrier insertion loss in ISO 9613-2 takes only the difference in path length into account when a barrier blocks the line of sight between a source and a receiver. In reality, the barrier will have little effect unless the absolute height of the barrier is at least roughly a wavelength at the frequency of interest, this can result in attenuation at low frequencies being over predicted by up to 9 dB for finite length barriers[18].

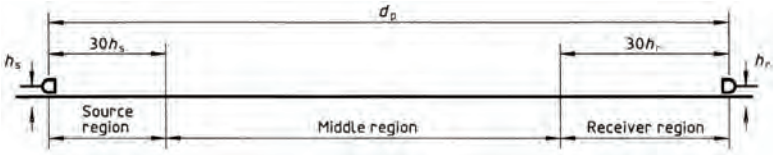
Very High and Very Low Sources — ground effects for very low and very high sources are unrealistic. A source height of zero provides no ground attenuation, and a very tall stack top can have many km of ground attenuation. Ray[19] suggested a minimum source height should be 1.5 m. According to ISO 9613-2, the source and receiver regions can have ground attenuations over distances far greater than the source to receiver distance (ISO 9613-2 allows 30hs + 30hr >> dp), Figure 2, resulting in no middle region, and the source and receiver regions overlapping.



Above:
Figure 1: Screening attenuation with one barrier with differing height for 500 Hz (left), and screening attenuation for two barriers with differing height of the first barrier for 500 Hz (right) (After Witte & Ouwerkerk[17])

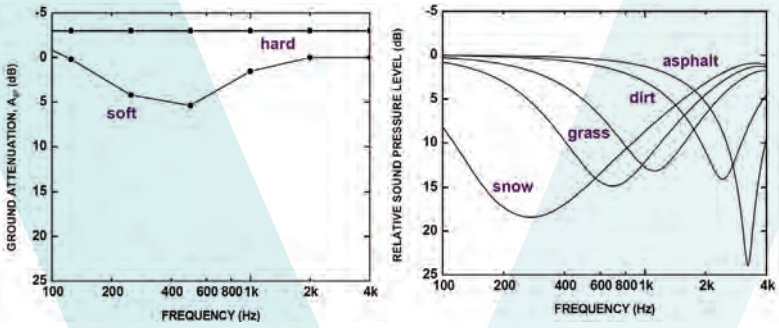


Above:
Figure 2: Curved ray in downward reactive atmosphere arcing over the top of a building without attenuation, and the diffracted ray assumed by ISO 9613-2 that is attenuated. (After Brittain[25])



Above:
Figure 2: Three distinct regions for determination of ground attenuation (After ISO 9613-2:1996)

Ground effects — ISO 9613-2 relies on ground effects for reflection off the ground. This typically works for 'neat' and relative flat ground at low angles of incidence, but can be questionable for high angles of incidence, as well as for rough ground or ground with a lot of ground clutter. In the presence of ground, the formula adds 4.5 dB to the level in the 63 Hz octave band irrespective of the source and receiver heights, range, or ground cover, while the calculations for 2,000 Hz and above are zero when the ground is soft. Daigle and Stinson[26] compared the ground effects algorithm of ISO 9613-2 with theory for a number of selected cases and showed that ISO 9613-2 ground effects tended to underestimate attenuation at 1.2 kHz above 600 m propagation and overestimate attenuation at 250 Hz above approximately 700 m, while omitting any effects from interference rays. Figure 3 shows a comparison between ISO 9613-2 and theory for different ground types at 250 Hz at a distance of 15 m from the source.



Above:
Figure 3: Ground attenuation calculated by ISO 9613-2 (left), and SPL predicted from theory for various ground surfaces (right) at a range of 15 m (After Daigle and Stinson[26])

References

17 R. Witte and M. Ouwerkerk, "Comments on ISO 9613-2," INTER-NOISE 96, Liverpool, (1996).

18 Dave Paryzch, "Handling of barriers in ISO 9613-2," Special Session on ISO 9613-2, Proc. NOISE-CON 2004, Baltimore, 2004.

19 Elden Ray, "Applications of attenuations and reflections in ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation," Special Session on ISO 9613-2, Proc. NOISE-CON

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25 Frank H. Brittain and Marlund E. Hale, "Issues in using ray-tracing software for predicting community noise from power plants," Special Session on power plant noise, Proc. NOISE-CON 2003, Cleveland, (Noise Control Foundation, Poughkeepsie, New York, 2003).

26 Gilles Daigle and Micheal Stinson, "Attenuation of Environmental Noise: Comparing the Predictions of ISO 9613-2 and theoretical models", InterNoise 2005, Proc. Of Rio de Janeiro, 2005

Transmission over uneven or rough ground — as suggested above, ground effects may not be applicable to uneven and rough ground as well as where there is a lot of ground clutter.

Where these aspects arise during a calculation, accuracy is likely to be less than described in Table 5 (see page 50), in which case the method should be used with discretion and an understanding of its deficiencies. These high attenuation factors often result in an overall calculated insertion loss which is higher than will be achieved in practice, meaning the resultant sound pressure level at the receiver will be an underprediction. However, there are other features in ISO 9613-2 which tend to overpredict, for example the 4.5 dB added to the 63 Hz octave band for ground effects, or the 3 dB added to the power level for large sources[24,27,28] obtained from measured levels at one meter. Despite these known issues, the methodology was used extensively, particularly in the UK and across Europe, becoming the Commission Recommended Interim Method[29] for strategic noise mapping of industrial facilities under the Environmental Noise Directive (END) 2002/49/EC and referenced in UK legislation transposing the Directive into the Environmental Noise (England) Regulations 2006[30] (and equivalents in Northen Ireland, Scotland and Wales).

BS ISO 17534

With the ever-increasing use of computer software systems for outdoor sound propagation calculation, developers were increasingly presented with challenges related to the uncertainty due to the description of engineering methods within standards, and the desire of users to achieve calculated results for situations not necessarily described within the standards. This was not unique to ISO 9613-2, it applied to most engineering methods, most of which did not included many, or any, test cases with known solutions and tended to be written assuming that the user would be making conscience decisions regarding how to apply the method, rather than it being automated in software. This tended to lead software developers to make interpretations of imprecise text to find solutions to issues within the standards, as well as extrapolations to the methods to address situations not described in the standards. This resulted in software developers addressing some of the known issues within the method, leading to a range of solutions becoming available, either by default in the software, or by a user activated switch in the calculation settings. This in turn led to a range of results for the same situation being calculated by different software tools, which was highlighted in 2009 with a 95% confidence interval across 1,741 receiver points of 7.8 dB[31] from five different software calculating the same XPS 31-133/NMPB96 models. The issue was beginning to be recognised and in turn led to NordTest NT ACOU 107[32], DIN 45687[33] and subsequently BS ISO 17534-1[34] and PD ISO/TR 17534-2[35].

The main objective of the ISO 17534 series is that the same method, with the same data, will produce the same results, in different software.

Part 1 is a standard which defines the framework and sets out requirements for the method developers, the software developers and the end users. Part 2 is a BS Published Document, or the ISO Technical Report, and contains recommendations for test cases which may be produced by method developers, and used by software developers to self-certify quality assured implementation of the method in software with reference calculation settings. Importantly, the ISO 17534 series does not cover the correctness of the method, only the consistent implementation of the method in software.

ISO/TR 17534-3:2015

In the frame of ISO 17534-1, ISO/TR 17534-3:2015[36] was published to provide recommendations for quality assured implementation of ISO 9613-2 in software. The report includes eight additional recommendations for amendments to the 1996 edition of ISO 9613-2, briefly described below, 20 simple test cases with detailed geometry and step-by-step solutions for propagation up to 200 m, and a recommended example of a declaration of conformity which may be used by a software developer to demonstrate quality assured implementation of ISO 9613-2 in software.

The recommended amendments are:

1. **Screening** – the existing single and double screen logic is replaced by ‘rubber band’ method to determine the diffracted path, supporting multiple vertical and lateral screens. P54

References

24 Keith Attenborough and Timothy Van Renterghen, “Predicting Outdoor Sound, Second Edition, CRC Press, 2012.
27 D.A. Bies and C.H. Hansen, Engineering Noise Control Theory and Practice, Second Edition, (E & FN Spon, London & New York, 1996).
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30 The Environmental Noise (England) Regulations 2006
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34 BS ISO 17534-1:2015, Acoustics. Software for the calculation of sound outdoors - Quality requirements and quality assurance, British Standards Institute, 2015
35 PD ISO/TR 17534-2:2014, Acoustics. Software for the calculation of sound outdoors - General recommendations for test cases and quality assurance interface, British Standards Institute, 2014
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2. **Limitation of the maximal possible attenuation by barriers** – the limit of 20 dB for single diffraction, and 25 dB for double diffraction in any octave band, should only apply for vertical diffraction and not lateral diffraction.
3. **Calculation of the path-length difference, z** – when the path is just in the illuminated zone, the path length difference, z, can be negative, resulting in an increase in level. It is recommended to apply Formula 14 stepwise to ensure that all results are reductions.
4. **Diffraction with barrier on reflecting ground** – addition of a barrier in the path should increase the mean propagation height and reduce the influence of the ground, however with reflecting ground A_{gr} is negative (– 3 dB) and even a very low barrier results in ground effect being removed and the barrier attenuation reduced by 6 dB. It is recommended that Formula 12 should not be used when A_{gr} is negative, this results in levels increasing by up to 6 dB with low propagation heights over large distances.
5. **No level increase caused by barriers due to lateral diffraction** – in rare cases, screening objects on elevated ground can result in total A_{bar} being negative, in which case it should be set to zero.
6. **No ground effect calculated with rays laterally diffracted** – this is to clarify that it is not assessed for lateral diffraction
7. **No lateral diffraction with elevated ground screening the direct ray** – lateral diffraction is not assessed if a ground feature (contour, TIN or breakline) is a screen in the vertical diffraction path. This is to clarify that lateral diffraction is not assessed around land forms.
8. **Multi-reflection – the extension to reflections of higher orders** – specular reflections through mirror image source is described, it is clarified that higher order reflections should also be described through mirror image sources.

For software which is quality assured to ISO 17534 for the implementation of ISO 9613-2, it should be possible for end users to confirm this by requesting a statement of conformity, details of the reference calculation settings and copies of the 20 test case models form the software developer.

Through implementation of the recommended amendments to the 1996 edition of ISO 9613-2, it is also hoped that several of the main issues previously identified have been successfully addressed in a consistent manner between different software tools.
While the recommendations within ISO/TR 17534-3:2015 have become the default configuration within the many of the commercial software tools[37,38], there has also been very little feedback regarding any changes in calculated levels which have occurred since these recommendations were introduced. It can be hoped that this a good sign and that consistent implementation in software has not led to a significant change in the results achieved when using the methodology.

BS ISO 9613-2:2024

Following a systematic review of ISO 9613-2 in 2017, a review was approved and a preliminary work item was assigned to a new working group established to undertake the work. The scope of the review was to address the comments received during systematic reviews over the previous 11 years, and to extend the scope of applicability to higher sources, and specifically wind turbines, as the 1996 edition was being widely used in the context.

WG 61 first met in early 2018 and the 2024 edition of ISO 9613-2 was published in January 2024. The second edition cancels and replaces the first edition from 1996 and while the method is fundamentally unchanged, it includes a number of technical revisions including the recommended modifications from ISO/TR 17534-3:2015.

The main changes to the method include:

- subdivision of extended sources improved (more detailed to decrease uncertainty within software implementations);
- improved classification of the source-directivity;
- improved and more detail specified in the determination of the ground factor G (projection to horizontal plane);
- integration of a correction for A_{gr} to account for the decreasing ground effect for small values of distance/height – harmonising the General method and the Simplified method;
- modified definition of the mean height h_m for the application of the Simplified method;
- integration of the strategy to calculate screening as it was developed within ISO/TR 17534-3;
- modified specification of the barrier attenuation D_z and the correction for meteorological effects K_{met} to eliminate well known shortcomings with low barriers and large source-to-receiver distances;
- inclusion of clear specifications on how to combine vertical and lateral diffraction (from ISO/TR 17534-3);
- improved specification of the minimal extension (width or height) of a reflecting surface;
- multi-reflections up to higher orders (in accordance with ISO/TR 17534-3);
- reflections at vertical cylindrical surfaces;
- additional to the simple method for the attenuation of foliage without any parameter dependencies of the old version ISO 9613-2:1996, a new and more detailed method including the influence of forestall parameters;
- the directivity correction D_c for chimney stacks;
- proposal for a meteorological correction derived from the local wind-climatology; and
- calculation of sound pressure levels caused by wind turbines.

The majority of these changes either broaden the scope of the method, or affect only specific situations. When implementing the changes and calculating the 20 test cases from ISO/TR 17534-3:2015 with a typical propagation distance of 200m, 12 of the test cases give the same results, to 2 d.p., while the largest change in the other eight test cases is -0.37 dB.

References

37 Erwin Hartog van Banda and Theo Verheij, Quality assured implementation of ISO 9613 in software, Proc. Of Acoustics 2017, Perth, 2017
38 Wolfgang Probst, Quality Assurance methods demonstrated with the calculation of sound propagation with ISO 9613-2 and with CNOSSOS-EU, Proc. Of 23rd International Congress on Acoustics, Aachen, 2019

It was therefore expected that the revised method would be very similar in use to the version widely in use within commercial software, which included the ISO/TR 17534-3 recommendations.
Unfortunately, this turned out not to be the case, particularly at distances over approximately 200m with hard ground. Investigations subsequently identified that for the same model, the 2024 edition could result in levels of +5 dB compared to ISO 9613-2:1996 + ISO/TR 17534-3:2015 recommendations, or up to +11 dB compared to the 1996 edition[39,40], the +6 dB difference largely being due to not using A_{gr} when negative, introduced within ISO 17534-3. Reductions of up to around -3.0 dB are also possible due to the introduction of K_{geo}, a correction to account for the vanishing effect of the ground with elevated sources.

So, what are the changes in the 2024 edition which have the most impact on the calculated results?

Ground effect

In the 1996 edition, the effect of hard ground was applied independently of the height of the source and/or receiver. Therefore, a point source above hard ground would *always* be considered to be radiating into half space. In practice as the source-receiver distance approaches, or becomes less than, the source and/or receiver height, the effect of the ground reflection reduces. This is one reason why the 1996 edition was not recommended for source heights below approximately 1.5 to 2.0m above ground. The 2024 edition introduces a correction, K_{geo}, to account for this. For a propagation distances much greater than the source/receiver height, the effect of the ground reflection remains around + 3.0 dB, reducing to around +1.0 dB for a propagation distance equal to source/receiver height, and eventually reducing to 0.0 dB for a propagation distance much less than the source/receiver height.

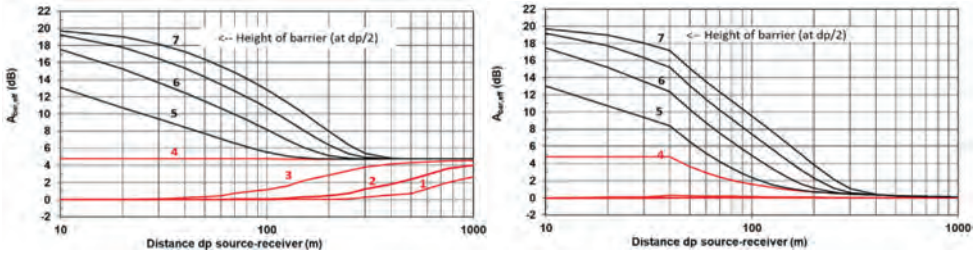
Barrier attenuation

Detailed analysis has been undertaken[40,41], and the main sources of change in results for the general method (in octave bands) are the revised approach to barrier attenuation, D_z, and the amendment to K_{met}.

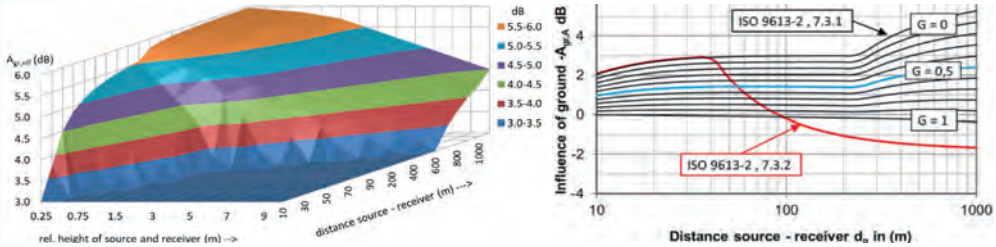
The 1996 edition, even with the ISO 17534-3 recommendations, calculates different barrier attenuation for the general method (octave bands) and the simplified method (overall). As the source receiver distance increases, with a barrier at the mid-point, the general method tends towards 4.8 dB attenuation, regardless of the barrier height, Figure 4 (above), while the simplified method tends toward 0 dB as would be expected, (see right), with ground factor G = 0.5 assumed.

However, in the 1996 edition of ISO 9613-2 negative values of A_{gr} tended to reduce the barrier effect by up to 6 dB for low barriers at long distance over hard ground, as shown in Figure 5, and to a large extent this counterbalanced the effect of the barrier attenuation tending towards 4.8 dB.

While this change was introduced in 2015 through ISO/TR 17534-3 it does not appear to have been strongly identified until after the publication of the 2024 edition.



Above:
Figure 4: ISO 9613-2 + ISO/TR 17534 insertion loss of a barrier, $A_{bar,eff}$, at the mid-point as the source receiver distance increases, for the general metrhod (left) and simplified method (right) (after Probst 2025)



Above:
Figure 5: -Agr (level increase) with general method for hard ground G=0 (left), and general method compared to simplified method (right) (After Probst 2025)

In order to amend the barrier attenuation in the general method such that it tends towards 0 dB at distance, the D_z formula was amended, and the K_{met} formula was also amended, such that in combination the barrier attenuation mimicked the effect of curved rays at distance and becomes more closely aligned with the behaviour of the simplified method.
In detail for D_z:

1996

$$D_z = 10\lg\left[3+(C_2/\lambda)C_3 z K_{met}\right] \text{ dB} \quad \ldots(14)$$

TR 17534-3:2015

a) $$z_{min} = \frac{-2\lambda}{(C_2 C_3 K_{met})}$$

b) $$D_z = \begin{cases} 10\lg\left[3+\left(\frac{C_2}{\lambda}\right)C_3 z K_{met}\right] \text{dB} & \text{for } z > z_{min} \\ 0 & \text{for } z \le z_{min} \end{cases}$$

2024

$$D_z = 10\lg\left[1+\left(2+\left(\frac{C_2}{\lambda}\right)C_3 z\right)K_{met}\right] \text{dB} \quad \text{for } z > z_{min} \quad (18)$$

and

$$D_z = 0 \text{ dB} \quad \text{for } z \le z_{min}$$

with

$$z_{min} = -2\lambda/(C_2 C_3) \quad (19)$$

P56

References

39 Richard Jovic, Reasons for Differences in Predicted Sound Levels Between ISO 9613-2:1996 and ISO 9613-2:2024, Environment Agency, 2025
40 Andy Pagett, Predicting Change – The new BS ISO 9613-2:2024, IOA Central Branch, March 2025
41 Wolfgang Probst, Problems with ISO 9613-2:2024 – Proposal for an amendment, 2025

And K_{met}:

1996

$$K_{met} = \exp\left[-(1/2000)\sqrt{d_{ss}d_{sr}d/(2z)}\right] \quad \text{for } z > 0 \qquad (18)$$

$$K_{met} = 1 \quad \text{for } z \leq 0$$

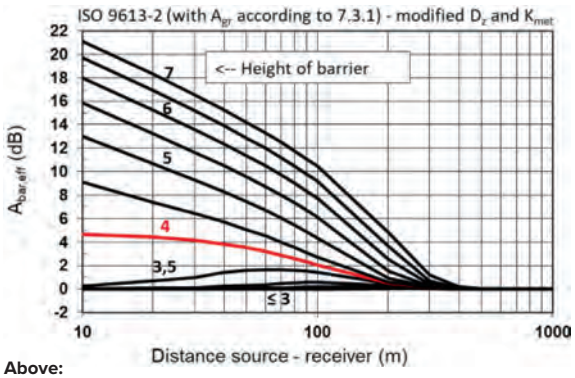
2024

$$K_{met} = \exp\left\{-(1/2000)\sqrt{\left[\max(d_{SS}, d_{SR}) + e\right]\min(d_{SS}, d_{SR}) \cdot d / \left[2(z - z_{min})\right]}\right\}$$

$$z_{min} = -2\lambda/(C_2C_3)$$

The introduction of the '+ *e*' removes the level jump when the second barrier breaks the line of sight, which does result in increased receiver levels.

The revised formulae for D_z and K_{met} in the general method do now produce a barrier attenuation effect which continuously transitions to zero for all barrier heights and is more in alignment with the simplified method, i.e. no longer tending towards 4.8 dB and corrects this long-standing known issue with barrier attenuation, as shown in Figure 6.



Above:
Figure 6: Effective barrier attenuation with modified Dz and K_{met} in ISO 9613-2:2024 (After Probst 2025)

Overall, the changes to A_{gr}, D_z and K_{met} lead to potentially up to almost 11 dB change between the 1996 edition and the 2024 edition at long propagation distances.

It could be argued that the 2024 edition more correctly represents the effect of barrier attenuation at long distance and the overall change in levels may be correct. However, in situations where planning conditions, operational licenses or other legislative controls are utilised, such a large change is inherently raising uncertainty in the validity of the calculated levels.

Discussion and conclusions

Since it was first published ISO 9613-2 has had a range of known issues. It is inherently an empirical engineering method, rather than a numerical method, and as such is only really applicable when applied to the type of test cases it was originally developed against. The method aims to calculate continuous A-weighted sound pressure levels under meteorological conditions favourable to propagation and accepts that values for individual octave bands will have higher levels of uncertainty that the overall level.

Long term average A-weighted levels may be calculated by inclusion of the meteorological correction, which can affect results by up to 5 dB, however long-term measurements carried out 1000m from industrial facilities ranged in level by 20 to 25 dB[42], or in another study by up to 33 dB at 800m[43] and in a third between 10 and 20 dB at 200m[44], due to variation in meteorological conditions.

Despite the documented shortcoming of the method and its frequent use outside its original design parameters, it has also been found to be generally reliable and used extensively for the calculation of sound propagation outdoors, particularly from industrial noise sources and more recently wind turbines, albeit with some adaptations.

The recommendations in ISO 17534-3:2015 addressed the most pressing issues regarding barrier screening effects and it has been the default methodology used under 9613-2 in most commercial software systems for the past 10 years.

The 2024 revision was driven particularly by the desire to extend the scope to include higher source heights to enable wind turbines to come into the scope of the method.

The changes have led to results at distances greater than 500m beginning to diverge by -3 to +11 dB compared to the previous version, including the ISO 17534-3 recommendations. This has led to ongoing further analysis and discussion about the differences which have become apparent. Both ISO 9613-2:2024 and ISO 17534-3 have recently come under review by ISO Working Group 56, however it is currently too early to forecast what the outcome of this work may be.

While these discussions are ongoing, as end users there remain certain aspects which should be borne in mind:

1) The ISO 9613-2:1996 was cancelled and replaced by ISO 9613-2:2024. Unlike the 1996 edition, the 2024 edition has also been implemented as a British Standard.
2) Where the ISO 9613-2 methodology is being used within a software implementation, it is important to clarify which version is being used:
   a. 1996 edition as written;
   b. 1996 edition with amendments introduced by the software developer;
   c. 1996 edition with recommended amendments from ISO/TR 17534-3:2015; or
   d. 2024 edition.
3) When used in software, the end users should consider the use of reference calculation settings and how any deviation from the reference settings could affect the calculated results, ideally undertaking testing in line with ISO 17534-1, or similar.
4) There are other methodologies for the calculation of sound propagation outdoors, whether they are numerical methods, or other engineering methods such as Nord2000, Harmonoise/IMAGINE or CNOSSOS-EU, which may provide a viable alternative.

Over the past few years, work initiated under BSI Committee EH/1/2 has been ongoing to develop a point-to-point propagation model capable of calculations in third-octave bands for a range of meteorological conditions, it can be hoped that this work could bear fruit during the deliberations on the review of ISO 9613-2:2024.

Finally, if readers have any experience of using the 2024 edition of ISO 9613-2 at medium to long distances and are finding deviations from previous calculations using earlier editions, or variance from measurements, we would be very interested to hear about them should you be willing and able to share information, as this would help to provide evidence and insight on how the method could develop in the future.

References

42 P. Sutton, "Process Plant Noise: Evaluation And Control," Applied Acoustics, 9(1), pp. 17-33, (1976).
43 Paul D. Schomer, "A statistical description of ground-to-ground propagation," Noise control Engineering J., 51(2), pp. 69-89, (2003).
44 D. Heimann, M. Bakermans, J. Defrance, D. Kühner: Vertical Sound Speed Profiles Determined from Meteorological Measurements Near the Ground, Acta Acustica united with Acustica Vol. 93 (2007) 228-240

Eastern Branch

By Sam Riley and Josie Nixon

Factory tour at Acoustical Control Engineers Ltd



The Eastern Branch visit to Acoustical Control Engineers Ltd

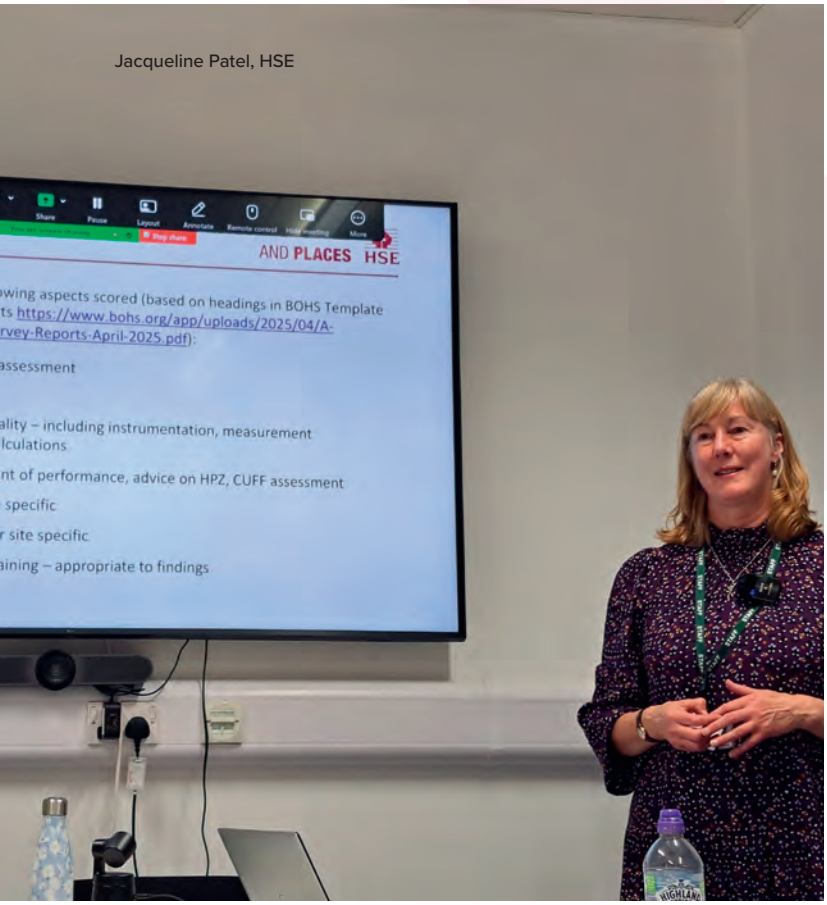
A joint event was held between Central Branch, Eastern Branch and the IOA Noise and Vibration Engineering Group on Wednesday 27 August at Acoustical Control Engineers Ltd. This was a fantastic event starting with a presentation by Richard Collman, the director of the company, who spoke about the origins of the company, type of work they undertook and the importance of enclosures.

We then had a tour around the site, looking at how different machines are used to create the acoustic enclosure and panels. Daniel Collman operated several machines so we could see how they make the different compartments and how these then fitted together to make panels.

It was great to see some of the complete enclosures they build to store plant in and mitigate noise and vibration levels. It was a fascinating tour and the event gave people a chance to network across the Branches

Thanks go to Richard for hosting us all.

Noise at work: selecting a noise consultant



Jacqueline Patel, HSE

On 18 September, Jacqueline Patel from the HSE presented a talk on noise at work (NAW) reports, which may sometimes be lacking in technical detail, which potentially results in employers not fulfilling their obligations and employees being under- or over-protected against workplace noise.

Jacqueline informed delegates that in 2022 there were 18,025 noise induced hearing loss claims, a shocking statistic. The presentation highlighted some of the issues around poor reports seen by the HSE and the steps being taken to prevent unprofessional and sometimes dangerous NAW assessments. Noise is now an HSE priority and extensive efforts are being made to advise and educate employers as well as contacting consultants whose reports are of a poor quality and could be potentially dangerous.

The discussion after the talk reassured attendees that they were not the target audience for this advice, but revolved around how to educate employers looking for qualified and competent consultants, and the frustration of unqualified or inexperienced consultants charging unrealistic fees to beat the competition who would do a thorough and robust assessment.

Jacqueline highlighted the wealth of information on the HSE website to provide guidance and assist in NAW assessments and calculations.

https://www.hse.gov.uk/noise/calculator.htm
https://www.hse.gov.uk/pubns/priced/l108.pdf

Thanks go to Jacqueline for her very interesting presentation.

Future topics

If you'd like to present or have a topic suggestion please get in touch. We are also open to suggestions for venues across the region, so please let us know if you have any suggestions or are able to host a Branch meeting. Please contact either Jody Blacklock or Josie Nixon at **jody.blacklock@createce.co.uk** or **Josie.Nixon@HA-Environmental.co.uk**

Make sure you have registered with the Eastern Branch to find out about all upcoming events or keep an eye open on the IOA event website page.

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Irish Branch

Visit to Anthem Vinyl, Kildare – Thursday, 4 December 2025 at 16:00

Anthem Vinyl is Ireland's ONLY vinyl-pressing plant, offering premium and sustainable record production for artists and labels. Based in Clane, Co. Kildare, the facility also features a media room for content creation, smart vinyl technology and direct distribution to independent record stores across Europe, the UK and the US.

Join us for an exclusive opportunity to step inside Ireland's only vinyl production facility and experience the artistry, science and precision of vinyl manufacture.

- Behind-the-scenes tour of Anthem Vinyl's record-pressing process.
- Insight into the science and craftsmanship of vinyl production.

To reserve your place, please email Diarmuid Keaney at **diarmuid@acoustics.ie**

(Please note, those who register must attend due to limited places on the tour.)

London Branch

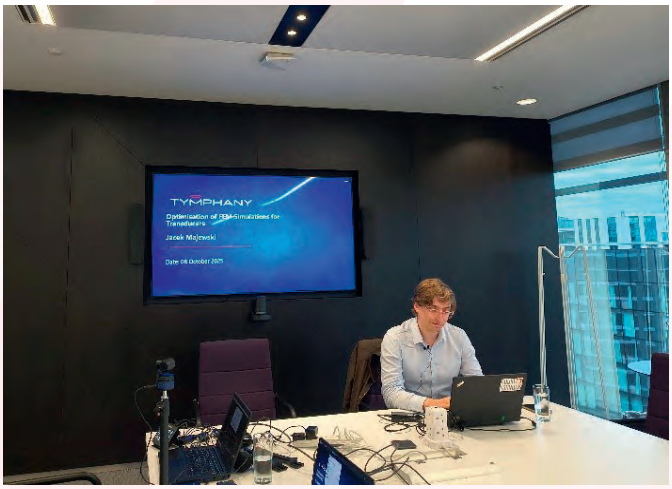
Diverse programme at London Branch

By Shaliny Denardi Vattathara

The London Branch continues to host engaging talks bringing together professionals in the field to share knowledge and ideas across several different topics in acoustics. This time we had an online meeting in September and a hybrid one in October, both well attended.

On 10 September, the Audio-Visual Solutions Architect Lead at King's College London, Rodrigo Sanchez, introduced RAfAEL (Real Audio for Analysis in Educational Lectures), which is a developing framework that uses deep learning to assess the clarity and intelligibility of speech in recorded lectures. He explained how the system's model can predict perceptual features such as clarity, definition and reverberation directly from raw audio. The talk sparked discussions about how AI and machine learning can support better audio visual and acoustic design in educational spaces.

Our October meeting featured Jaceck Majewski, Acoustic Engineer Intern at Tymphany Acoustic Technology. He presented his thesis project focused on the use of a FEM model to improve acoustic transducer design. Jaceck discussed an alternative method for estimating material properties using standard testing equipment, offering a more accessible approach than the traditional techniques. Afterwards we headed to the pub to continue the conversation.



Jaceck Majewski of Tymphany Acoustic Technology, presenting to London Branch members

Looking ahead, we are excited to round off the year with two more sessions. On 12 November, three master's students from the London South Bank University will present their projects and on 3 December, Peter Rogers from Sustainable Acoustics Limited, will talk about sound insulation and mental wellbeing. We look forward to meeting everyone to finish the year on a high note.

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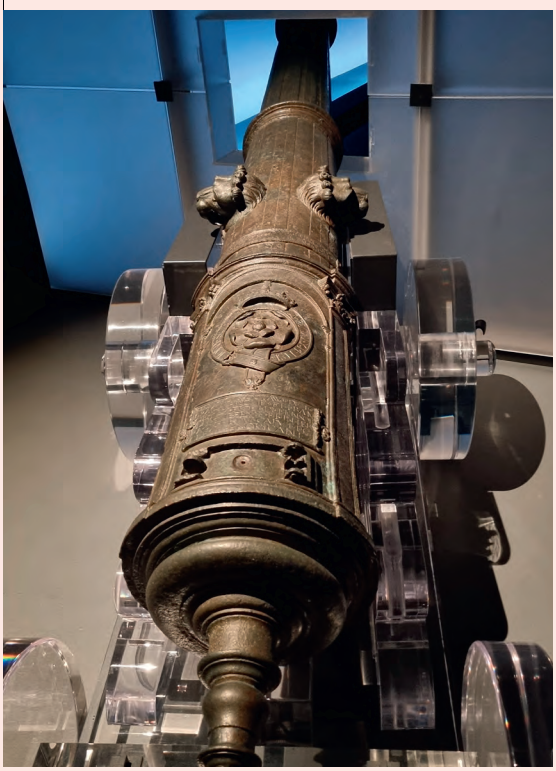
Southern Branch

Assessing personnel noise exposure in the military

By Seb Woodhams



Southern Branch members visited the Mary Rose Museum at the Portsmouth Historic Dockyard



IOA Southern Branch members visited the Mary Rose Museum at the Portsmouth Historic Dockyard to watch Karen Wilmot of QinetiQ present a talk on assessing personnel noise exposure in the military. Karen gave an overview of UK noise at work regulations, which apply to all members of the UK armed forces. The noise at work regulations stipulate that military personnel are provided with adequate hearing protection for the environments they find themselves in, however accurate prediction and measurement of noise levels in these scenarios is difficult. Karen presented the techniques that QinetiQ use and the challenges faced, and provided an insight into recent research into improving the robustness of their methodology. After the presentation, the attendees were treated to free access to the Mary Rose Museum to socialise and view the exhibits which included the famous Mary Rose, flagship of King Henry VIII.

diary

COMMITTEE MEETINGS 2025

DAY	DATE	TIME	MEETING
Tuesday	11 November	10.30	CCWPNA Examiners
Tuesday	11 November	13.30	CCWPNA Committe
Thursday	13 November	10.30	Diploma Tutors and Examiners
Thursday	13 November	13.30	Education Committee
Tuesday	18 November	10.30	CCENM Examiners
Tuesday	18 November	13.30	CCENM Committee
Tuesday	25 November	11.00	CPD Committee
Thursday	27 November	10.30	Executive
Thursday	**4 December**	**10.30**	**Council**

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Certificate of Proficiency in Environmental Vibration Measurement

The IOA introduces a four-day Certificate of Proficiency in Environmental Vibration Measurement course, teaching theory and practical skills for accurate vibration assessment. Expressions of interest are sought from candidates and potential accredited centres.

Prediction and assessment of environmental vibration is often required in the UK, for example when proposing to build new residential developments in the vicinity of transportation infrastructure, or where vibration from construction, industrial or commercial activities could impact on nearby sensitive receptors.

Effectively obtaining and interpreting environmental vibration data is an important step in the assessment process.

However, not all of us have the knowledge, skills or experience to select appropriate equipment, transducer mounting methods, measurement parameters and operating conditions to successfully undertake these types of measurements.

To address this challenge, the IOA is introducing the **Certificate of Proficiency in Environmental Vibration Measurement**, a four-day course (plus written examination) that will cover all the theory, skills and practice you need to start making environmental vibration measurements with confidence.

What we are we looking for

In offering this course, we would really like to hear from **you** so we can manage demand. We would like expressions of interest from:

1. prospective candidates; and
2. organisations / centres interested in running the course.

For potential centres to be considered for accredited status, as a minimum the following equipment and facilities are required:

- classroom/seminar type facility;
- tri-axial accelerometer transducers;
- three channel (minimum) vibration analyser;
- suitable mounting equipment for ground vibration measurement; and
- vibration source (indoors or outdoors).

If you are interested in attending, or hosting this course, please let us know at: **education@ioa.org.uk**

Enhance your career prospects in acoustics

The IOA runs a range of certified short courses nationwide, assessing competence in the areas shown on the right. The courses run twice a year at accredited training centres across the UK (courses are held prior to exam dates and usually run for around five days).

To find out more about any of these courses visit: **https://www.ioa.org.uk/education-training** and contact the appropriate centre directly.

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