Volume 47 No 1 January/February 2021

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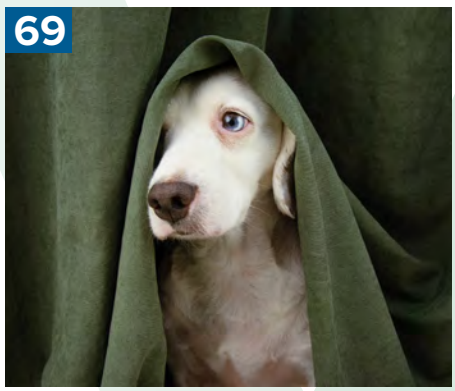

The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. It was formed in 1974 from the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society. The Institute of Acoustics is a nominated body of the Engineering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

Institute of Acoustics

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Dear Member

I finished my last letter with this rather cryptic statement:

We are also liaising with the national Governments over various issues, including some of the acoustic related COVID requirements which have emerged, one of which, technically, leaves a lot to be desired. Hopefully by the time you read this, we might have been able to help sort out that particular situation.

I am glad to say that the acoustic related COVID requirements that were the cause of our concern have now been removed from the statute book. They related to regulations that applied to England and which came into effect at the end of September. I exchanged several emails with the relevant Government department over a period of about five days immediately after the requirements came into force, explaining the issues and the nature of our concerns. Although I then heard no more, it has now subsequently transpired that about two weeks later, in mid-October, further regulations came into force which repealed the original requirements we felt were not technically robust. I'd like to think that our intervention helped with this successful outcome. In my view, one important role for the Institute is to keep an eye on such issues and to hold the legislature to account if we feel it necessary. (For more details on this, turn to page 24.)

COVID and conferences

COVID is, of course, still dominating our lives with each of us moving in and out of various degrees of lockdown. At the time of writing, one vaccine has now been approved for use which does mean that we might be able to look forward to a slightly more normal 2021. One of the impacts of COVID on the life of the Institute is that we have not been able to put on conferences in the traditional way. In November, however, we held Reproduced Sound 2020, which was our third virtual conference to have occurred since the first lockdown. For this event, and as you might expect from the Electroacoustics Group, all the technology was prepared by the group without any external assistance. I dread to think how much time some of our members spent on that, but the result was very successful, with delegates joining us from around the world. My thanks go to Keith Holland, John Taylor, Paul Malpas, Ludo, Sebastian and Glenn for all their efforts (and apologies to any others whom I should have named).

It is the Institute's Meetings Committee who have the responsibility for looking after IOA conferences and meetings. They currently have the challenge of working out what we might be able to do next year and planning accordingly. Very sensibly, in the first week of January, the committee is meeting with Exec to look at our possible meeting strategy both for 2021 but for subsequent years as well. At the moment, all we know is that we will not be holding any attended events before 31st March 2021 at the earliest. However, we do have Acoustics 2021 in the diary for October, to be held in Chester, Reproduced Sound 2021 in November in Bristol, and we are the hosts of Internoise 2022 in August that year, to be held in Glasgow. My predecessor, Barry Gibbs, is leading our work on that.

Members' Forum meetings

The benefits of virtual meetings have not been lost on the Institute and the fortnightly IOA Members' Forum meetings have continued during the last part of 2020 and will continue in 2021. These do enable members throughout the world to join us for conversation and to hear some latest news from the Institute and others. There is also the new regular feature of 'Meet the...' where I interview, very gently, members who look after various aspects of the Institute about what they do. So far, we have heard from the Chief Executive, the Vice-President Engineering, the chairs of Membership Committee and the Environmental Noise Group and one of our Council members. These sessions provide an opportunity for members to hear in more detail about the various activities in the Institute.

Early Careers Group

I am acutely aware that COVID has particularly adversely impacted some of our members. A particular sector that has been affected are our Early Careers members with a concern that their career development has stalled as a result of the pandemic. I am delighted therefore to tell you about the initiative being taken by our Early Careers Group under the leadership of Tom Galikowski who have surveyed their members to find out what the Institute can do for them in these difficult times. A webinar was held at the end of November when the results of the survey were published and several excellent ideas were beginning to emerge.

Finally, you will see in this issue the write up of Acoustics 2020 (starting on page 30). If you use road traffic and rail traffic noise models in your work, do consider the request about contributing to one of the drafting panels that are being established to develop methods to replace CRTN and CRN on page 38.

In the meantime, I hope that you were able to enjoy some Christmas festivities with your friends and family and that you have a happy, peaceful and safe New Year.

2021 conference programme

Understandably, the 2021 conference programme is likely to be affected by the COVID-19 virus. We have not published details of any international events in this issue of Acoustics Bulletin, but will provide updates in future editions.

HEAR FOR TOMORROW

6th October 2021

Royal Academy of Music, London
Organised by IOA and Hearing Conservation Association

ACOUSTICS 2021

11th-12th October 2021

Chester

REPRODUCED SOUND 2021

16th-18th November 2021

Bristol

Phishing scam warning

Earlier in the year there were a number of phishing emails sent to companies who have advertised either in Acoustics Bulletin or Find a Supplier. Just before Christmas there were more malicious emails reported. We would like to reassure you that **our database has not been compromised**. What we believe the criminals are doing is looking to see which companies advertise through the IOA, thereby indicating a commercial relationship with the Institute. The criminals then check records at Companies House to get the name of the directors, and send an email to one of the directors supposedly from the IOA asking for account details.

Please be aware and note we will never ask for your account details by email.

If you receive a suspicious email from the IOA please check that the sender URL is the IOA.

Finally, if you are unsure, phone us to confirm whether the email is from our office (Tel +44 (0) 300 999 9675).
We have put a warning on our website so all members are made aware of this scam.

Allan Chesney
IOA Chief Executive

Institute of Acoustics

Early Careers Group

Under 35? In the first five years of your career?

If so, then join us for:

- Updates about relevant events in your area
- Discounts at conferences and meetings
- Access to a network of like-minded acousticians

Early career members are not automatically registered. To join, on the IOA website go to:
'My Details' > scroll to **'View Dashboard'** > **'Your Groups'** then from 'Join Group' select **'Young Members'** > **'Add'**

Engineering Division

The IOA Engineering Division is ready to support you to become one of almost 225,000 registrants that hold international professional recognition.

By Blane Judd BEng FCGI CEng FIET FCIBSE, Engineering Manager

With the news of vaccines and inoculation in the media, let's hope we are approaching whatever the new normal will be. For us here in the Engineering Division, there may be changes we have had to adopt during lockdown, which will remain in place going forward. Discussions will no doubt be had about continuing video interviews for professional registration for example. It has worked well and both interviewers and candidates have given positive feedback about the experience.

We will begin the process of introducing the new UK-SPEC version four in 2021. For the first half of the year anyone who is looking to become registered, together with those who are already working on their submission will be encouraged to use UK-SPEC version three. From July onwards we will be suggesting that candidates work to version four, and we will be adjusting the paperwork and guidance documentation to reflect that change.

The Engineering Council is expecting us to have made the transition by December 2021 and we are on track to meet that deadline. The changes in version four are relatively subtle and so it will make little difference in most cases. Since, on average, it takes six months to complete the process, July is considered to be a suitable start point for transition.

IOA support

Emma Lilliman continues to do a great job supporting candidates through the registration process. We are just as dedicated to providing the necessary levels of support to assist members like you, through the process. The systems are working well even though we are still conducting some activities remotely. Special thanks go to Neil Ferguson, who continues to help us with the academic equivalence support. Through his help and guidance, we support a wide number of applicants who do not have exemplifying qualifications as laid down by the Engineering Council.

Our next round of interviews will be in the New Year and we have candidates working towards those interview dates. We hold a number of interview events through the year, depending on the number of candidates we have coming forward for registration. If you are interested in taking the next step to becoming a professionally registered engineer, contact us on **acousticsengineering@ioa.org.uk** sending a copy of your CV and copies of certificates and transcripts of your qualifications. It is important that we have all of your further and higher education certificates, not just your highest attainment.

Academic qualifications

The requirements for academic qualifications for CEng and IEng changed in 1999. Pre-1999 an honours degree at 2:2 or above was required for CEng or a higher diploma/certificate for IEng. Post-1999 this changed and for CEng a master's degree was required or an ordinary degree for IEng.

There are two routes:

1. **standard route** if you have the appropriate EC-accredited qualification (also referred to as an exemplifying qualification) in acoustics; and the
2. **individual route**, which requires further preparatory work from you before submitting evidence of your competence.

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

For the individual route, the Institute accepts a number of courses in relevant subjects such as audio technology from certain academic centres, 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 masters 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.

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 300 or so members holding EC registration. They provide the essential peer review process that affirms that you are at the appropriate level for recognition as an Engineering Council Registered Professional Engineer.

Engineering Council successful candidates

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

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

The IOA is pleased to announce that Edward Elbourne and Richard Muir have attained the standard required for admission to the national register at Chartered Engineer level.

Edward Elbourne CEng

Left: Edward Elbourne CEng

Ed graduated from Warwick University with an MEng in systems engineering in 2008, and following an MSc in audio acoustics from Salford University, he joined Arup's acoustics and venues team in 2010. Based in London, he leads building acoustics and performing arts projects.

Talking about the CEng qualification process, Ed said: "I'm honoured to have been awarded chartership and grateful to the IOA for their support in the process. Chartership is an important recognition that I have met a level of experience and rigour as an engineer.

"In December 2019 I reviewed my CPD records and recognised that I'd gained sufficient experience to apply for chartership. I got in touch with Emma and Blane at the IOA to initiate the process, and when lockdown started in March 2020, this was the perfect opportunity to focus on writing my professional review interview (PRI) report. At first this seemed like a daunting task, but with good CPD records I found plenty to write about. In fact, the process was enjoyable because it was an opportunity to reflect in detail on my development as an engineer and the experience I've gained over the past decade.

"My interview in October 2020 was via Zoom. Blane started by introducing me to the two interviewers, and they then spent an hour asking me about aspects of the report. Whilst the format was quite formal the interviewers were friendly, the discussion was genial and the hour passed very quickly."

Richard Muir CEng

Right: Richard Muir CEng

For the past 18 years, Richard has been a partner at Sandy Brown based in London working on building and environmental acoustics projects in the UK and abroad. Richard has worked as an acoustics consultant since graduating in 1985 and has a BSc in mechanical engineering from Newcastle Polytechnic and an MSc in environmental acoustics from South Bank University. Prior to joining Sandy Brown, Richard spent part of his career working overseas as an acoustics consultant in New York, Australia, and Hong Kong which gave him a broader international view of the acoustics industry.

Recently awarded CEng Richard said: "Blane Judd, IOA Engineering Manager, was invited to give a talk to Sandy Brown about professional registration. I asked him how we could best support our staff in the process. Blane said, 'lead by example' and I committed there and then to apply for the CEng qualification process. I spent a lot of time going through my archive of reports and realised that I hadn't given myself enough credit for my 35 years of professional experience; CEng was a way of recognising this experience.

"I really enjoyed the time spent preparing my report for the PRI and reflecting on my time in the industry and the wealth of projects I have had the good fortune to be involved in. I chose a few key projects as examples, together with examples of business and financial management to demonstrate the various competencies required. The process prompted me to further question my commitment to sustainable design in acoustics and reaffirm its importance. The interview conducted over Zoom due to the COVID lockdown was friendly and informal. I feel the Chartered Engineer qualification compliments my experience and having been through the process, now feel able to mentor, support and encourage my colleagues towards their own professional registration."

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Approved membership applications

The Membership Committee reviewed 49 application forms on 29th October 2020 by the online system. Thirty-four have recently been approved by the Council following the recommendations of the Membership Committee. Of the total, 14 were new members, five were IOA Diploma students, one was re-instated and we have one new sponsor, the remaining 14 had upgraded their membership.

MIOA

James Arnold
Nikhil Banda
Jamie Barratt-Gibson
Simon Brown
Kyriacos Demetriou
Francis Goodall
Belinda Grattan
Timothy Heffernon
Axel Montes de Oca
Matthew Naylor
Josie Nixon
Jacob Povall
Matthew Richards

AMIOA

James Ambrose
Ali Aurangzeb
Sarath Dasan
Ullas Edayillam Karicherry
Stuart Goodbun
Alastair Grieves
Jack Holmes
Piotr Jaszczynski
Richard Jovic
Paula Menin
Enis Murat Cakir
Jago O'Sullivan
Jonathan Phillips
Seena Sajeev
Timothy Walton
Michael Welsh

Tech IOA

Ayan Booyens
Adam Freeman
David Kendal
Avtandil Kraveishvili

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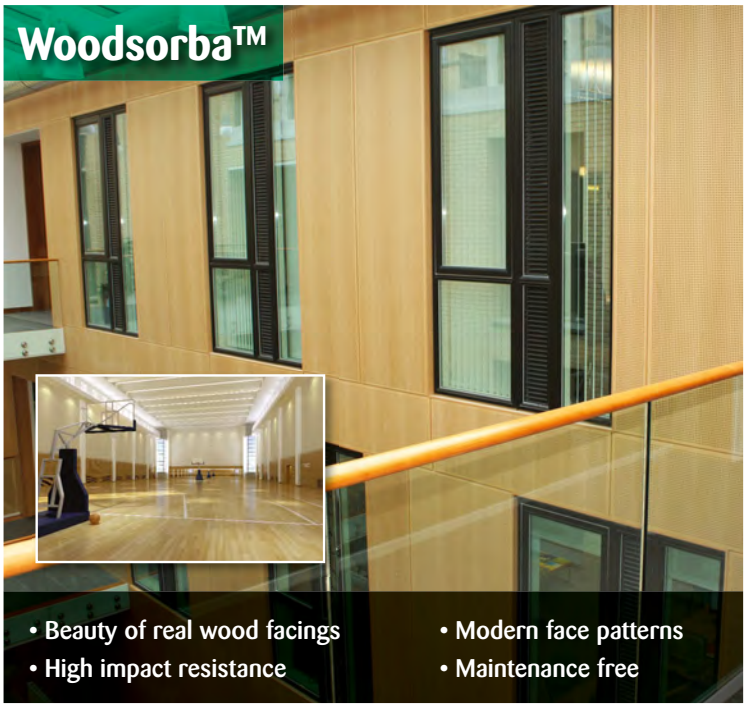

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The Institute of Acoustics Diploma results 2020

By Professor K Attenborough, HonFIOA (IOA Education Manager)

The 2019/2020 presentation of the IOA Diploma in Acoustics and Noise Control was centre-based at four institutions; (Derby University, Leeds Beckett University, Southampton Solent University and London South Bank University) and delivered as tutored distance learning (DL) through four centres; (Milton Keynes, Trinity College Dublin, Bristol and Edinburgh Napier University).

The Covid-19 pandemic made it impossible to hold written examinations at centres in 2020. Consequently, at relatively short notice, arrangements were made for examinations to be downloaded 'at home' and for the written answers to be scanned and submitted online within four days (one candidate mailed answers within this period). This made the examinations essentially 'open book' with the result that fewer candidates have failed than has been typical.

Another consequence of the pandemic was that several candidates had to change their project topics and methods. Although considerable latitude was given to these candidates in terms of project content and the deadline for submission of the final report, 11 candidates have been forced to defer their projects until 2021.

There were 114 candidates (including five resits) for the General Principles of Acoustics (GPA) Module examination in 2020. This is well below the peak of 216 candidates who registered for GPA in 2006.

There were 14 candidates for examinations in Regulation and Assessment of Noise (RAN), 69 for Noise and Vibration Control Engineering (NVCE), 92 for Building Acoustics (BA) and 58 for Environmental Noise Measurement, Prediction and Control (EN).

Of the 112 candidates registered for the Project Module, 15 are listed as having failed in the table of results, but, as mentioned earlier, these include 11 who have deferred as a result of the pandemic.

As in previous years, a merit threshold of 70% was applied to the written GPA paper and the conflated GPA mark. The examination scripts of candidates satisfying the conflated mark threshold, but gaining between 68% and 72% on the written paper, were examined at moderation, re-marked where appropriate and judged individually as 'pass' or 'merit'. However, even if these criteria were satisfied, a merit was not awarded if a coursework assignment mark was carried over from a previous year.

A criterion based on the means and standard deviations from the previous eight years was used again to decide whether to moderate examination marks for the specialist modules. Probably as a consequence of its 'open book' nature this year, the EN examination marks were comparatively high. On the other hand, the EN assignment turned out to be much too long so the mean mark achieved for the EN assignment was significantly less than the mean marks obtained for the other specialist module assignments. Account was taken of these abnormalities at moderation. To obtain a merit grade on the specialist modules, candidates were required to have a conflated mark and written examination marks of at least 70%. No merit was awarded if it depended on a deferred score.

GPA coursework assignment topics were:
1. estimating sound levels from large sources; and
2. airborne ultrasound.

They resulted in mean marks of 71% and 74% respectively.

The specialist module coursework topics this year included the health impact of listening to loud music through earphones or headphones (NVCE), ventilation noise (BA), sleep disturbance (RAN) and railway noise (EN).

It was found necessary again to moderate some centre marks for the laboratory module to bring them into line with those for DL candidates.

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

12 exceptional candidates have obtained five merits. The prize for best overall diploma performance (based on gaining the highest overall marks for GPA, EN, NVCE and merits for the project and laboratory modules), is to be awarded to Robert Jinks (University of Derby).

Letters offering congratulations on achieving five merits also, have been sent to:

- Toufic Attieh (DL Milton Keynes);
- Vaishnav Balaji (DL Milton Keynes);
- John Cullen (DL Dublin);
- Christopher Duffill (DL Bristol);
- Justin Haves (DL Milton Keynes);
- Daniel Hawe (London South Bank University);
- Rory Hendrick (London South Bank University);
- Ian Hooton (University of Derby);
- Ben Phipps (University of Derby);
- Alexander Stronach (DL Milton Keynes); and
- Lucy Withers (University of Derby).

P14

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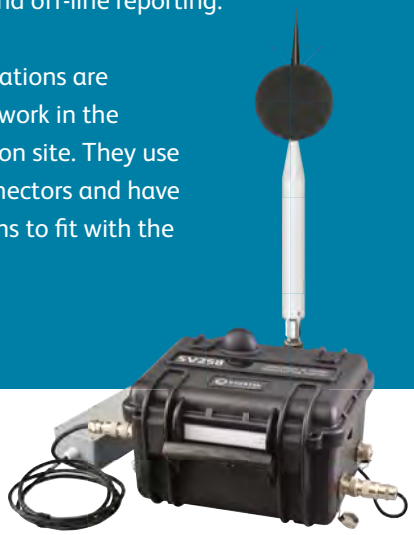

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Special commendation letters, offering congratulations on achieving four merits, have been sent to:

- Emma Aspinall (University of Derby);
- Jim Candlin (University of Derby);
- William Champ (University of Derby);
- Simon Peter Erskine (DL Milton Keynes);
- Tiffany Geara (DL Milton Keynes);
- Mark Hebblethwaite (University of Derby);
- Jack Hopper (Leeds Beckett University);
- Elliot Hurst (DL Milton Keynes);
- Hannah Mills (DL Milton Keynes);
- Robert Moores (DL Bristol);
- Nathan Parker (DL Milton Keynes);
- Stjohn Peters (DL Bristol);
- Finnbarr Sedas (DL Dublin); and
- Phil Softley (Solent University).

John Cullen will be receiving the prize for the best overall diploma performance by an Irish student.

Paul-George H Roberts has been awarded the 2018-19 ANC prize for his project on the sound propagation from lightwells.

This report is an opportunity to welcome Ian Matthews and Matthieu Folzan to the tutoring team, together with Tim Britton, Eleanor Girdziusz, Matthew Cassidy and James Hill as new examiners.

I am grateful to all examiners and tutors for their cooperation and contributions in this difficult year. In addition to Richard Collman and Latha Vasudevan who again have been a great help, special thanks go to David Trew and Anthony Hayes for their help with tutoring the MK DL candidates.

Thanks also to the splendid new recruits, Helen Davies and Caitlin Jesney as Education Officer and Education Assistant respectively, for their contributions during the 2019/2020 presentation year of the diploma.

IOA DIPLOMA RESULTS CHART FOR 2019/20

Centre Name		GPA	Labs	BA	NVCE	RA	EN	Project
Distance Learning (Bristol)	Merit	6	2	N/A	N/A	N/A	N/A	2
	Pass	1	4	N/A	N/A	N/A	N/A	7
	Fail	0	0	N/A	N/A	N/A	N/A	0
Distance Learning (Edinburgh)	Merit	3	0	3	4	1	3	0
	Pass	5	10	4	3	1	2	6
	Fail	2	0	0	0	0	0	5
Distance Learning (Milton Keynes)	Merit	16	10	16	10	3	10	8
	Pass	13	22	16	15	3	5	20
	Fail	5	2	1	0	1	2	4
Distance Learning (Dublin)	Merit	6	3	5	2	N/A	1	3
	Pass	2	6	3	2	N/A	4	4
	Fail	1	0	0	1	N/A	1	2
Leeds Beckett University	Merit	5	0	4	1	0	4	2
	Pass	6	10	5	1	2	6	7
	Fail	2	0	0	0	0	0	3
London South Bank University	Merit	6	2	6	9	N/A	N/A	5
	Pass	9	13	10	6	N/A	N/A	9
	Fail	0	0	0	0	N/A	N/A	1
Solent University	Merit	3	1	3	2	N/A	0	2
	Pass	2	4	3	1	N/A	2	3
	Fail	0	0	0	0	N/A	0	0
University of Derby	Merit	13	6	3	6	2	10	8
	Pass	7	15	9	5	1	8	11
	Fail	1	1	1	1	0	0	0
TOTALS	**Merit**	**58**	**23**	**40**	**34**	**6**	**28**	**30**
	Pass	**45**	**84**	**50**	**33**	**7**	**27**	**67**
	Fail	**11**	**3**	**2**	**2**	**1**	**3**	**15**

PROJECT TITLES 2020

University of Derby

- Attenuation through an open window: an analysis of the attenuation against opening size.
- Ball impact noise and the effect of perimeter and goal backboard material within artificial grass pitches.
- A review of the effectiveness of acoustic screens and other treatments in adding acoustic comfort within open plan offices.
- An assessment of noise generated through different uses of artificially-surfaced football and hockey pitches.
- A literature review on the effects of interior train carriage noise exposure.
- An investigation into the accuracy of Cadna-A as a tool in the prediction of road traffic noise.
- Open plan offices: design, control and mitigation.
- Comparing methods of assessing the noise impact of clay pigeon shooting on nearby sensitive receptors.
- Noise impact of an artificial grass pitch (AGP).
- Investigation into the implications of the weaknesses in terms of acoustic performance of a gas turbine test cell personnel door.
- An investigation into the acoustic nature of impact sound created by a range of golf clubs/ golf balls.
- An investigation into the impact of forced-air heating system nuisance noise in a public place of worship.
- Investigation into literature to evaluate the noise impact of drones and sUAVs.
- An investigation into the environmental noise impact from Shisha premises and its guidelines.
- Noise assessment strategy for doggy daycare centres.
- Review of methods used for the identification and assessment of tranquillity and their application to UK policy.
- The use of BS4142 and the consideration of low frequency noise.
- Critical review of environmental noise management at outdoor music events.
- An investigation into the impact of motorcycle vibrations on the human body.

Leeds Beckett University

- The noise impact of converting all internal combustion engine cars to electric cars on the UK urban environment.
- An investigation into the use of different road traffic measurements and their interpretation of the noise impact on a proposed block of flats along Carr Lane in York.
- Office acoustics – a critique of Selby District Council's customer contact centre.
- Acoustic properties of a primary school classroom.
- Can genetic algorithms be used as a practical design tool in architectural acoustics?
- The effectiveness of household objects at amplifying sound from a smartphone speaker.
- An acoustical analysis of an amplified music venue.
- Review of BS EN 61252:1997+A2:2017.
- BS5228-1:2009 – An 'absolute' nightmare?

London South Bank University

- An investigation into output level differences between over-ear and in-ear communications systems.
- Investigating UK exhaust noise legislations and methodology.
- Noise impact from motor sport at Lydden Hill race circuit.
- Meeting airborne sound insulation criteria in a secondary school music facility with box-in-box construction design.
- Comparison between using a cabinet loudspeaker and a polyhedron loudspeaker for sound insulation testing.
- Validation study of Sabine, Eyring and acoustic simulation programme reverberation time prediction methodologies.
- Why undesirable weather conditions should be considered when designing high-rise residential buildings in the UK.
- An investigation into the vibration characteristics of fibre reinforced concrete composite
- Noise exposure levels in vehicles, are cars auraly safe?
- Assessing the noise escape from Carrow Road stadium during football matches and music concerts and investigating suitable noise control measures.
- An assessment of an office meeting room in providing speech intelligibility: case study of the London Borough of Southwark.
- Assessment of government-imposed lockdown on environmental noise levels in England.
- STI – Speech intelligibility in open plan offices – how does the trend for modern open plan affect speech intelligibility and speech privacy, and what can be done to improve intelligibility and privacy when needed.
- What effect does the sound absorption class of an acoustic product have on the required area and cost?

Southampton Solent University

- Applications and limitations of modelling the sound reduction index of composite acoustic panel partitions using INSUL 9.0.
- A practical investigation of three different methods for measuring nuisance low frequency noise.
- Suitability and shelf life of class and ship specific noise assessments.
- A comparison of pass-by noise emitted by steady speed battery electric vehicles and internal combustion engine vehicles.
- Can a BS4142 style impact assessment of a condenser unit be accurately conducted with no acoustic measurements?

Distance Learning (Milton Keynes)

- A review guide: essential acoustical parameters and solutions for DIY home studio design.
- Prediction versus measurement of acoustical descriptors for open plan office before and after acoustic treatment.
- Assessing the effect of Covid-19 on the soundscape of Melbourne.
- A comparison between measured and calculated reverberation times of a critical listening room and practical remedial acoustic treatment options for these spaces.
- Considering the impact of noise from construction sites on the smart working model.
- Far field validation of aircraft engine ground runs.
- An investigation into the ideal subwoofer positioning at Soul Church, Norwich.
- An investigation into statutory noise nuisance and the viability of a clay pigeon shoot on farmland, under permitted development rights. P16

- Acoustic design of an audiometric cabin.
- Comparison of the attenuation of different floating floor constructions when impacted by a mass.
- A hand-arm vibration (HAV) assessment of a council's greenspaces team's equipment.
- Determine under what conditions can a box loudspeaker be used instead of an omnidirectional loudspeaker for airborne sound insulation testing while still meeting the requirements of ISO140 and/or ISO16283.
- Outdoor chiller noise; investigating a complaint.
- Classroom acoustics: an evaluation of acoustic quality (insulation performance) of IEK Delta vocational school classrooms.
- Sound transmission loss verification of an operable wall.
- Investigation into subjective noise and vibration complaint.
- Calculation of a more representative ambient noise level as a result of numerous naturally occurring exceedances (in the absence of construction works) between 22:00-07:00 hrs at a construction site in central London.
- A quantitative scoping report into the accuracy of the HSE +4 dB real world factor as utilised within the control of noise at work regulation (2005) when passive hearing protection is used in conjunction with personal protective equipment.
- The design, build and testing of a small noise enclosure.
- Dynamic compensation convolution for MEMS microphones in professional sound level meters.
- The suitability of BS 5228-1:2009 to predict noise from construction sites.
- The drone that drones make! An investigation into aerial delivery drones and the most appropriate way to measure the potential sound impact in the community.
- An investigation into the most effective methods of predicting reverberation time in small and large spaces.
- An investigation into the human perception to road traffic noise using A-weighting and loudness.
- Acoustic performance of a pod within an open plan office.
- An investigation of traffic noise reduction using periodically spaced rectangular roughness: a computational study.
- Analysis and proposal of acoustic treatment for a basement home/ project studio.
- Reduction of traffic noise due to vegetation.

Distance Learning (Bristol)

- A performance related comparison of the airborne wall sound insulation criteria across four European countries.
- Analysis of the acoustic properties of a small music studio.
- An assessment speech recognition in a lecture theatre vs. that of different automatic lecture recording techniques.
- Investigation into whether the static speaker façade test method is appropriate to predict internal levels for a vehicle pass by and therefore determine its likeliness for disturbance.
- Fan power level – prediction against measured.
- An Investigation using computer modelling into the effect of occupancy on the acoustics of a university lecture theatre.
- An investigation into the impact sound reduction of plasterboard partitions.
- A safe, cost effective methodology for mapping invasive crayfish habitat using acoustic imaging.
- An investigation of the sound emissions from a domestic kitchen extractor fan, and the noise annoyance caused.

Distance Learning (Edinburgh)

- The difference between values generated in geometrical modelling software, CATT-Acoustic, and in-situ measurements for the ISO 3382-3 parameters D2,s and Lp,A,S,4m within open plan offices.
- Acoustic treatment for Thomas Coats Memorial Baptist Church.
- An evaluation of the validity of the calculation of road traffic noise (CRTN) shortened measurement method.
- Unmanned aerial vehicle noise pollution.
- Comparison of speech transmission index prediction methods in sports halls.
- Investigation into recreational noise exposure and its risks to developing NIHL.

Distance Learning (Dublin)

- Noise exposure from recreational firearm use.
- Sound absorption in a garage space for audio recording.
- Optimisation of room reverberation in an open plan office using wall absorption.
- Evaluation of the need and effectiveness of roadside noise mitigation measures.
- Industrial noise in Ireland – data centre regulation, energy demand and noise impact.
- Sound insulation testing on different materials in detached dwellings and comparing sound insulation standards around the world.
- The suitability of churches for use as contemporary music performance spaces.

DIPLOMA AWARDED 2020

Distance Learning Bristol
Curtis J
Duffill C
Elvidge D
Hunter M
Morgan G
Nickolls L
Peters S
Moores R
Stubbs E

Distance Learning Dublin
Cullen J
Kelly M
Maher L
McClung K
McKenna C
Nelligan J
O'Sullivan J
Sedas F

Distance Learning Edinburgh
Chatto E
Forsyth C
Massie G
McLean C
McLean S
Savory S

Distance Learning Milton Keynes
Assafiri I
Attieh T
Balaji V
Broom M
Cakir E
Charlton A
Ciarla F
Dasan S
Davies S
Erskine P
Forsyth D
Geara T
Goodbun S
Hall D
Haves J
Hurst E
Jaszczynski P
Jhaveri U
Karasoulas M
Karicherry E
Karpouzas G
Mahmoud H
Mann K
León Martin L M
Mills H
Moore G
Oatley J
Parker N
Rehill S
Reyland S
Sloan S
Smith C
Stronach A

Leeds Beckett University
Craig Z
Elms N
Hoare B
Hodson I
Hopper J
Jefferson S
Lodge P
Mosley J
Pitt T
Swallow T
Sweeney K
Watkin T
Wendl M A

London South Bank University
Allen J
Anderson E
Colquhoun Flannery L
Fort M
Fryer D
Hawe D
Hawkins C
Hendrick R
Lowe W
Miles A
Osewa T T K
Quinn A
Richardson P
Wilson S

Solent University
Baldwin K
Hodge M
McMorran H
Softley P
Turner J

University of Derby
Ankers L
Aspinall E
Biza P
Brookes Z
Candlin J
Champ W
Delaney L
Griffiths H
Guest J
Hallam K
Hebblethwaite M
Hooton I
Iannicelli C J
Jinks R
Mitchell S
Nwokolo K
Phipps B
Smith M
Turner J L
Wilkinson G
Withers L

IOA CERTIFICATE RESULTS FOR 2020

During the 2020 pandemic some centres were not able to offer the certificate courses. Other centres adjusted to the Covid-19 restrictions simply by limiting numbers. Nevertheless, only three centres ran CCWNRA and four centres ran CCENM (before Covid-19 restrictions started). As well as limiting numbers, Solent experimented with 'hybrid' delivery of CCBAM and CCENM. This involved three days of 'theory' online with practical assessment and examination over a further two days on site.

In 2021 most centres are planning to run their certificate courses either as normal or with more 'hybrid' delivery.

LIST OF SUCCESSFUL CANDIDATES:

CERTIFICATE:
Workplace Noise Risk Assessment
Exam date: 6 March 2020

Leeds Beckett University
Boothman P
Donkin G
Kerrigan R
Roberts A
Tisdale W

Shorcontrol Safety Ltd
Brett E
Doherty G
Douglas I
Madden C
McDonnell G

CERTIFICATE:
Building Acoustics Measurements
Exam date: 11 September 2020

Solent University
Broom I
Cable P
Chand G
Hunt A
Szeliga T

CERTIFICATE:
Workplace Noise Risk Assessment
Exam date: 2 October 2020

Make UK
Raffan J
Williams J P18

CERTIFICATE:
Environmental Noise Measurement
Exam date: 9 October 2020

Liverpool University
Ahmadi S
Barnes J
Forbes J
Harrison P
Haves J
Horwich A
Hurst E
Orebowale P
Stocks C

Shorcontrol Safety Ltd
Austin F
Balfe M
Donovan C
Doyle R
Kealy M
Mulligan C
O Hogain M
Plunkett I
Pniewczuk K
Saunders R

Solent University
Bal H
Brown E
Flint O
Foy A
Hamatui N
Harington A
Hodgson W
Hunt A
Livett S
Mackay A
McNicholas L
Power D
Ridley L

Ulster Environmental
Halleron E
Liggett R
McNulty B
Mitchell U
O Neill B

CERTIFICATE:
Management of Occupational Exposure to Hand-arm Vibration
Exam date: 23 October 2020

Institute of Naval Medicine
Atkins D
Dickson K
Evans M
James A
Pritchard S
Tuach M

Acoustic innovation showcased at trade body event

Acoustic consultancy professionals gathered online to see examples of innovation from across the sector in the Association of Noise Consultants annual awards programme.

For the past eight years the ANC has held its awards to promote and recognise excellence among UK acoustic consultants.

In line with COVID-19 restrictions this year, the awards were held in a virtual format to showcase the skills of members across four categories. A distinguished panel of judges comprising academics, professionals and representatives from the sponsor companies scrutinised the entries.

Paul Shields, Chair of ANC, said: "This was an awards' event like no other for the ANC, but the online approach worked well.

"We were able to see examples of the unique skills of our acoustic, noise and vibration professionals, through video and written case studies, which gave a great deal of depth to the content of the event."

The 2020 ANC awards results

Environmental category, sponsored by ANV Measurement Systems
Commended – Arup Acoustics for HS2 West Ruislip
Highly commended – Miller Goodall for 13 Dalton Square
Winner – Hoare Lea for Ground Run Enclosure at Cambridge Airport

Vibration Prediction & Control category, sponsored by CMS Danskin
Commended – Adrian James Acoustics for Vibration Impact on Bugs
Winner – WSP for their work at Hanover Square

Innovation category, sponsored by Mason UK (the judges recognised all entrants as deserving an innovation award in this category)
Atkins & Jacobs for Roadside Vehicle Noise Measurement
Apex Acoustics for Acoustic Performance EvaluAtion through Listening
WSP again for their work at Hanover Square

Building Acoustics category, sponsored by Acoustics 1
Commended – Cole Jarman for the Courtyard Project
Highly Commended – AECOM for the English National Ballet
Winner – Hoare Lea & RBA Acoustics for Lafayette 4 Pancras Square

The Smaller Consultancies award
Winner – Hayes McKenzie for 25 Clifton Road
The full ANC Awards 2020 event show, and separate five-minute video presentations of each of the finalists' entries, can be found at **https://www.association-of-noise-consultants.co.uk/anc-awards-2020-results/**

ANC Acoustic Awards 2020

The awards showcased the skills of members across four categories, with a distinguished panel of judges - comprising of academics and professionals, as well as representatives from the sponsor companies - scrutinising the entries.

In line with Covid-19 restrictions, the ANC's Acoustic Awards were held in a virtual format.

The results of the ANC Awards 2020

ENVIRONMENTAL CATEGORY
Sponsored by ANV Measurement Systems
Winner: Hoare Lea, Ground Run Enclosure at Cambridge Airport
Highly Commended: Miller Goodall, 13 Dalton Square
Commended: Arup Acoustics, HS2 West Ruislip

VIBRATION PREDICTION & CONTROL
Sponsored by CMS Danskin
Winner: WSP, Hanover Square
Commended: Adrian James Acoustics, Vibration Impact on Bugs

INNOVATION CATEGORY
sponsored by Mason UK
All shortlisted entrants received an innovation award: **Atkins & Jacobs** for Roadside Vehicle Noise Measurement, **Apex Acoustics** for Acoustic Performance EvaluAtion through Listening and **WSP** again for their work at Hanover Square.

BUILDING ACOUSTICS CATEGORY
Sponsored by Acoustics 1
Winner: Hoare Lea & RBA Acoustics, Lafayette 4 Pancras Square
Highly Commended: AECOM, English National Ballet
Commended: Cole Jarman, Courtyard Project

THE SMALLER CONSULTANCIES AWARD
Winner: Hayes McKenzie for 25 Clifton Road

The full ANC Awards 2020 event show, and separate five minute video presentations of each of the finalists' entries, can be found at **bit.ly/ANCAwards2020**

IOA STEM activity

IOA STEM committee members, Matthew Muirhead and Vicky Stewart, report on the success of the virtual Crawley STEMfest and look forward to the year ahead.

By Matthew Muirhead and Vicky Stewart

In 2020, the IOA was a sponsor at Crawley STEMfest, a virtual careers fair for kids. The fair ran from 11th November until 2nd December and included workshops, a virtual careers fair, and fun activities using videos made by STEM volunteers.

On behalf of the IOA STEM Committee, Matt Muirhead from AECOM and Vicky Stewart from Atkins, worked together to collate engaging content for the IOA elements of the fair. Where possible, the STEM stand made the most of the existing IOA videos, including the parliamentary video and careers video **(https://player.vimeo.com/video/394140051 and https://youtu.be/abYZX377ZLs)** and worked with the ANC to update the joint home-schooling document **(https://tinyurl.com/yx8tmbwz) specifically for the event.**

The video from SRL on structure-borne noise **(https://tinyurl.com/yyew8oy8)**, which won the ANC STEM Challenge at the John Connell Awards in 2019, was also added to the site as a workshop, along with a worksheet that was created just for the event by Huelwen Peters from SRL.

In addition to this, Matt and Vicky found some amazing volunteers, covering the range of careers in acoustics, and they all recorded videos for the stand covering 'What's my Job?' and 'Desert Island Risk'.

- Desert Island Risk – Jennifer Glover, PhD research student in aeroacoustics at Loughborough University;
- What's my Job? – Kim Onjun, graduate acoustics consultant at AECOM;
- What's my Job? – Nikhil Mistry, research fellow in underwater acoustics at the University of Southampton; and
- What's my Job? – Emma Shanks, senior scientist in noise and vibration at HSE Science and Research Centre.

The stand looked fantastic and there was great feedback from the organisers about the IOA. However, the most brilliant thing about working on the stand was being able to show what our industry can do when we work together. Huge thanks go to everyone involved, from those mentioned above to the supporters within the IOA for giving the STEM committee the opportunity and support to attend this event.

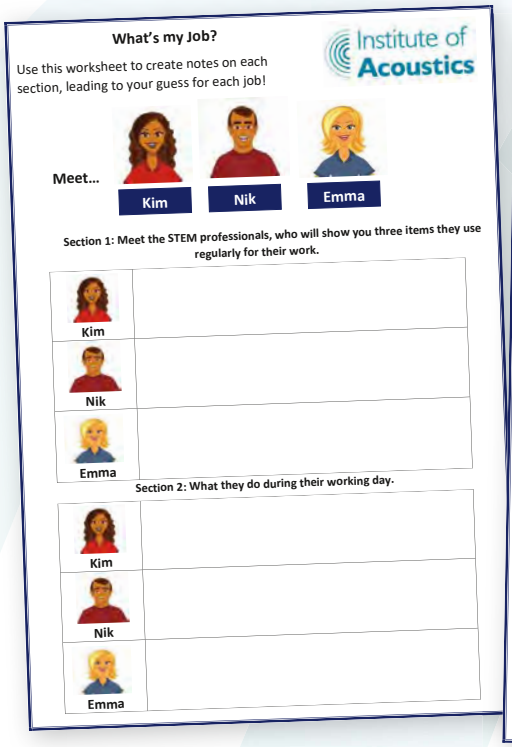
Record your STEM volunteering

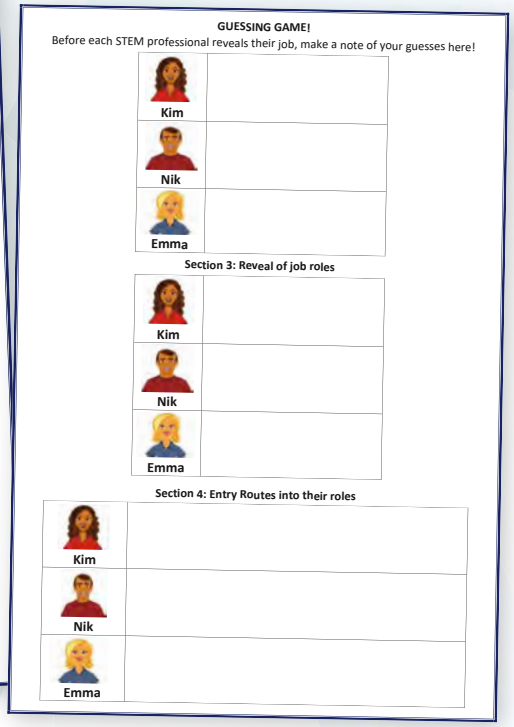
Were you involved with STEM last year? Please remember to keep track of your volunteering and to update your profile on the STEM hub; this is something that is very easy to forget to do but is an important tool to understand what is taking place, not to mention proof of at least your minimum requirement as an ambassador.

If you have any materials or experience that you would like to share please contact the STEM committee at (**STEM@ioa.org.uk**) to let them know what you have been up to or share with us on the LinkedIn 'Inspiring Future Acousticians' Group.

Support for STEM ambassadors

One of the STEM committee's initiatives for 2021 is to provide practical guidance for ambassadors when supporting schools with STEM in a virtual environment. Moving forward, there will be an increased focus on online learning, and activities not led by the class teacher may well be predominantly delivered remotely for some time to come.





Above: This worksheet for Crawley STEMfest covers the range of careers in acoustics

Below: The worksheet created by Huelwen Peters from SRL for Crawley STEMfest

The STEM committee wants to support this by providing helpful information on how to deliver engaging virtual events, what does and does not work and how to create exciting video content to both support activities and act as resource for dissemination.

The aim is that continued remote working should not hinder the support we provide to students and could even enable a wider reach for our activities if we are not confined by locality.

Revision 5 of BS EN IEC 60268-16

Objective rating of speech intelligibility by speech transmission index is published

In October, the long-awaited revision of BS EN IEC 60268-16 was published. Although the revision is not as substantial as Revision 4 in 2011, this is still a significant upgrade and incorporates a number of important changes.

Left: Peter Mapp, Chair of Revision working group

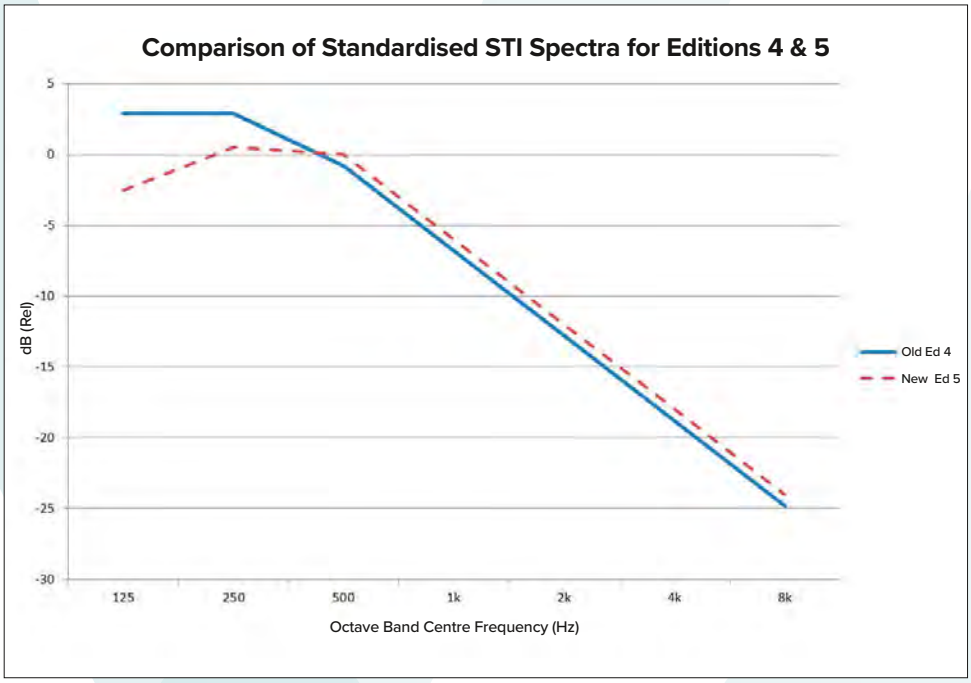
Most notable of these is the change to the STI speech spectrum, which has been brought better into line with other standards and more recent research. The primary change to the spectrum is the reduction in the low frequency content of the standardised signal as indicated in the figure below.

The revision to the spectrum apart, from better agreeing with other published data, also means that the signal is slightly less taxing when driving artificial mouths, talkboxes and PA/VA systems.

Other important changes within the revision are:

- additional information and clarifications have been included with respect to measurement and prediction procedures;
- the spectrum and weighting factors for female speech have been removed as this was found to be a cause of confusion and STIPA (the shorter method for measuring STI using a sparse modulation matrix) has only been validated for male speech;
- verification information for STI measurement devices has been added;
- the relationships between STI and number of other speech intelligibility measures have been updated in Annex E;
- greater information is given in Annex M about adjustments to the measured STI results to simulate effects of alternative ambient noise and speech levels;
- the (obsolete) RASTI method of measurement has been omitted;
- four new Annexes (D, O, P & Q) have been added. These concern:
  1. use of STI measurement devices (Annex D);
  2. alternative direct methods for measuring Full STI (Annex O);
  3. information to be provided by manufacturers (Annex P); and
  4. effect of uncertainties of selected parameters on STI uncertainty.
- a number of formulae have been corrected.

One of the main objectives of the revision was to provide additional information to assist both the practitioner and device manufacturer to understand STI and its measurement. To this end, the standard has increased in size by around 50%, increasing from 78 pages (71 pages of text) to 115 pages (107 pages of text).



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Parliamentary Liaison Group update

Some members may have seen acoustics shoot up the Governmental agenda with the recent addition of an 85 dB(A) limit imposed on hospitality venues in England for pre-recorded music.

By Peter Rogers FIOA

For those who may have missed it, this happened on 28th September 2020 through an amendment to The Health Protection (Coronavirus, Restrictions) (Obligations of Undertakings) (England) Regulations 2020, Section 2 (1C), which stated:

'A person responsible for carrying on a business of a public house, café, restaurant or bar (including a bar in a hotel or members' club) must, during the emergency period, ensure that no music is played on the premises which exceeds 85 db(A) when measured at the source of the music.'

www.legislation.gov.uk/uksi/2020/1008/regulation/2/2020-10-03

IOA concerns

This prompted immediate questions from members, and for our President to reach out to the Department for Business, Energy & Industrial Strategy to flag concerns for how this would be implemented and enforced.

It was repealed at midnight on 14th October 2020 when reg 2(1A)-(1E) of the Health Protection (Coronavirus, Restrictions) (Obligations of Undertakings) (England) Regulations 2020 were "omitted" (their expression) by virtue of reg 1(2) of and para 4(4) of Schedule 3 to the Health Protection (Coronavirus, Local COVID-19 Alert Level) (Medium) (England) Regulations 2020.

It remains a matter of concern that there is a link between aerosol spread and acoustics that prompted this legislative reaction, linked with COVID, and this remains a compelling area where acoustics may be able to help minimise risks.

Members may find this helpful when considering the acoustics in entertainment and hospitality and increased vocal effort.

Sound Masking

from aet.gb ltd

Open plan offices benefit from Sound Masking

Cellular offices achieve better speech privacy with Sound Masking

Sound Masking is a cost effective solution to the problem of improving speech privacy in today's modern office environment. Best installed during office fit out but often installed as retrofit, Sound Masking from AET has improved the office environment for many international companies throughout Europe over the last 20 years.

In today's office speech privacy becomes a key aim and open plan offices can suffer from two speech problems:

- Other people's conversations can be an irritating distraction
- Confidential conversations can be almost impossible to conduct

Similar problems also exist in cellular offices. Apart from noise breakthrough via partitions, flanking over, under and around them, other problem areas include light fixtures, air conditioning systems and services trunking. Sound masking compensates for these problems.

An investment in increasing privacy of speech is certainly cost effective, with Sound Masking one of the easiest ways of achieving this aim. Sound Masking systems along with acoustic panels and acoustic door seals are increasingly used to achieve the desired level of privacy by a number of our major clients including:

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- Procter & Gamble
- Swiss Re
- Mobil Exxon HQ
- Elizabeth Arden
- Barclays Bank
- Freshfields
- KPMG
- PWC
- BP

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Tel: 0044 (0)8453 700 400 sales@aet.co.uk

Certificate Number 130222

Sound Masking is also known as sound conditioning or white noise systems

Daniel Goodhand, Chair of the IOA Publications Committee

Daniel Goodhand, Chair of the IOA Publications Committee and Nicky Rogers, editor of Acoustics Bulletin, talked about how going more digital is already reaping benefits for the Institute.

As part of its 2018 office relocation and with some prudent foresight, the IOA established an updated communications strategy that included its versatile conference suite that came into its own during the pandemic.

Physical events are challenging to run, so do digital events offer IOA members a suitable alternative?
Daniel: "Absolutely, this is something the IOA was developing well before the Covid-19 crisis as we were concerned to reach members that weren't able to regularly attend meetings in person. We already offer blended learning for our Diploma candidates, streamed meetings and conferencing and have started to deliver events digitally – all of great benefit to our members and the wider acoustics' communities."

Below: Daniel Goodhand

How effective are digital events, especially for networking opportunities?
Daniel: "This is one of the major challenges because we simply can't get together to talk and exchange ideas, which can be limiting. However, initiatives such as the Members' Forum held on Mondays by Stephen Turner and Martin Lester are proving successful and popular." (See the article by Stephen Turner on page 42 of the September/October 2020 issue of Acoustics Bulletin).

Are there any limitations we should consider when planning digital events?
Daniel: "Prior knowledge of the events is always crucial. A useful tool is the IOA shared calendar which has all the major IOA events so members ought to register for the IOA shared calendar (details on how to do this below). For event organisers, it is important to get the message out early and repeat it several times in different ways, such as on the website, through the email update and in Acoustics Bulletin."

How is the IOA focusing on digital communications to develop its services such as education, membership, publications and in generally supporting acoustics communities here and abroad?
Daniel: "We are working to improve our education delivery, moving towards a greater focus on videos via the website. By using more social media platforms, we are engaging with more people and promoting our events further across the globe."

How is the IOA adapting its advertising revenue approach during the pandemic?
Daniel: "During the pandemic, many companies have unsurprisingly put some of their advertising spend on hold and we have lost a few regular advertisers as a result, particularly those who used Acoustics Bulletin to advertise their job vacancies. To help these loyal supporters, and our members who may be looking for career opportunities, we have let companies know that we will carry their job vacancy adverts for free up until the end of March 2021.

"To promote the Institute itself, the IOA is now investing a lot more in digital communications, recognising that it can't rely solely on the more traditional methods."

What previously hidden opportunities for acousticians have come to light during pandemic that could lead to innovation and changes?
Daniel: "We have recently published a great supplement, 'Innovations in Acoustics'. The lock down has offered some unique circumstances for Acoustics research, for example, the Quiet Project, which started life in March and is still running (**www.thequietproject.co.uk**). The decrease in traffic and aircraft noise presents exciting opportunities for research. More generally, the pandemic gives us opportunity to reduce travelling time and lower our carbon footprints."

How does the IOA support members and non-member acousticians who are currently being affected

by the pandemic by either being furloughed or not currently able to secure employment?
Daniel: "Forums, meetings and conferences have all been taking place online, which additionally, provide platforms for networking. We know that acoustics is a profession with not enough skilled people in the workforce, so as demand is fluctuating at the moment, this could be the ideal time to upskill in time to meet the increased demand when finally, we do emerge from these lockdowns. Increased online content for learning and CPD has proven valuable, particularly for members who have been furloughed and who have time to continue their learning, it also allows them to keep up-to-date with various industry developments."

For those who have retired from acoustics, is there a role for them to support others in light of the pandemic?
Daniel: "Sharing skills online and mentoring is always immensely valuable, especially given that many retired members will have gone through recessions before and survived."

For people who are new to the profession, is this a good time for them to train themselves in the diverse and varied fields of acoustics?
Daniel: "It's a great time to learn and a great time to sign up to the IOA Diploma, Certificate of Competence, CPD courses or short courses, while members may be furloughed or job hunting. All previous recessions and economic slowdowns have been temporary. This recession is a little different to others – all the infrastructure is largely in place and there is pent up demand, so as managing COVID becomes more effective without needing to resort to lockdowns, the industry will have to be ready to move quickly to meet demand, so we should not slow down our efforts in attracting people to the profession.

"For most of my career, my experience is that there has been more work than there have been acousticians, and when there is a rush to deliver work, it is very hard to find the time for upskilling; so investing in yourself whilst furloughed or looking for work makes a lot of sense."

How do you think the role of the IOA might change post-pandemic?
Daniel: "We already have branches across the globe and are affiliated with organisations all around the world: so this time period of uncertainty and change presents an opportunity to become more connected with them. Crises often bring opportunities and this one is driving technology forwards in ways that will encourage us to work smarter and free up time. It also challenges us to question why we do things in certain ways, which might have made sense years ago, but may be due for a change now. A case in point is homeworking and the reclaimed travel time.

"Many IOA students now live and work abroad, this again demonstrates the extending reach and growing reputation of the IOA around the world." P28

Should Acoustics Bulletin become more than just a member resource to become a publication of use and value to the wider acoustics community?
Daniel: "It is primarily a members' resource, but a lot of content will be of interest to people across many different industries. In terms of content we aim for the bulletin to be an informative light read with aspects of technical content suitable for experts and nonexperts. We are not a peer reviewed publication, although the technical contributions are reviewed for suitability by an editorial review board made up of acousticians from different areas of the industry.

"Brexit and the pandemic have been a catalyst for the IOA to become more outward looking and to be an influencer in policy – our priority will always remain with our members but at the same time there is a need to widen our scope and reach more professionals in related industries. We have moved up a gear despite COVID-19; for a long time, we have been saying that our members should not just be acousticians, but the affiliate or student membership category are suitable categories that many associated industries would benefit from. We reach out to them particularly with our supplements (so far, the 2019 'Acoustics – A Sound Career' supplement and the 2020 Innovations in Acoustics supplement). We have plans to produce an environmental supplement in future and we have just launched the 'Acoustics Bulletin video' which includes interviews with key industry figures, the IOA YouTube channel also continues to expand our presence to the broader communities and across industries."

Thinking about IOA's other publications – are there any plans for making this material more accessible to the wider acoustics community?
Daniel: "As part of our planning, we have now started putting proceedings online immediately. We make each issue of Acoustics Bulletin available to anyone 12 months after its distribution to members, and proceedings, abstracts and all other content generated by our events are uploaded to the IOA website."

What action or initiative is the IOA considering to make a positive difference in the industry and for its members during and after the pandemic?
Daniel: "The three-minute IOA video for Westminster's debate on noise, sound and acoustics, that was produced by our then incoming President, Stephen Turner, is a good example of how the Institute has cleverly packaged essential information on the importance of acoustics to inform MPs ahead of the debate held by the Parliamentary & Scientific Committee in February 2020. (Watch the video at **www.ioa.org.uk/news/noise-sound-and-acoustics-was-recently-debate-westminster-24th-february-2020**)

"The success of the video, to inform and educate in a simple but straightforward way was very encouraging and this method of communication will most likely be used again to reach not only politicians, but influencers and people in industries where acoustics really has to be a consideration.

"As the IOA wants to focus on making acoustics an exciting career for young people, it will work to encourage a new generation of acousticians, starting with those who are at GCSE level who could be guided into appropriate degrees, but we also reach out to younger school children. The IOA has a very enthusiastic team of STEM ambassadors, spearheaded by Vicky Stewart, which works to an ambitious programme of school visits and events where possible and contributes to online events such as TeenTech and Vicky with Angela Lamacraft are planning school competitions in 2021.

"The IOA sponsored the Virtual STEMfest, organised by STEM Sussex last November, an excellent opportunity to showcase the depth and breadth of acoustics, and the many and varied routes into the subject and the industries it supports."

The IOA also has an Early Careers Group (ECG) led by Tom Galikowski, which focuses on increasing knowledge and interest among its younger members. The ECG runs a social calendar and provides get togethers either in the real world or virtually. More information on what the ECG is up to can be found by emailing: **earlycareers@ioa.org.uk**.

Members' Forum

To join the Members' Forum meetings, please look out for the Zoom Meeting links sent out in the regular newsletter by email.

Please check your account page on the website to make sure it has your personal email address (as well as your business address) so even if you are furloughed, or not at work for any reason we can still reach you.

If you still don't receive this then check that **ioa@ioa.org.uk** is whitelisted in your email client or contact the IOA office.

IOA events

To see IOA planned events go to **www.tinyurl.com/y6faxozf**

STEM ambassador

To sign up to be a STEM Ambassador:
www.stem.org.uk/stem-ambassadors/join-stem-ambassador-programme

Online courses and CPD

For more information on courses and events visit the website:
www.ioa.org.uk/education-training
www.ioa.org.uk/events

Thank you

None of this work would have been possible without the hard work and commitment that is shown by IOA staff, members of the Publications Committee and magazine staff. I thank them all for their dedication.
Daniel Goodhand.

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Acoustics 2020

Acoustics 2020, the annual conference of the IOA was held online 5th, 6th, 8th and 9th October. Delegates heard about the future of acoustics, the latest thinking and what has been happening in the industry in the UK and around the world.

Institute of Acoustics

Celebrating another year of outstanding work and research, policy and exploration, highlights included sessions from IOA specialist groups;

- buildings acoustics;
- environmental noise;
- noise and vibration engineering;
- physical acoustics;
- speech, hearing and bioacoustics;
- soundscapes;
- musical acoustics;
- future of rail and road modelling;
- early careers group; and
- poster session.

The 15 minute pre-recorded presentations were followed by a 10 minute live Q&A session, and each day closed with a virtual happy hour for delegates.

The Rayleigh Medal 2020 keynote lecture was given by Professor Robin Langley.

Building Acoustics Group

By Roger Kelly

The virtual conference was extremely well organised and my job as a chair was made very easy by the company running the event, GloCast. As the presentations were pre-recorded, we didn't have any papers that ran over time and I think that helped the quality and impact of the talks. Questions came in during the presentations, which made it easy to ask the right ones at the end.

Rainfall noise

The first presentation of the day was by Carl Hopkins, Professor in Acoustics and Head of the Acoustics Research Unit at the University of Liverpool. Consultants are often required to predict the level of noise created by rain and Carl talked us through the calculation of conversion factors between laboratory measurements with artificial rain to other situations with natural or artificial rainfall, and between measurements on roof elements that are inclined at different angles. If you have an interest in rain noise you must read this paper.

Stiffness of trapped air layers

Next up was Ben Burgess, of Buro Happold, who took a detailed look at the issue of the stiffness of trapped air layers in box-in-box constructions. He gave a conceptual framework to consider the physics of the phenomenon and to help with the decisions that engineers have to make about venting the cavity or not. A typical method for assessing the stiffness of an air layer uses a simple equation that looks at the suspended mass and the depth of the air cavity. Ben offered a three-step alternative method, which calculates the potential for stiffening effects due to time, the potential for air to escape into a reservoir and how to calculate the hole size to allow the air to escape. He finished by letting us know where he would like to further investigate composite sound reduction index (SRI), flow resistance, vent shape and vent location.

Assessment methods

The last presentation was from Ilaria Fichera, of Cundall. Her paper described two common assessment methods (Sabine formula and CATT-Acoustic modelling software) for the prediction of reverberation time in general teaching spaces. Comparison was then made against the measured reverberation time of completed classrooms to assess how accurate the predicted values are against actual in-situ measurements. The results showed that the two prediction methods are both valid for the prediction of reverberation time in typical classrooms. The innovative result of this paper is that when using the equivalent absorption area, the results are much more accurate than when using an absorption coefficient for proprietary rafts. In addition, the study demonstrated that the CATT-Acoustics reverberation time prediction is more accurate than the Sabine reverberation time calculation for most of the cases when the model is well built.

The presentation also touched on the importance and influence of furniture, something that was highlighted as needing further study.

Environmental Noise Group

By Steve Mitchell

The two Environmental Noise Group sessions progressed in two parts each of three papers, chaired by Steve Mitchell of Mitchell Environmental Ltd and David Waddington of Salford University. While the pre-recorded papers were presented, the chairs collated questions that each speaker answered following their paper.

Agent of Change Principle

The first paper was by Toby Lewis, a Technical Director with WSP, entitled 'Implementing the Agent of Change Principle in Planning Decisions'. He summarised the current policy and guidance around the complex subject of ensuring that new noisy developments are consented only so that existing facilities do not have unreasonable restrictions placed on them as a result of development permitted after they were established. He used two case studies to illustrate new developments following this policy, demonstrating the importance of robust and defensible noise assessments being completed early in the design process.

Noise policy developments in Wales

The second paper was by Martin McVay of the Welsh Government's planning division, entitled 'Noise Policy Developments in Wales'. Martin explained the Welsh Government's progress in ensuring that noise is considered within the overarching sustainable development framework set by the Well-being of Future Generations (Wales) 2015 Act. He described the new five-year Noise and Soundscape Action Plan that forms the Welsh public sector's central noise policy document, and how Planning Policy Wales (PPW) edition 10, has completely reframed national planning policy in Wales in line with Wellbeing of Future Generations principles. He also advised a new replacement TAN11 covering air quality, noise and soundscape is under development to provide technical guidance.

Managing noise and air quality

The third paper was by Nigel Jones of Extrium, entitled 'Synergies and Conflicts Between Air Quality and Noise'. Nigel summarised some of the findings of two reviews, commissioned by the English and Welsh Governments, into synergies in managing noise and air quality in action planning resulting from the Environmental Noise Directive and Local Air Quality Management. He referred to best international practice in combined action planning and discussed a series of technical and policy recommendations that could assist in enabling a greater alignment of air quality and noise assessment.

Acoustic features of industrial noise

The fourth paper was by Julija Smyrnowa of the Environment Agency, entitled 'Application of Psychoacoustic Metrics for the Assessment of Tonality of Industrial Sound'. Julija's paper concerned the rating of the acoustic features of industrial noise in a BS4142:2014 assessment using objective or subjective methods. Julija explained a number of objective psychoacoustic metrics that can be used to describe features of binaural sound recordings made in the vicinity of industrial sound sources with prominent acoustic features, in particular, tonality. Other psychoacoustic metrics such as loudness, roughness and sharpness were also illustrated.

BS4142

The fifth paper was by Professor Bill Davies of Salford University, entitled 'Rethinking BS4142'. Bill observed that the evidence base for the feature corrections prescribed in BS4142 is weak and anecdotal accounts suggest there is significant variance between practitioners. He described a recent industry workshop at Salford University that considered the problems with BS4142 and, in six small groups, identified the research questions, objectives, methods and stakeholders needed to produce a more rigorous assessment method. From this, Bill outlined the research project he proposed to deliver the underpinning science needed, and to invite further involvement from stakeholders.

Noise guidance in Scotland'

The sixth paper was by Ashley Leiper, of EnviroCentre, entitled 'A Review of the Implications of Local Planning Authorities' Noise Guidance in Scotland'. Ashley described guidance issued to Environmental Health Officers by The Royal Environmental Health Institute Scotland (REHIS). One feature of the guidance is that while it understandably promotes internal noise criteria to be met with open windows, it allows an assessment of internal noise levels with closed windows if four clear planning objectives are met, and this is applied as a blanket criterion for a whole site. This can lead to large swathes of land allocated for housing in local development plans as undevelopable, when in fact, the proportion of properties which would require closed windows to meet internal noise levels is often low. Ashley described other implications of the rigid application of the guidance, their impact on developers and the ability of councils to meet housing supply targets.

Noise and Vibration Engineering Group
By Malcolm Smith, Emma Shanks and Chris Steel

The annual conference session for the Noise and Vibration Engineering Group always caters for a diverse range of interests, so given the online format for this meeting it was useful to have the complementary knowledge of Malcolm and Emma as joint-chair, as well as the assistance of Chris in preparing this report.

A review of noise exposure in UK call centres

It has been estimated that 780,000 people are employed in agent positions in contact centres throughout the UK, and this paper by Mat Tuora and Ian Rees of Adrian James Acoustics presented evidence that a substantial number of staff may be exposed to noise exceeding the first or second action level in the 2005 Noise at Work Regulations. High ambient noise levels in call centres are combined with often poor intelligibility of telephone audio, so agents often run their headsets at 20-25 dB above background levels.

Fourteen call centres were visited, generally open plan call centres with high numbers of occupants. The study looked at noise exposures from monaural headsets since these were preferred by staff as they improved workplace ethos. Employees typically set their headsets to produce noise levels of between LAeq,T 81 dB-91 dB, although with significant outliers at LAeq,T 71 dB and 101 dB. As a result, 25% of staff tested were likely to exceed the Upper Exposure Action Value of LEP,d 85 dBA after five hours of headset work.

Good acoustic design of the call centre is required, and potential ways of controlling ambient noise were given as:

- break the line of sight;
- increase distance between staff;
- reduced reverberation time; and
- use binaural or noise cancelling headsets.

The presentation concluded with a discussion about call centres in a post-COVID future.

Questions focused on details of the measurement methodology, such as how the signal was monitored as the call proceeded, and the reasons for using a dummy ear rather than a full head.

Sound from domestic air source heat pumps: a case study

The second talk was given by Matt Torjussen (noise.co.uk) who presented a case study on a noisy domestic air-source heat pump that caused a dispute between neighbours. These devices are set to become far more common as a solution for low carbon heating.

Domestic heat pumps are installed in the UK under the Microgeneration Certification Scheme, which avoids P32

the need for local authority scrutiny. Under the scheme, the installer completes a noise assessment that requires the total sound pressure level, plus a notional background level, not to exceed 42 dB(A) at the nearest residential receiver. The talk demonstrated how the methodology fails to account for strong acoustic features present in the noise, particularly the fan blade passing frequency, which would be a significant factor in a BS4142 assessment.

From the discussion following the talk, it was clear that the current generation of heat pumps are far from ideal for this country, which has many closely spaced houses in relatively quiet suburban locations, and that the current certification scheme could potentially lead to many disputes. The discussion also highlighted how there was considerable scope for improved design, with either noise control at source or built-in acoustic louvres.

Focusing of ground vibrations generated by trans-Rayleigh trains travelling with acceleration

Professor Victor Krylov presented his research into 'sonic booms' of ground borne vibration when high speed trains travel faster than the Rayleigh wave speed in the ground. When the train continues accelerating, focusing effects can occur which increases the intensity of the boom. This is similar to the focusing of sound waves from accelerating supersonic aircraft which can create a 'superboom'. For a train it leads to focusing along caustic lines located symmetrically on both sides of the track. Victor outline the basic theory of the mechanism, and presented results from his numerical models showing how the focusing could result in a significant increase in ground vibration. He noted that in densely populated countries like the UK, with relatively short distances between railway terminals, these conditions could happen rather frequently.

The first question concerned what such a boom would feel or sound like. Victor explained that the pulse of energy might make windows rattle, could startle animals, and might reach the point where damage to buildings could occur. He stressed that although there have been few observations of the effect internationality, he was concerned that it could be an issue in this country. There are a number of potential mitigation measures however, such as track side measures to modify ground conditions or changes of operational procedures to reduce acceleration rates. Soil conditions are the key to when and where it happens, and this could vary with the time of the year.

Attenuating lateral vibration sources

The effect of ground borne vibration on buildings is often characterised in simplistic terms in the vertical axis, with isolation systems to block transmission of structure borne noise being designed on the basis of single degree of freedom calculations. Adam Fox (Mason UK) explained that ground borne vibration from rail sources could have significant energy in lateral directions, for which normal transmissibility calculations did not apply, and building isolation systems also needed lateral supports. As a result, design compromises between structural design and acoustic design were often required. Designs should be sympathetic to this and must respect limits on movement required by the project structural engineer, but this could lead to designs which are overly stiff in the vertical plane. A number of practical examples were presented where it was necessary to prevent lateral structural movement under wind loading while respecting the building acoustics and blast/seismic scenarios.

Initial questions concerned the nature of vibration sources and the natural frequencies for the isolators. Adam explained that to control vibration and structure borne noise from a railway needed isolators tuned to 12 Hz, whereas road vibration might require lower frequencies. The subsequent discussion highlighted various complications in using multi-degree of freedom or finite element models to design the system, for example, in determining the effective loading for bearings. Other questions focused on design considerations such as the need to meet fire regulations and maintenance issues, and the pros and cons of springs versus rubber mounts.

Sound distribution for safe-listening venues: a review

This review, which was requested by the World Health Organization (WHO), considered two key aspects of safe listening: the design of the PA system and the venue acoustics. In summary, Ken Liston (Nottingham Trent University) and Ian Wiggin (University of Nottingham), found that the sound distribution is critical to achieving safe listening conditions in practice, and that although general advice is possible, every venue is different. In particular, controlling sound at front of house will leave some audience members over-exposed. Questions remain over the risk of low frequency exposure.

Current research aims to develop a set of tools that can be applied to live amplified music venues so that a more even sound field is created for the audience that will standardise the noise exposure level and produce a better listening experience. Current indoor venues typically vary by 5 dBA from front to back of audience, and outdoor venues by 8 dBA, but there is high variability between venues. Hearing regulations are designed to protect employees but there are few regulations for the audience, which is a concern for WHO. Assessment of the sound system and venue design showed that the reverberant build-up of sound at indoor venues was significant, even from unamplified music, and that modal density was a factor for smaller indoor venues. Various control techniques were discussed such as use of absorption, Helmholtz resonators and diffusion to control reverberation times.

The presenters were asked about the suitability of using A-weighting for setting target limits. They indicated that both linear and A-weighted parameters may be helpful to make the control of lower frequencies more obvious. Questioned about the effect of low frequency noise on hearing loss, they indicated that further research would be beneficial.

Construction: best practice for control of today's noise and hand-arm vibration exposure

Noise and hand-arm vibration (HAV) exposures represent a significant health risk in many activities in the construction industry, explained Emma Shanks (HSE Science & Research Centre). The Health and Safety Executive had identified a need to update information and practical knowledge of noise and HAV exposures, and to identify what activities cause the highest risks to construction workers. It was found that there was little evidence of P34

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good control being applied because duty holders put noise and HAV in the 'too difficult' box. As a result, control of noise was reliant on hearing protection, and control of HAV was done by logging tool use by workers.

The project aimed to:

- identify high risk noise and vibration activities in construction;
- establish realistic exposure levels based on typical construction jobs;
- determine current best practice; and
- get that information out to industry.

Six high-risk task/processes were assessed and a range of reasonably practicable control methods were outlined; as a result, construction documents have been produced to be made freely available to industry.

The first questioner asked whether there are easy ways to identify if you have a noise or HAV problem. Emma explained that the HSE has simple broad rules: for noise, if you have to shout at one metre you are probably above the upper action value; for vibration, one hour usage for a rotary tool of 15 minutes of an impulsive tool is likely to give exposures above action value. Asked whether it is worth doing HAV surveys or better to use HSE data, Emma noted that since there is no regulatory requirement to do measurements, using HSE's data is a good starting point. Duty holders know their work better than anyone, so could establish typical tool usage from job observation or from how the job is priced or timed.

Regulatory expectations versus noise and vibration realities

The final talk, by Chris Steel (HSE), focused on the competency of noise and vibration consultants, why it's relevant and important, and the action that HSE is taking to improve the quality of consultants' reports. Recently, HSE has successfully prosecuted a noise and vibration consultant under Section 3 of the Health and Safety at Work Act 1974, which requires consultants to demonstrate competency to their clients and to HSE. Failure to comply can result in enforcement, and in 2020/2021 the HSE noise and vibration team will, for the first time, review the quality of consultants' reports. A random selection of reports will be collected during routine HSE inspections, and where poor practice is found enforcement action will be taken. Chris has been tasked with developing a joint discussion with the IOA, BOHS, IOSH and ANC about competency, and what a duty holder should, and should not, expect from a consultant. He would like your input and involvement.

Chris was asked about the 'questions clients should ask consultants' document, which can be found at **https://hearingconservation.org.uk/be-a-smart-buyer-when-it-comes-to-noise-consultancy-services/**

If a consultant fails to identify a risk, it doesn't change the fact that the risk existed before the consultant arrived. The HSE will take action against those doing a bad job if their advice is likely to result in people being exposed to risk, as they would take action against someone who has done a bad job of putting up a scaffold even if no one has fallen off it yet.

Chris was asked whether there should be a responsibility on companies to employ competent consultants, e.g. IOA/ANC members, and he agreed, reminding us that this responsibility is included in the Management Regulations. He added that low price consultancy reports were often of poor quality. There is a need to lift quality, which will affect cost, but not beyond the cost that employers should be paying to get competent advice

Asked about whether it was acceptable to produce reports without referring to any control measures, even hearing protection, Chris noted that it is ultimately the duty holder's responsibility to assess their risk and implement controls, and if they are reasonably well-informed and only prepared to pay to collect noise data then there's no problem with that. A higher level consultancy could include exposure levels and hearing protection advice, and a very competent consultant may be in a position to add control advice. Chris remains constantly surprised by reports that don't even reference the information available on the HSE website **https://www.hse.gov.uk/foi/internalops/fod/inspect/noiseappe.pdf** and **https://www.hse.gov.uk/foi/internalops/og/og-00119.pdf**.

In conclusion, asked about what he would like to be talking about in two years' time, the answer was:" Control! I'd like to be talking to you about control."

Speech, Hearing, Bioacoustics and Musical Acoustics

By Gordon Hunter

Five papers were presented on a diverse range of topics spanning these themes:

Andrea Harman of Saint-Gobain Ecophon gave a presentation describing how hearing impairment greatly worsened the quality of life of people with dementia, and how a clinic in Denmark used acoustic intervention to mitigate against these problems.

Hector Romero of the University of Sheffield gave what was, in the context of the current COVID situation, a highly topical talk about how acoustic monitoring could be used to characterise whether a person's breathing pattern of inhalation and exhalation was showing evidence of any pathological condition.

Professor Stephen Dance of London South Bank University gave the latest instalment on his ongoing research project, carried out with his former PhD students, Doug Shearer and Georgia Zepidou, measuring the hearing damage experienced by students of classical music and their piano accompanists at the Royal Academy of Music. Results on various types of instrumentalists and singers were presented, showing some interesting features, which should help control musicians' levels of exposure to potentially dangerously loud sounds.

Gordon Hunter of Kingston University described work done with his student, Sabine Dreibe, on how statistical language models, trained on specialised datasets compiled from news broadcasts on particular themes – for example, business news or sports news – could be used to automatically classify news broadcasts according to their theme.

Finally, Nicholas Brown described a project he had carried out with Haydar Aygun of London South Bank University on the development of a smart phone app designed to fill the role of traditional methods for performing auscultation – monitoring the sounds produced by the human heart and lungs during their function, as a component of making diagnoses – such as mechanical stethoscopes.

The presentations prompted interesting questions and discussions by other delegates.

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Soundscape session
By Grant Waters MIOA and Peter Rogers FIOA

If there is one thing that 2020 taught us, it's that we shouldn't take our soundscape for granted. The sounds we hear on a daily basis fundamentally changed in 2020; noise from road traffic, aircraft and human activity dropped to such levels that the natural sounds of our environments and wildlife found their voice once again. This re-emerging sound of nature provided a lot of us a welcomed bit of tranquillity and calm amongst the health and social chaos that was unfolding.

The soundscape session, chaired by Peter Rogers of Sustainable Acoustics and Grant Waters of Anderson Acoustics & Tranquil City, was a progression of those that came before. Instead of content focusing on discussing what 'soundscape' means in acoustic consultancy practice, the speakers presented papers that provided listeners with a 'toolkit' for implementing soundscape principles in their everyday projects and the discussions ranged across next steps.

Soundwalks in industrial areas

The first speaker of the session was Dr Julija Smyrnowa, a noise advisor in the Environment Agency presenting her paper titled 'Soundwalks in industrial areas'. Julija's study explored how soundscape practices could be used to enhance the understanding and assessment of typical industrial sources, combining both public engagement and acoustic mapping of soundwalks in Rotherham and Sheffield. The process asked participants to listen in silence for short periods along the route and asked questions on their perceptions. The questionnaires used were created making reference to ISO/TS 12913-2 and asked questions such as to rate the 'present environment' and whether the participant found the surrounding environment 'pleasant', 'chaotic', 'vibrant' or 'calm' (amongst others). It also asked questions on perceptions of the visual environment too. The soundwalks were captured in both using a binaural microphone and recorder as well as using a sound level meter and calculations were made of both statistical and psychoacoustic parameters with comparisons and correlations investigated. Julija's findings suggested that for noise impact assessments that result in low impact, soundscape considerations of 'aural and visual appropriateness' could be helpful to fully investigate the effect of the sound's context.

Soundscape assessments

Following Julija was Yiying Hao of Bureau Veritas presenting her paper titled 'An exploratory review of soundscape descriptor modelling for soundscape assessment and design practice'. Yiying outlined the case that there was no universal method for how to conduct soundscape assessments in practice, specifically context based soundscape mapping. Yiying presented the key soundscape descriptors that were focused on, 'annoyance', 'pleasantness', 'overall quality', 'tranquillity', 'vibrancy'. The study piloted a 'tranquillity' and 'pleasantness' mapping model and compared their performance. The study found that psychoacoustic indicators played an important role in determining 'pleasantness' and 'vibrancy', whilst being of lesser importance in the 'overall quality', annoyance and 'tranquillity' models. Yiying's research also highlighted the importance of non-acoustic factors in the modelling, such as visual, especially in the example of modelling 'tranquillity'.

DEFRA Noise Mapping report

The final speaker of the first half was Peter Rogers of Sustainable Acoustics, presenting his paper titled 'Noise mapping and soundscapes' that discussed findings from the DEFRA Noise Mapping report (NO0256) that sets out future possibilities for how national noise mapping, one of which was to combine mapping sound quality as part of wellbeing. He also developed thinking from an earlier paper on the language being used to how mapping sound quality as part of soundscape quality could be achieved practically.

Data collection

The second half of the session began with Frederick Gast of HEAD acoustics with his paper titled 'Tools for data collection in Soundscape applications'. His message was not to overlook the soundscape in smart cities to achieve a high quality of life. He set out a blended approach that includes use of binaural recordings and psychoacoustic analysis to support the ISO 12913-2 (Annex C) methodology to acquire data and put it into practice robustly.

APEAL method of soundscape assessment

Jack Harvey-Clark of Apex Acoustics presented his paper on the new APEAL method of soundscape assessment with his paper titled 'Acoustic perception EvALuation of buildings – the APEAL method'. He shared how he has developed an audio visual method to systematically capture point of view assessments of soundscapes to assist communication of the soundscape in use to non-specialists and also evaluate it acoustically.

Assessment techniques and the EIA process

Dani Fiumicelli of Vanguardia Ltd with his paper titled 'Soundscaping and Environmental Impact Assessment' that asked the question of whether soundscape assessment techniques could be helpful in the EIA process, to help account for many non-acoustic factors, and contextual influences that are often poorly accounted for in traditional approaches. He proposed with his usual style how this may change what the mitigation being proposed should be aiming to achieve, with not just noise reduction but improved health and wellbeing as important outcomes.

Process for capturing standardised sound, visual and subjective information

The final speaker of the session was Andrew Mitchell of UCL, presenting a paper titled 'The Soundscape Indices (SSID) Protocol – A method for practical soundscape assessments in the city', an overview of the work he has been part of with Jian Kang and Francesco Aletta. The paper presented how the protocol, a process for capturing standardised sound, visual and subjective information for use in determining various soundscape indices, was developed and tested. Andrew presented comparisons of how the overall sound level influences 'pleasantness' for a number of central London locations. The results indicated that there was a wide range in correlation strengths when considering overall level, but the protocol allows further investigation of the influence of locations where certain types of sounds were dominant, i.e. natural, traffic or human sounds, to help determine the importance of certain sounds on perceptions.

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Soundscape challenges

When the speakers were asked by the chairs about what the main obstacles to soundscape in practice were today, the two main challenges identified were: educating practicing acousticians on feasible methods to account for soundscape considerations in real-world projects, and how to combine traditional acoustic and psychoacoustic measurements with other contextual factors meaningfully, such as visual elements which are known to notably affect the perception of sound. One audience poll identified a strong will of the audience (97%) to create a specific IOA Soundscape group, which was committed to be followed up by the chairs, as a legacy of this session. An update post event is that this has been put to IOA Exec.

Musical Acoustics Group session report

By Professor Stephen Dance

The Musical Acoustics Group was badly affected by COVID during 2020, however, meetings were held virtually and the eighth consecutive AGM was held during the IOA virtual conference in October 2020.

Each of the planned physical events was delayed by one year to allow the pandemic to clear. The first event was to be held at the Royal Academy of Engineering during early April 2020 in collaboration with the newly formed Hearing Conservation Association with the focus on music and the sound of performance. This was supported by UK Acoustics Network through two special interest groups: Room Acoustics and Communication, and Biomedical.

The second meeting was due to be held at Birmingham City University in mid-October 2020 to cover all areas of music and acoustics.

At Acoustics 2020, a special session was held jointly with the Musical Acoustics Group, the Speech and Hearing Group and the Biomedical Acoustics Group. Earlier in the year, the first virtual inaugural lecture was presented by Professor Stephen Dance on 'Facing the Music – Music and Sound Exposure'. This was held over Zoom and had 77 participants.

The management committee of the Group has held six virtual meetings using internet conferencing facilities, thereby avoiding any unnecessary travelling and, more importantly, keeping safe in these concerning times.

We expanded our ranks with a new IOA Early Careers Group representative, Celia Diaz Brito, who joined the committee. Our thanks go, as ever, to all members of the committee for the active roles they take in all aspects of the Group's activities.

We hope that 2021 brings musical acoustics back to the fore with the support of the new UKAN+ EPSRC grant.

The future of road and rail modelling

By Hilary Notley, Defra

One of the final sessions of Acoustics 2020 was on the future of road and rail modelling and was co-chaired by Matthew Muirhead from AECOM and Hilary Notley from Defra.

The first paper, 'Design manuals for the roads and bridges: an introduction to LA111 noise and vibration' was given by Ian Holmes of Highways England. Ian's presentation covered the changes to the noise and vibration assessment methodology within the Design Manual for Roads and Bridges (DMRB). His current role has ownership for the noise chapters within DMRB, specifically LA111, Noise Assessment and LD119, Roadside Environmental Mitigation and Enhancement. The changes were first published in November 2019 and there have been revisions since then. Ian described the changes in LA111 as "evolution, not revolution" compared to its predecessor HD213/11. High level points raised included:

- a focus on requirements and advice, removing the narrative;
- consideration of LOAEL and SOAEL;
- how to determine whether noise or vibration from a scheme gives rise to Significant Environmental Effect; and
- consideration of non-acoustic factors for determination of operational significance.

Ian highlighted that the document requires likely significant effects to be identified (based on assessment of noise change on people), however he emphasised that the level of detail shall be proportionate to the quality of data available and the risk of likely significant environmental effect.

Following the presentation Ian answered questions ranging from the level of feedback received since the publication of the guidance last November, to clarification of technical details.

The remaining papers in the session were all linked to an initiative being driven by the British Standards Committee on Transportation Noise (EH/1/2). All speakers and chairs in this session are members of EH/1/2 and also members of a working group of EH/1/2 tasked with scoping proposals for British Standard on the Calculation of Sound Levels Outdoors (BS CSLO). It is proposed that this British Standard could eventually replace national modelling methods such as CRTN and CRN.

An IOA workshop was held in March to discuss the proposals and formulate a preferred way forward for the proposed BS CSLO. As it happens, that meeting turned out to be last one run with physical attendance by the IOA before COVID-19 restrictions were implemented, although even then there were indications of what was to come as it had a blended format allowing for online delegates as well as in person. The papers from that workshop were updated for Acoustics 2020 to allow for additional consultation and engagement with IOA members and interested professionals to ensure any resulting standards meet the needs of the wider industry.

The first paper in this group was a scene-setter called 'Noise Mapping – the Case for Change', presented by Simon Shilton of Acustica. Simon chairs the working group scoping the proposed BS CSLO and he explained that the aims of the working group were to develop the business case and to identify the user and business requirements. Two key objectives underpinned this work:

- do the current CRTN and CRN methods meet current and known future needs? and
- if not, what are the requirements of the methods which could replace them?

Identification of user requirements considered those from stakeholders (e.g. national and local government organisations, consultants), data providers (e.g. OS, road traffic survey companies) and consumers of results (e.g. national and local public health bodies, planners). The analysis resulted in the following concept:

- British Standard for the Calculation of Sound Levels Outdoors
  - o Part 1: Definitions and Quality Assurance;
  - o Part 2: Calculation of Sound Propagation Outdoors;

P40

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  - Part 3: Calculation of Railway Vehicle Sound Power Emissions; and
  - Part 4: Calculation of Road Traffic Sound Power Emissions.
- Potential for future extensions for other sources such as wind turbines, construction, open sites, industrial facilities, etc.

The vision for any resulting BS CLSO would be:

- sound power emission levels from road and railway sources;
- attenuation of sound outdoors from source to receiver;
- robust, repeatable, ratified and reliable results, within clearly defined boundaries;
- calculates the sound reduction arising from noise mitigation measures implemented either at source or in the propagation path;
- basis of development to reflect technological changes to the sources, or enhancements in understanding of sound propagation; and
- complete and clear documentation, ratified and supported with test cases with known results, to help provide consistent implementation in software – i.e. ISO/TR 17534-X.

Simon further outlined some functional and non-functional requirements. The findings of the scoping group, as reported by Simon when outlining the case for change, were that existing methods meet current requirements through a series of extensions and are applied beyond the original design parameters. They do not robustly support some of the emerging use cases and neither do they meet all the identified functional requirements based upon user requirements. In conclusion, developing a new BS CLSO could leverage the developments in source and propagation modelling over the past 30 years and provide a robust and supported method for emerging and future user requirements.

Data

The next paper was presented by Nigel Jones from Extrium. In a world that is now driven by, and generates, data in many more ways and to a far greater volume than ever envisaged when CRTN and CRN were first developed, Nigel built on the previous paper to outline 'Data Requirements and Opportunities'. To illustrate the point, Nigel took a simple definition to highlight just how integral data is to, and throughout, the process:

What is noise modelling?
Definition (italic words indicate data requirement):

- *computer based* calculation
- following a *defined methodology*, to calculate
- sound levels emitted by *specific sources*
- propagation *through space*
- to *defined receptor locations*
- within a *defined geographical area*
- over a specific period of time.

Nigel summarised the different types of data required in noise modelling, covering issues such as the different scales of modelling required for different use cases and the different levels of detail available in datasets. He then raised the question of whether we need or whether it would be advisable/helpful to have different defined/standardised data (data schemas) for particular end uses, perhaps reflecting different assessment levels. He then gave an example of geospatial metadata.

This naturally led to a discussion on data standards, these could perhaps be based on ISO TC 211 and the Open Geospatial Consortium standard framework. Looking to the future, Nigel explained, this could include a wide data landscape including smart cities, sensors, interoperable data and more joined up decision making – which must surely be an aim for us all.

Having laid out the broad landscape the next papers started to focus in on specific topics. First it was the turn of our President, Stephen Turner of ST Acoustics. Stephen also chairs EH/1/2 under which the scoping working group sits. Stephen acknowledged that his paper, 'Railway Source Terms', was the work of Chris Jones, who presented his work at the March meeting. Stephen kindly agreed to present Chris' paper and also paid tribute to the great contribution to this field by Chris Jones and Rick Jones, both railway noise experts and both recently retired.

Stephen started by outlining the case for change, picking up on some of the requirements identified in Simon's earlier paper. He detailed the different sources of noise contributing to the overall noise emitted from railways and discussed the different methods available, which may be suitable for adapting to a new BS CSLO such as IMAGINE, CNOSSOS-EU:2015, sonRail and other schemes.

However, the outstanding question is how the input data can be captured. Fortunately, Subgroup I of CEN TC 256 W3 Railways – Acoustics is currently drafting a standard for the assessment of 'apparent sound power', which will cover all sources of a moving vehicle (e.g. rolling, aero, engine).

Stephen then discussed the considerations for rolling noise, aerodynamic noise, bridges and squeal presenting the challenges ahead for both modelling or measuring elements of the source and other terms. Stephen reminded us that there were further considerations to be resolved such as barriers and directivity (cylindrical, not spherical dispersion).

Finally, there are organisation issues to resolve. These include who 'keeps' the database and who pays for the development/data gathering maintenance.

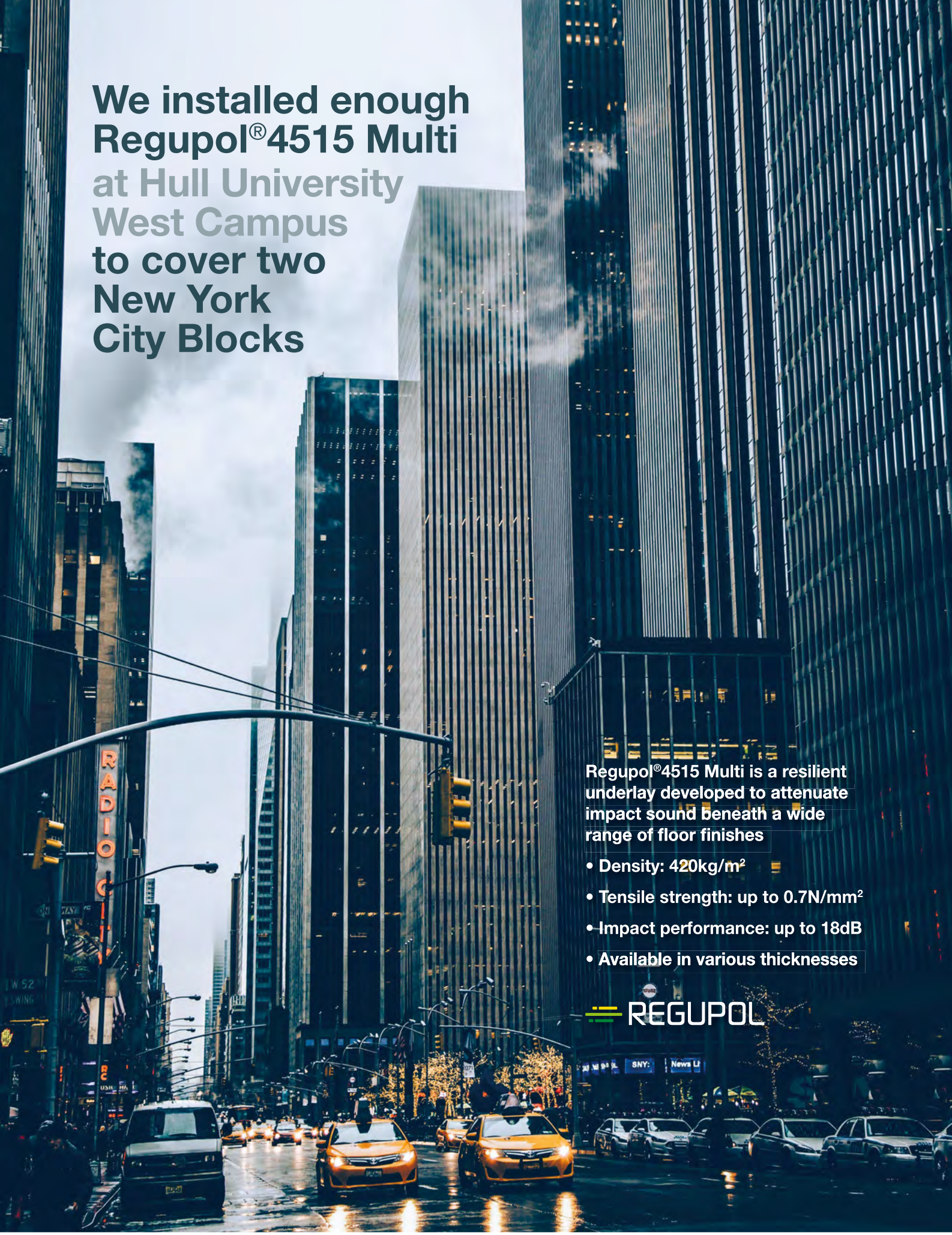
Road source terms

We turned our attention next to 'Road Source Terms' presented by co-chair, Matt Muirhead from AECOM.
As with the previous paper, Matt started by expanding on the case for change. Potential limitations with the current methodology include a lack of appropriate metrics and time periods, a desire for a scalable approach, fleet composition (particularly with the introduction of electric vehicles), the ability to account for acceleration and deceleration of traffic (including congestion) and changes to tyre regulations. Matt then discussed some of the emerging requirements from the use case analysis and identified some of the different methods available, which may be suitable for adaptation to a new BS CSLO. These included Harmonoise/IMAGINE, Nord2000 and CNOSSOS-EU:2015 and Matt outlined some of the advantages and disadvantages of these approaches.

In a similar vein to the rail source terms paper, Matt reminded us that nothing is simple or complete and that there are challenges with obtaining relevant input data. There are European databases that will prove sufficient for some purposes and assumptions which may be made, but adaptation for the UK and the chosen propagation method will be necessary to deem the data suitable for all identified use cases.

Finally, echoing the rail paper yet again, Matt identified the next steps, which include scoping the required tasks and seeking (and securing) funding streams.

P42



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Quality framework, propagation and future aspirations

The final paper in the session saw Simon Shilton from Acustica take to the (virtual) stage again. His presentation, 'Quality Framework, Propagation and Future Aspirations', expanded upon the road and rail source terms papers to cover options identified for the propagation aspect of any new BS CSLO. He began by outlining some of the limitations associated with current methods such as simplified paths (e.g. lack of lateral diffraction), the advantages of 3D over 2.5D propagation and the difference in approach for homogenous vs favourable conditions. Simon further detailed new and future potential developments, such as accounting for green infrastructure, trees/foliage/woodland attenuation and future requirements including assessment at quiet façades in courtyards and tunnel portals.

The key requirement was a need to:

- develop the draft methodology for the propagation of sound levels outdoors;
- catalogue all input and output datasets;
- provide test cases with known results; and
- release an open source software implementation.

Moving on from propagation to consider the proposed standard as whole, Simon emphasised the need for clear definitions and quality assurance, especially as currently, methods are frequently used beyond their design scope, with software developers having to extend the range of application to meet the expectations of users. Therefore, the following quality framework, based on research and results from scoping panel, is proposed for Part 1 of the standard (Definitions and Quality Assurance):

- define scope of application;
- application of the methods in different use cases;
- define quality criteria – per use case;
- data schema specification for input and output objects;
- address uncertainty; and
- develop technical report under ISO 17534.

In addition, the concept outlined in Simon's first paper (see above) may need to be enhanced with guidance, perhaps in the form of informative annexes or a separate 'code of practice', 'guide' or technical report.

In order to deliver this concept, it is proposed that separate drafting panels are formed for each part of the standard. The scoping working group will transform into a steering committee, which will have overall responsibility for delivering the standard through:

- ensuring consistency in approach between the drafting panels;
- securing internal consistency within each part of the standard;
- defining the scope of the methods; and
- defining the approval criteria.

There are various research requirements, some of which were covered in the individual papers and others identified by the scoping working group and yet more still to be identified by the drafting panels. New or novel solutions may be required for some user requirements.

EH/1/2 is looking for volunteers from across the industry to come together in the drafting panels. Expertise is sought in:

- sound propagation outdoors;
- emission sound power from roads and railways;
- existing methods, including Harmonoise, IMAGINE, Nord2000, NMPB 2008, CNOSSOS-EU:2015;
- development of software for source and propagation models;
- GIS and database design for data schema;
- noise modelling for test cases;
- long-term sound measurements for basis of validation;
- authoring of guidance documents; and
- ISO 17534.

A discussion then followed to allow the BSI working group to gather some feedback from the delegates. Areas mentioned for further consideration included stationary and slow-moving trains (depots), wet roads, climate change (wetter weather, stormier weather, warmer weather = more windows open), greening on and between buildings, perception/soundscape – not just decibels.

If you feel you can contribute to one of the drafting panels, or can help secure funding (e.g. expertise in grant applications), please contact the EH/1/2 committee at Joanna.Macnamara@bsigroup.com clearly marking your email as being in relation to the EH/1/2 CSLO working group.

Early Careers Group

By Tomasz Galikowski

The early careers session of Acoustics 2020 was organised jointly by the early careers groups of the IOA and the UK Acoustics Network. The purpose of the session was to give Early Career Group members an insight into the topics of effective collaboration between industry (both R&D and consultancy) and academia, and on career routes from academia into industry.

We had four invited speakers in the session from a range of backgrounds in both industry and academia. Ashley Leiper from EnviroCentre spoke on his experience as a consultant developing soundscapes for urban planning, and the role academia has in supporting soundscape research.

Andrew Mathieson from Thales spoke about his experience moving from academic research into industrial R&D, and his perspective on the different forms that collaboration between industry and academia can take.

Joseph Allen from RBA Acoustics gave an overview of his career development, and gave our early career members advice on their career development based on his own experiences.

Finally, Nikhil Banda from Seiche gave a talk on his experiences in the field of underwater acoustics during his time at university and at a consultancy, highlighting the ways to transition from academic research into industry. We are grateful to all four speakers for giving their time to share their experience with our early career members.

The session was followed by a virtual social and quiz event organised by the IOA Early Careers Group. The quiz comprised four rounds – acoustics and general knowledge questions – with an increasing difficulty and decreasing amount of time for answers. The winner was Kial Jackson from Scotch Partners LLP followed by Alec Korchev from Clarke Saunders and Zach Simcox from Azymuth Acoustics. Well done to all! Enormous thanks to Laura Broadley, Robin Mackenzie and Dean Chapman for organising and hosting the event.

There is no report from the Physical Acoustics Group. Once this has been completed, it will be included in the next available issue of Acoustics Bulletin.

It's not just quiet, its COVID quiet...

Last year was a strange time for acousticians. The impact of the COVID-19 virus on noise consultants and regulators alike was mixed...

By Tony Higgins and John Shelton

On the one hand, the lack of road traffic and transport noise led to markedly lower noise levels in the general environment (more of that later). On the other hand, domestic noise complaints, behavioural noise and noise in streets from impromptu parties have been an increased source of complaint as the lockdown generation tried to cope with the new normal. The two observations may be connected – one unmasking the effects of the other?

This article doesn't address the behavioural noise elements but instead, focuses on the broader picture; the changes in transport that have seen markedly lower environmental noise levels and whether assessment of that noise during lockdowns is producing appropriately robust impact assessments.

Those familiar with environmental noise will be aware of a number of key standards in relation to noise and health. The World Health Organization (WHO) guidance (1999 and 2009) provide 'noise limits' based on long-term LAeq levels that provide fixed limits linked to health effects and disturbance. WHO recommends that limits for day time and night time noise should not be exceeded and these are summarised in the table below:

Most environmental noise is mainly influenced by transport activities, in particular road traffic, so let's look at an example of road traffic data pre- and post-COVID.

Traffic noise

Take for example the nation's busiest B road, the B2145 Chichester to Manhood Peninsula road in Sussex. The road supports a diverse mix of traffic that includes many large lorries transporting vegetables, salads and fruit from the greenhouses and fields there. Around 11,000 vehicles per day pass the monitoring point and lorry traffic continues during the night.

The monitoring station logs one second LAeq values, and 1/3 octave spectra, which are uploaded to the web every 15 minutes for archiving, calculations and documentation. The monitoring station has an unobstructed view of (and is 50m from) the road in line with the façade of the receptor.

The monitoring has been going for three years and includes the lockdown cycle last year (2020) so it is interesting to see what effect there might be. P44

Specific environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAmax fast [dB]	Source
Outdoor living area	Serious annoyance, daytime and evening. Moderate annoyance, daytime and evening	55 50	16 16	- -	WHO 1999
Outside bedrooms	Sleep disturbance, window open (outdoor values) Lowest Observed Adverse Effect Level (Loael)	45 40	8 8	60	WHO 1999 WHO2009

Calculations of standard parameters are available, but for ease of comparison L_{den} results are shown in the figures below.

The data in Figure 1 (below) provides a summary of the observed measured L_{den} levels. The average measured levels show consistent results as expected for a busy road.

Typically, pre-COVID the L_{den} is between 61 and 63 dB(A) (see 2019 overview) corresponding to an L_{Day} of around 59-61 dB(A) and an L_{Night} of 52-54 dB (see conversion table from research carried out by Brinkla et.al. 2017).

This converted data is then directly comparable to the WHO standards noted above. During 'normal' times the receptor location is clearly subject to high levels of transport noise that exceed the WHO guidelines for both day and night time noise exposure. WHO guidelines would indicate this level of exposure might cause 'critical health impacts', serious annoyance during the day and problems with restful sleep at night.

Below left:
Figure 1:
2019 L_{den} data

Below right:
Figure 2:
2020 L_{den} data

Compare this to the results observed during the lockdown 2020, typically levels of 58-60 dB(A) L_{den}, a reduction of approximately 3 dB, and a corresponding drop in Lday and L_{Night} levels. 3 dB is a noticeable drop in noise levels but might we have expected more?

Studies* indicate drops in LA_{eq} levels from 1.2dB-10.7 dB, but dependent on type of transportation noise.

Results at the monitoring position noted that there continued to be high levels of noise from the road despite lockdown. Observations noted that the number of HGVs continued unchanged, but car numbers reduced significantly. The higher proportion of HGVs as the dominant source conspired to keep receptor noise levels high.

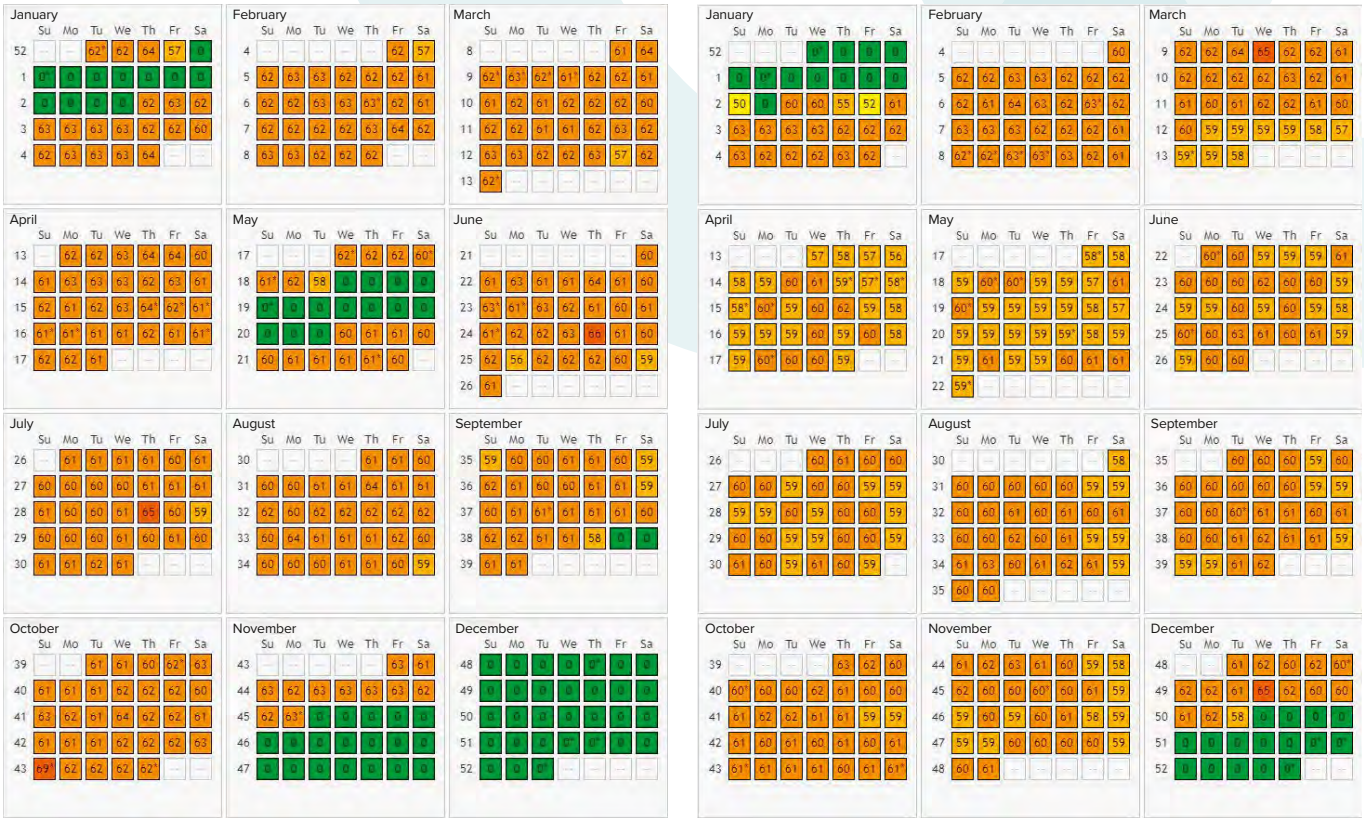
Our data provides a conservative estimate of long-term averages linked to WHO criteria.

Clearly, the 2019 data shows a high level of noise, above WHO levels both before and during the COVID crisis. The reduction due to COVID is significant, but not enough to reduce the overall level of impact despite the perceived level of reduction (the lack of cars on the road).

From an impact assessment perspective, where does this leave the acoustician in terms of context? Obviously, a lower noise level is less harmful, but can we actually say that the impact is now reduced? The presence of higher levels of HGVs no longer masked by increased overall road traffic may actually exacerbate adverse impacts.

So, the case for impact assessment addressing reduction in level from road vehicles may be variable dependent on actual perceived impact, which may or may not be demonstrable from the data. Perhaps looking at transport noise events would better demonstrate impact in these COVID times?

The best example of event noise due to transport is that produced by aircraft. P46



(On 23rd March 2020, lockdown began although traffic had already been reducing prior to that date.)

Assessing the changing urban sound environment during the COVID-19 lockdown period using short-term acoustic measurements; Francesco Aletta, Tin Oberman, Andrew Mitchell, Huan Tong, and Jian Kang May 18, 2020 **https://www.researchgate.net/figure/On-the-left-Sound-levels-distributions-at-the-11-London-locations-for-Location-IDs_fig1_342804275 .**

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Aircraft noise

We will take the example the Heathrow. Monitoring was carried out in Windsor between 28th May and 2nd June 2020.

The monitoring station logs one second L_{Aeq} values, and 1/3 octave spectra, which are uploaded to the web every 15 minutes for archiving, calculations and documentation. The monitoring station is located on a flat roof away from other sources of noise, and well above the street level and ambient road traffic (reduced as it was!).

The monitoring provided data in terms of L_{Day}, and L_{Night} for the period in question, and an LA_{max} analysis of events (aircraft noise) in real time.

The tables below provide the data for pre- and post-lockdown noise associated with flights from Heathrow. Flights commenced on 1st June 2020 so the data from 31st May 2020 night and 1st June 2020 day reflect the impact of a return of flying (according to Heathrow data about 60% of capacity).

Start Time (L_{night})	Duration	LA_{eq} (dB)
29/05/2020 23:00:00	08:00:00	46.6
30/05/2020 23:00:00	08:00:00	46.0
31/05/2020 23:00:00	08:00:00	55.0
01/06/2020 23:00:00	08:00:00	42.4

Start Time (L_{day})	Duration	LA_{eq} (dB)
29/05/2020 11:45:41	11:14:19	47.9
30/05/2020 07:00:00	16:00:00	47.9
31/05/2020 07:00:00	16:00:00	48.0
01/06/2020 07:00:00	16:00:00	56.6

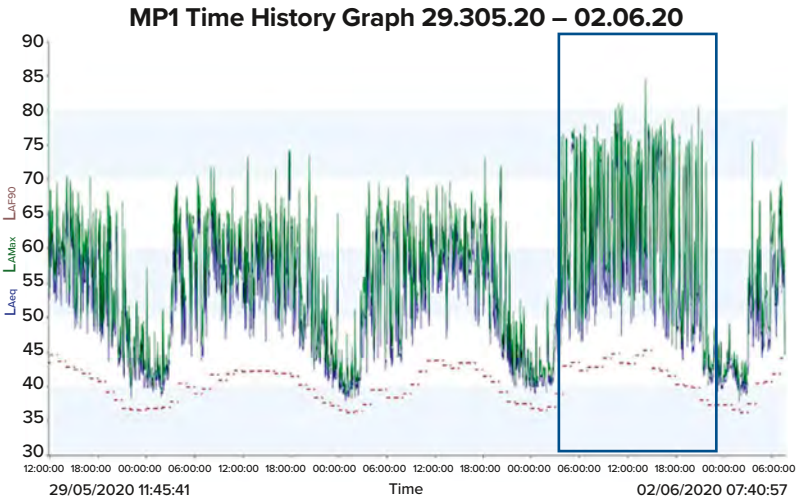
The increase in noise level was significant, a 9-13 dB increase in night time noise, and an 8-9 dB increase in day time noise.

This corresponds with the research of Aletta et al**, that reported a maximum increase of up to 21 dB L_{den}.

But, as with the traffic noise example above, long-term levels may not provide the best results for assessment of impact.

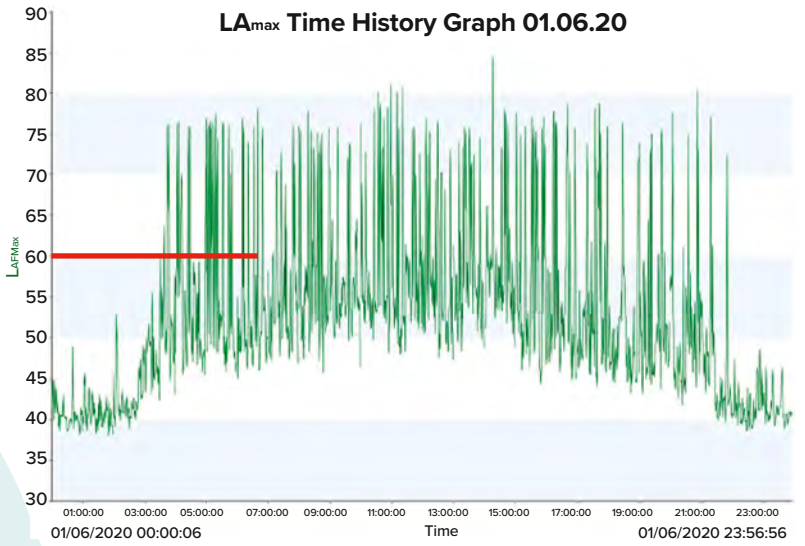
Figures 3, and 4 below show the comparison of L_{max} data for the monitoring period pre- and post-COVID restrictions. Flights recommenced on 1st June 2020.

Below:
Figure 3: Noise data pre- and post-COVID



The data clearly shows a significant increase in number and level of LA_{max} events. Trigger recordings taken also confirm that the events were aircraft-related.

Closer analysis of the results shows the commencement of flights (about 250 of them) and the increase in levels. The red line shows the WHO compliance standard that is broadly complied with or without aircraft noise, the graph below shows the level and number of exceedances even from relatively low aircraft activity. P48



** https://www.degruyter.com/view/journals/noise/7/1/article-p123.xml?language=en

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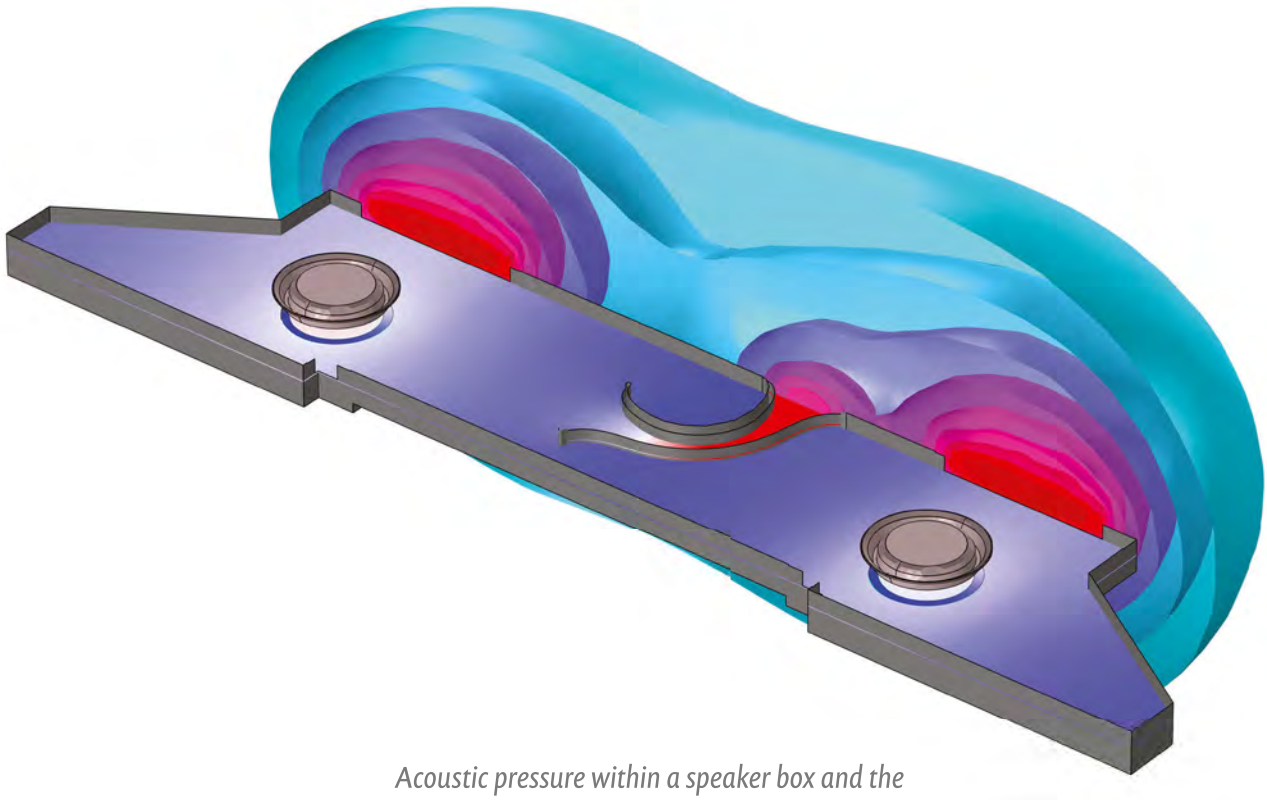

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Conclusion

So where does all that leave us?

We can't all stop flying and driving, and impact assessments based on monitoring during COVID lockdowns may represent a skewed and unacceptable result in terms of predicting impact. Clearly in some locations, transport noise has historically been high, breaching WHO guidelines, and will no doubt return to those levels when COVID measures are relaxed. The problem for acousticians is not so much how we comply as how we evaluate noise in the current climate. The COVID lockdown processes have clearly affected the ability of acoustic consultants to produce environmental noise reports that assess noise levels 'typical' for the area. In the absence of specific government guidance, the IOA and others issued helpful guidelines to those undertaking measurements, in order to keep development and the economy going, at **https://tinyurl.com/y7qej3mt**

The COVID lockdowns, for all their negative implications, have provided one positive. The lockdowns have shown the impact of transport noise reductions and some of the measures that will be necessary to reduce transport-related noise in order to comply with WHO guidelines.

Noise is recognised by the WHO as second only to air pollution in terms of the adverse impacts on health and wellbeing, COVID has shown us just how far we may need to go (and how much further we may still need to go) to meet the levels where noise does not adversely impact on health.

Author
Tony Higgins MIOA is a director of Enviroconsult, an independent environmental consultant specialising in noise and environmental issues. John Shelton MIOA is a director of AcSoft Group, specialists in noise and vibration measurement and monitoring instrumentation, and Chairman of the IOA M&I Group.

Reference table

↓Desired metric↓	↓Known metric↓												
	$L_{Day}{}^{a}$	$L_{Day}{}^{b}$	$L_{Day}{}^{c}$	$L_{Night}{}^{a}$	$L_{Night}{}^{b}$	$L_{Evening}{}^{a}$	$L_{Evening}{}^{b}$	L_{Aeq24h}	$L_{den}{}^{a}$	$L_{den}{}^{b}$	$L_{dn}{}^{a}$	$L_{dn}{}^{b}$	$L_{dn}{}^{c}$
$L_{Day}{}^{a}$		+0.1	-0.5	+7.1	+6.0	+1.6	+2.9	+1.3	-2.0	-2.3	-2.1	-1.8	-1.3
$L_{Day}{}^{b}$	-0.1		-0.6	+6.9	+5.9	+1.5	+2.8	+1.2	-2.1	-2.4	-2.2	-1.9	-1.4
$L_{Day}{}^{c}$	+0.5	+0.6		+7.6	+6.5	+2.1	+3.4	+1.8	-1.5	-1.8	-1.6	-1.2	-0.8
$L_{Night}{}^{a}$	-7.1	-6.9	-7.6		-1.1	-5.5	-4.2	-5.7	-9.1	-9.3	-9.2	-8.8	-8.3
$L_{Night}{}^{b}$	-6.0	-5.9	-6.5	+1.1		-4.4	-3.1	-4.7	-8.0	-8.3	-8.1	-7.7	-7.3
$L_{Evening}{}^{a}$	-1.6	-1.5	-2.1	+5.5	+4.4		+1.3	-0.3	-3.6	-3.9	-3.7	-3.4	-2.9
$L_{Evening}{}^{b}$	-2.9	-2.8	-3.4	+4.2	+3.1	-1.3		-1.5	-4.9	-5.1	-5.0	-4.6	-4.1
L_{Aeq24h}	-1.3	-1.2	-1.8	+5.7	+4.7	+0.3	+1.5		-3.3	-3.6	-3.4	-3.1	-2.6
$L_{den}{}^{a}$	+2.0	+2.1	+1.5	+9.1	+8.0	+3.6	+4.9	+3.3		-0.3	-0.1	+0.3	+0.7
$L_{den}{}^{b}$	+2.3	+2.4	+1.8	+9.3	+8.3	+3.9	+5.1	+3.6	+0.3		+0.2	+0.5	+1.0
$L_{dn}{}^{a}$	+2.1	+2.2	+1.6	+9.2	+8.1	+3.7	+5.0	+3.4	++o.1	-0.2		+0.3	+0.8
$L_{dn}{}^{b}$	+1.8	+1.9	+1.2	+8.8	+7.7	+3.4	+4.6	+3.1	-0.3	-0.5	-0.3		+0.5
$L_{dn}{}^{c}$	+1.3	+1.4	+0.8	+8.3	+7.3	+2.9	+4.1	+2.6	-0.7	-1.0	-0.8	-0.5	

References

Conversion between noise exposure indicators L_{eq24h}, L_{Day}, $L_{Evening}$, L_{Night}, L_{dn} and L_{den}:
Principles and practical guidance; Mark Brinka, Beat Schäfferb, Reto Pierenb, Jean Marc Wunderli **https://tinyurl.com/yc59dslw**

Some acoustic and communication effects of face masks

Face masks are here to stay for now, but they make life for deaf and hard of hearing people, among others, very difficult. Peter Mapp specialises in the field of speech intelligibility and has measured the speech attenuation properties of more than 20 face masks to see what they were actually doing.

By Peter Mapp PhD FIOA FASA FAES

Since the outbreak of COVID-19, face masks have not only become commonplace but indeed mandatory in many situations. However, the wearing of masks has had an immediate impact on speech communication by not only muffling the sound but also by obscuring lip movement and facial expression.

Some masks seem to attenuate consonants and high frequency speech components more than others. Whilst masks have impacted the deaf and hard of hearing most, the loss of high frequency sounds can cause speech intelligibility issues even to those with only a mild or negligible hearing loss – e.g. confusion between 'fifty' and 'fifteen'. In schools, particularly where primary aged children are still developing speech recognition and cognitive skills, wearing a mask can be an impediment to learning. The teaching of Phonics, for example, is reliant upon the child being able to clearly see the teacher's lips – particularly as sounds are often emphasised to aid understanding.

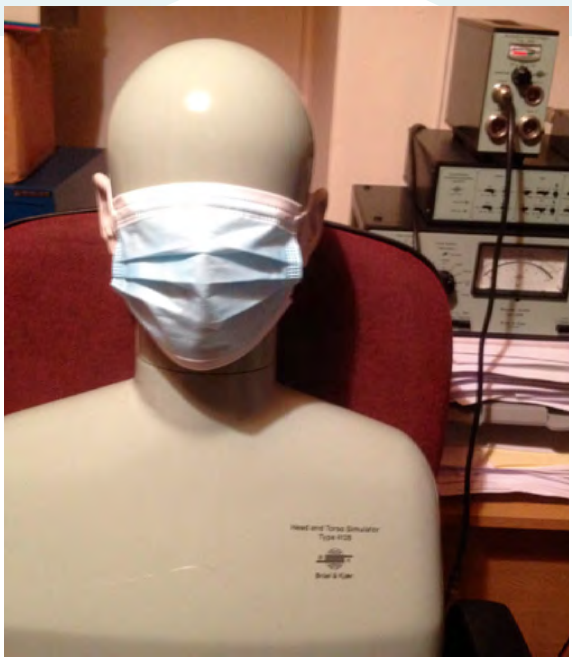
A colleague of mine, who is profoundly deaf, but gets by with his digital hearing aids, has all but given up going out and attempting to shop or to communicate with staff at his bank, as the loss of lip reading combined with the acoustic attenuation that masks produce means it is impossible for him to understand what is being said. I therefore decided to measure the acoustic properties of a number of masks and see what they were actually doing. Not only have the speech attenuation properties of more than 20 masks been assessed but also the speech transmission index (STI) was measured for many of them under simulated practical conditions. The masks investigated included a selection of fabric/fashion masks as well as three grades of medical mask and also a number of clear masks or masks with clear panels specifically designed to aid lip reading. Several clear visors were also tested both separately and in combination with the medical masks, as this is a common scenario – even when visiting the hairdresser or barber.

Measuring technique

The acoustic attenuation produced by the masks was measured using a Bruel & Kjaer Head and Torso Simulator (Type 4128) with the signal being picked up by NTI XL2 audio analysers with type 1 microphones together with a calibrated preamplifier/digital audio computer interface and EASERA acoustic measurement software (see Figure 1).

The attenuation measurements were primarily made at a distance of 0.5m in the calibrated listening room at PMA, which has an essentially flat reverberation time characteristic of 0.3 seconds over the frequency range of interest. A measurement distance of 0.5m was chosen as this enabled sound radiated from the entire surface of the mask to integrate whilst minimising room acoustic effects. (The measured STI at this distance, under quiet conditions, was typically 0.96; indicating that there was effectively no interaction with the room).

The transfer function of each mask and the HATS was measured, enabling potential attenuations to be directly established. For simplicity, the masks were numbered and their key and description are set out in Table 1. Fabric/material masks are designated **M** and masks whilst clear panels or clear masks and visors are designated **CM**. In total, over 25 masks were tested but for clarity, the results of just 15 (19 in combination) are reported here, the omitted test samples being covered by similar items within the overall corpus. P52



Below: Figure 1: HATS with surgical, three-layer mask

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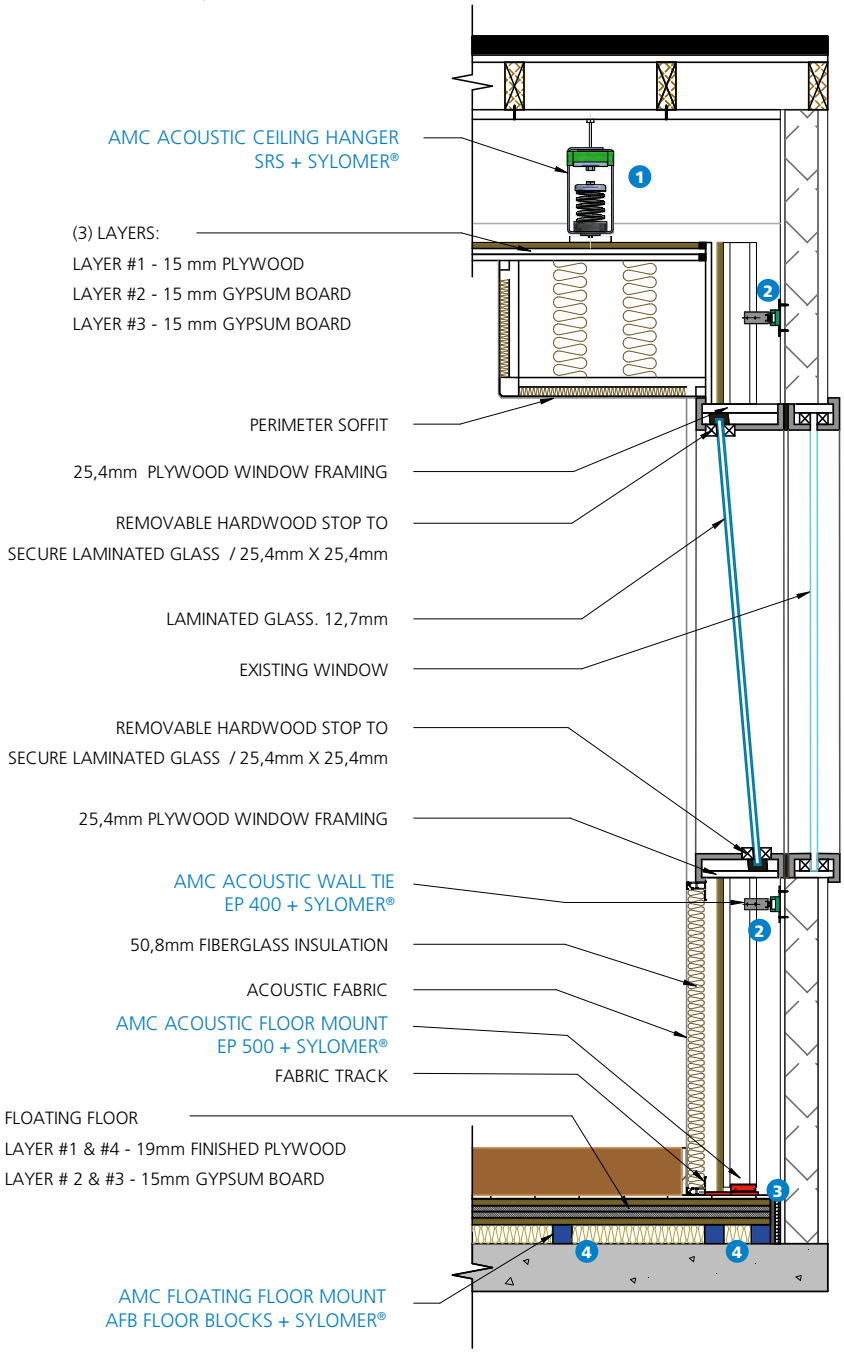

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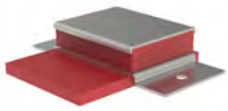

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Mask ID	Mask description
M2	Polyester, three-layer FFP1 'surgical' mask 4 x APF* (see Figure 1)
M3	Stiffer 'particle filtering' mask
M4	Washable cotton mask
M8	Black fashion mask with air valve
M9	Heavy duty mask with filter (five layers)
M23	Multilayer washable mask
M23F	Multilayer washable mask with filter
CM7	Fabric mask with clear panel
CM8 or V	Full face visor or face shield (see Fig 6)
CM10	Clear mask with foam seals top and bottom
CM20	Clear flexible plastic mask with air valve
CM21	Clear, rigid plastic mask
M20	FFP2 (N 95) Medical mask 10 x APF*
M21	FFP3 (N 99) Medical mask 20 x APF* (with valve)
M22	FFP2 (N 95) Medical mask 10 x APF*
	APF* = Assigned Protection Factor

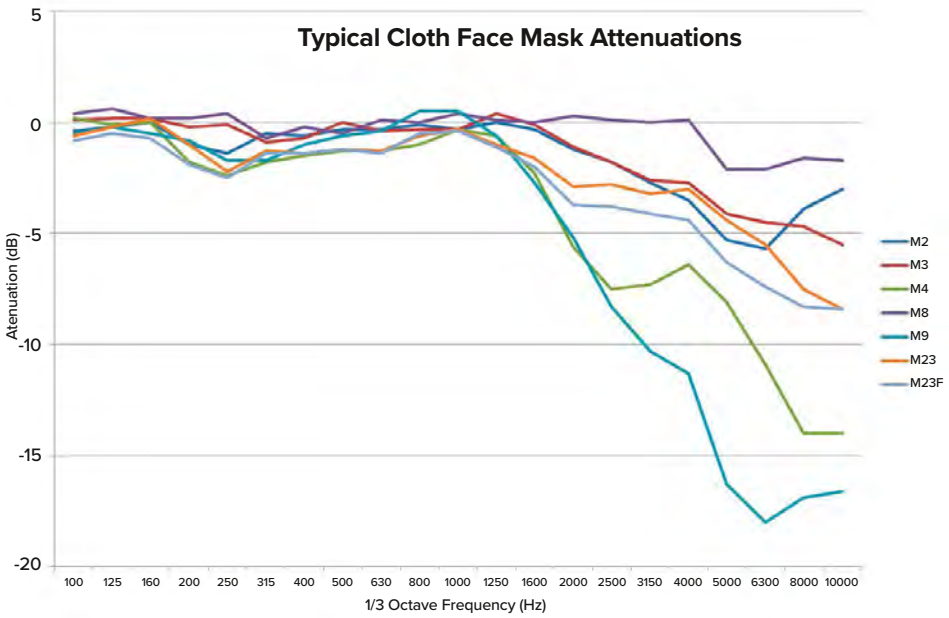
Left:
Table 1

Below:
Figure 2: Typical fabric face mask sound attenuation

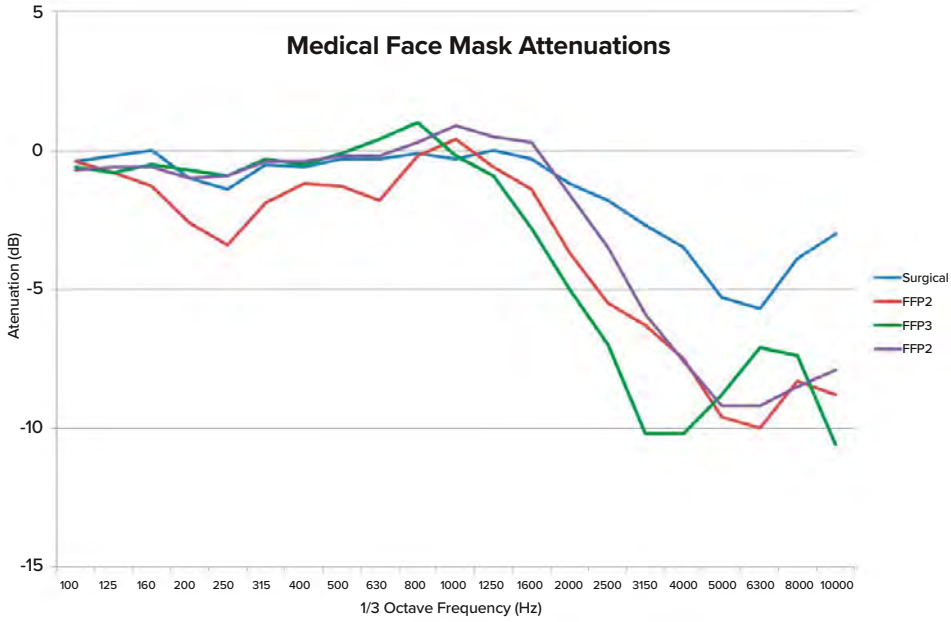
The majority of the measurements were made using a pink noise test signal with 1/3 octave analysis resolution as this was found to provide optimal precision, though a further series tests was also conducted using 1/1 octave and 1/24th octave resolutions, the latter being based on an exponential sine sweep signal.

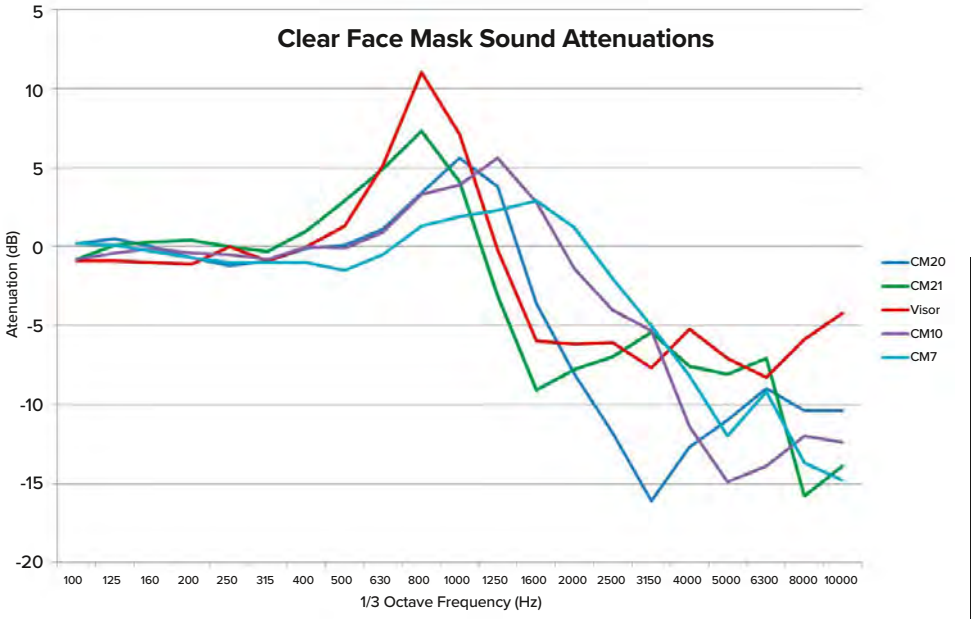
Figure 2 summarises the results for the fabric/material masks. As the graphs show, the masks effectively form a low pass filter with high frequency attenuation setting in above 1250Hz. Most of the masks exhibited an attenuation of 3-5 dB in the important 4 kHz intelligibility band, though the heavier and washable ones had greater attenuations (e.g. M4 and M9). Conversely, the fashion mask with filters (M8) exhibited little attenuation with just 2 dB loss at 5-8 kHz, which would not be noticeable under most conditions. The standard polyester light blue, three-layer surgical mask (M2) was also measured to have an attenuation of 3-5 dB at high frequencies. Interestingly, several of the masks also exhibited a 1.5 to 2.5dB loss at around 250Hz – produced by the resonant 'drum skin' effect of the stretched material. This effect is even more noticeable with the stiffer medical masks as shown in Figure 3.

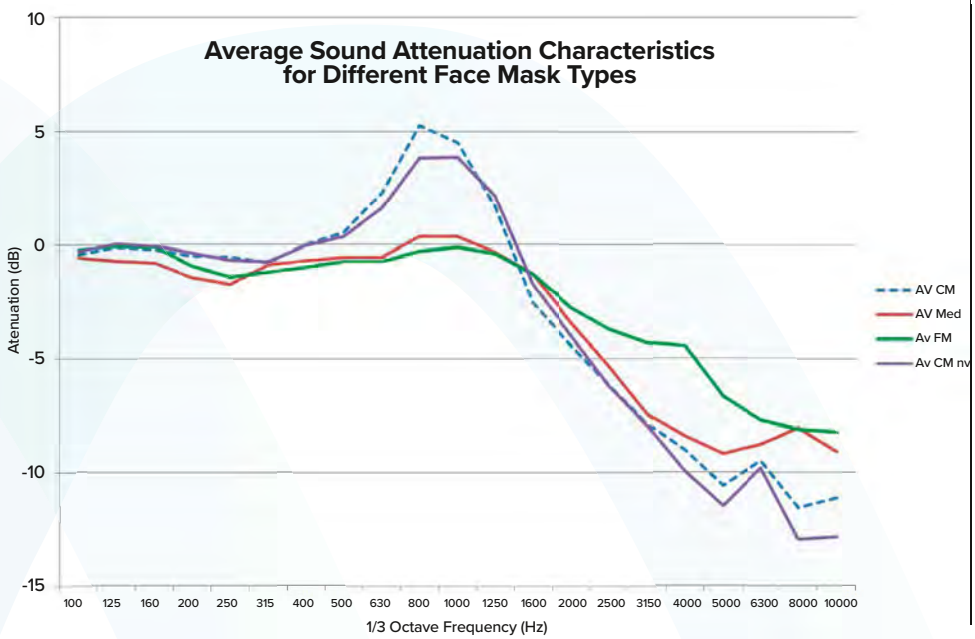
The stiffer, heavier grade material of the medical masks also resulted in greater high frequency attenuation, with typical losses of 9-12 dB occurring at around 4 kHz.



This is a significant attenuation and certainly enough for many people to mishear or even not hear 'f, 's' and 'th' even under quiet conditions. Whereas the medical and general-purpose face masks follow a similar, low pass filter trend, it was found that clear masks exhibited very different characteristics – as shown by Figure 4. All the clear masks, be they a fabric material with a clear panel, completely clear – pliable or rigid, all exhibited a resonant gain at around 800-1250 Hz before a low pass roll off. A gain of 11 dB was found to occur with the full-face visor (red curve and see also Figure 6) though then this mask displayed a nominally flat attenuation of







about 6 dB. CM7 is a fabric mask with a flexible clear panel and perhaps, not surprisingly, this exhibited a resonance with a lower Q, though still had an attenuation of 10 dB at 5 to 6 kHz (light blue curve in Figure 4). The resonant peaks were very audible and significantly coloured the sound (and speech) – though it is possible to argue that this increase in level should increase intelligibility – certainly within the 1 kHz octave band. Ironically however, the high frequency attenuations produced by the clear masks were worse than their fabric counterparts and so a person wearing a clear mask would potentially be less intelligible – at least from an acoustic perspective. Figure 6 summarises the situation by showing the average attenuation of sound produced by each type of mask. The clear mask data is shown with and without inclusion of the full-face visor as it displayed significantly different characteristics. From the figure, the increased sound attenuation produced by the medical grade masks and the clear masks can readily be seen. P54

Above left:
Figure 3: Typical sound attenuation by 'medical grade' face masks

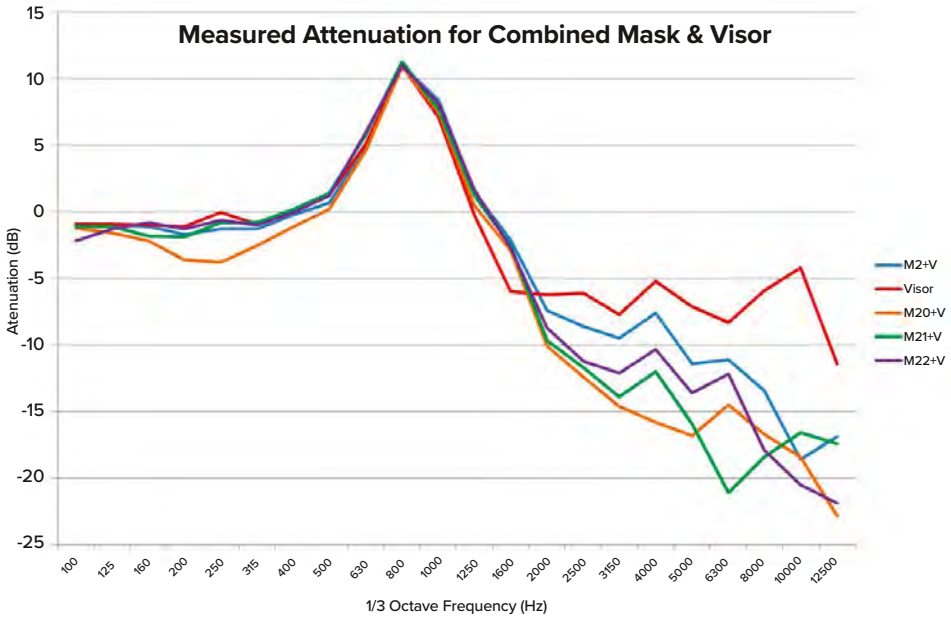
Left:
Figure 4: Typical sound attenuation exhibited by clear face masks

Left:
Figure 5: Averaged sound attenuation produced by different mask types

Above: Figure 6: Visor and FFP3 face mask combination

It is common practice, both in medical situations and certain other close-contact situations such as hairdressers and therapists, for the practitioner to wear both a face mask and a visor. This combination was therefore also measured in order to establish the combined attenuation that this might produce. Figure 6 shows a full-face visor and FFP3 mask under test, whilst Figure 7 presents the attenuation data for the combined masks.

Below: Figure 7: Attenuation for visor and face mask combination



Face masks with visors

As might be expected, the combination of a mask and visor significantly increases the attenuation, potentially reducing the higher frequency speech intelligibility components by more than 10-15 dB (M21 is the FFP3 mask– see table 1).

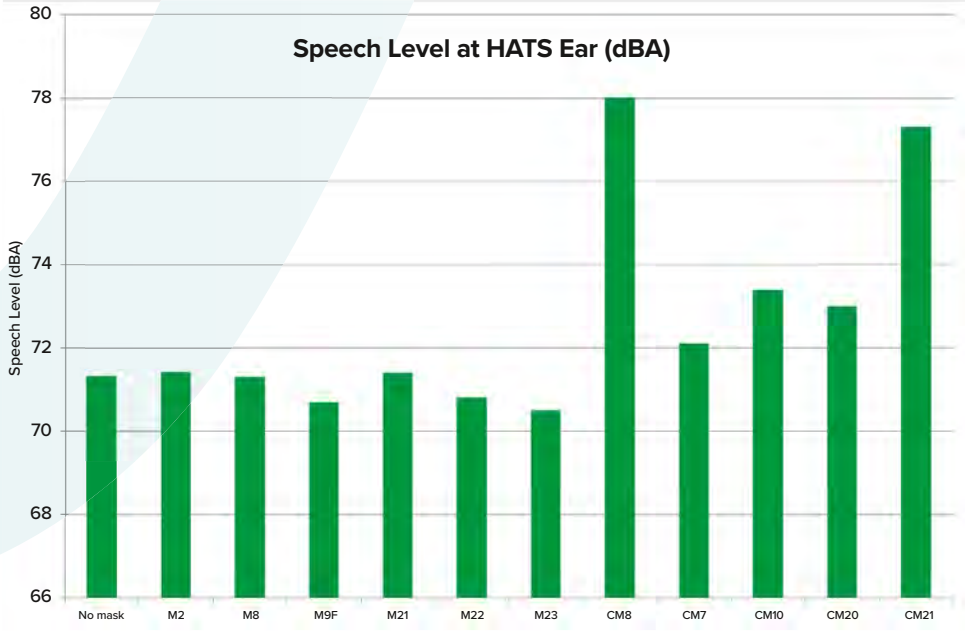
One associated aspect of wearing a mask, is the change in 'self-speech level' perceived by a talker. For example, when wearing a visor or some of the other types of clear mask, the speech level at the talker's ears can actually increase, falsely indicating to talkers that that they are talking more loudly. This is, of course, is in direct contradiction to the reality of the situation whereby the mask substantially reduces the speech output as far as a listener is concerned. Figure 8 compares the speech levels measured at the ear of the HATS, with and without a mask or visor in situ. As can be seen from Figure 8, the clear face masks all increased the speech level at the talker's ears. In the case of the clear visor, the increase was a very audible 7 dBA and a corresponding 6 dBA for the rigid clear mask – levels that could well cause talkers to reduce their speech level. This in effect produces a 'double whammy' for a listener, as not only is the speech level and spectrum reduced and distorted by the mask but this reduction in speech level is then reduced still further by the talker reducing his/her vocal effort.

Intelligibility

Whereas measuring the acoustic attenuation produced by the face masks is certainly useful and the parameter has a direct bearing on intelligibility, it does not directly indicate what the effect on intelligibility might be. A series of STI tests was therefore undertaken to see how the masks affected this parameter. A total of 19 masks (or mask + visor combinations) were tested. The STI tests were carried out in a room that mainly had hard surfaces, set up to simulate a treatment room or similar space. (Room dimensions 3.65 x 3.10 x 2.25 m). Although most of the surfaces were sound reflecting, the mid-frequency reverberation time was only 0.4-0.5 seconds.

The in-room STI measurements were made at a distance of 2m (i.e. in line with social distancing) under both

Below: Figure 8: Speech level at talker's ears when wearing a face mask, measured using a 60 dBA [1m] STIPA test signal



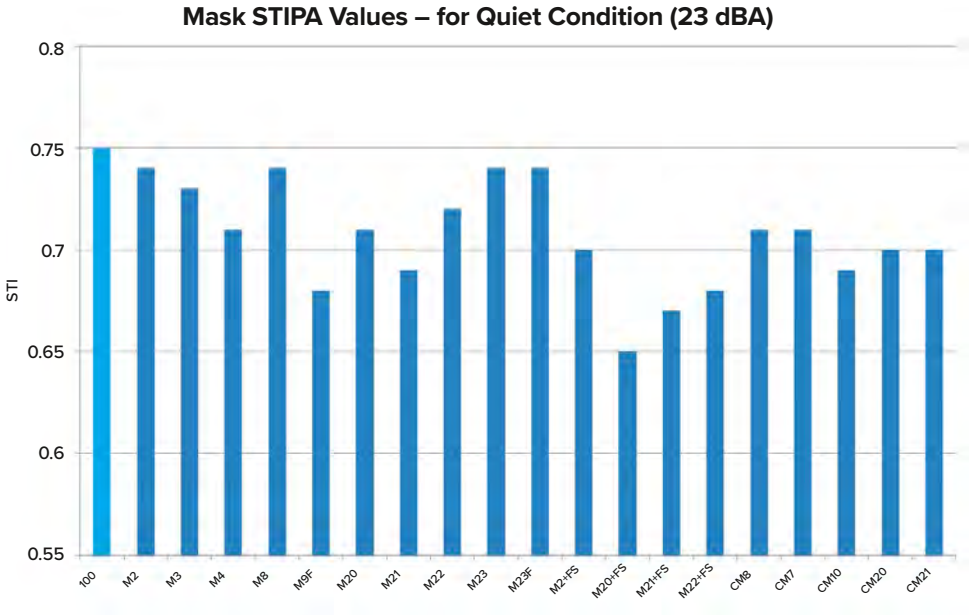
quiet conditions (23 dBA) and with a diffuse artificial noise field equivalent to NR50. The STIPA speech level was set to be 60 dBA.

Under quiet conditions, the STI (STIPA) was 0.75 for the HATS at 2m without a mask. The potential intelligibility for this condition would be rated as 'excellent'. With a mask, the intelligibility, even under these very quiet conditions, measurably reduced. The results are summarised in Figure 9, which presents the STI data for the 20 conditions. The FFP3 and visor combination, not surprisingly, produced the lowest STI result of 0.65. This should however, potentially provide 'good' intelligibility albeit with the high frequency components severely reduced.

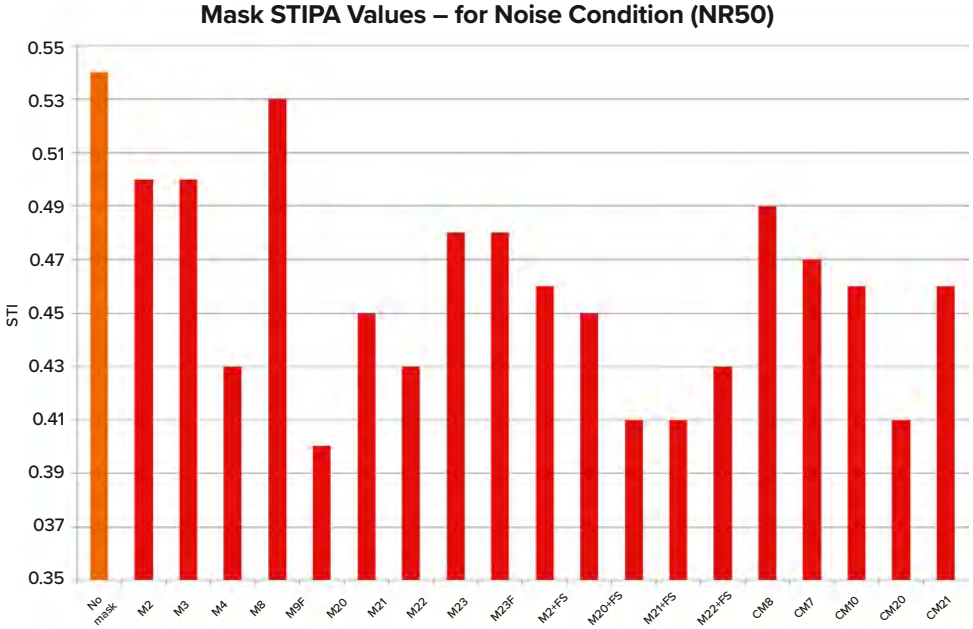
For the second STI test, the noise level in the test room was artificially increased to NR 50 (54 dBA) which, in communication terms, is not a particularly high noise level. The tests were then repeated – maintaining the 60 dBA STIPA signal level. Figure 10 summarises the results. With no mask, the STI reduced to 0.54 – which should provide reasonable intelligibility. (Bearing in mind that the minimum standard for a voice alarm/life safety system is 0.50 STI). From Figure 10 it can be seen that the rank order has changed slightly and two of the masks and two of the mask/visor combinations only achieved 0.41 STI or less – indicating that speech would be virtually unintelligible, with only a limited number of words being deciphered.

With concentration and perhaps a limited vocabulary, the masks achieving an STI value of ≥ 0.43 could be considered to provide limited intelligibility, with 0.50 being considered to be the minimum acceptable value for normal speech. Where complex information is being discussed or exact data needs to be understood (in an operating theatre for example) then an STI value of at least 0.62 to 0.66 needs to be achieved. It is worth noting that only three masks achieved STI scores of ≥ 0.50 for the test condition with the NR50 noise level.

Whilst these STI test results apply only to the case in point, they nevertheless clearly indicate how face masks can significantly affect speech intelligibility, even under fairly benign conditions. P56



Above: Figure 9: STI measurement results for quiet (23 dBA) condition (speech = 60 dBA)



Above: Figure 10: STI measurement results with NR50 ambient noise (speech = 60 dBA)

Furthermore, it should not be forgotten that the above STI results apply to listeners with perfect hearing or with no more than 5 dB of loss – which is negligible. Applying a mild hearing loss of 20 dB (approximately equivalent to the normal hearing acuity/loss for a 40-year-old male) then the potential effect of a mask on speech intelligibility becomes even clearer.

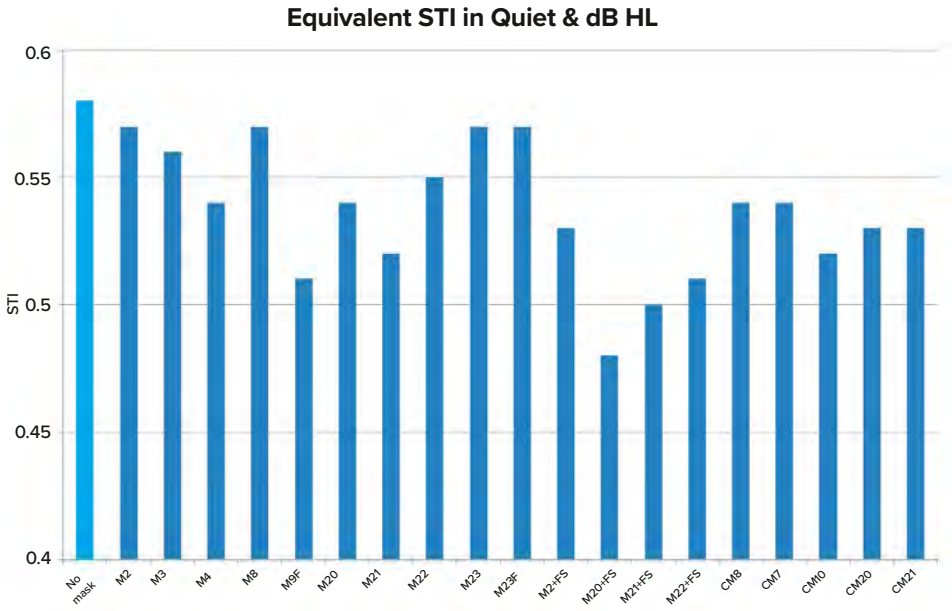
Figure 11 shows the STI quiet data corrected for a 'mild' 20 dB hearing loss. Although most masks and mask visor combinations achieved an STI value ≥ 0.50 under these quiet conditions, the impact of even mild hearing loss, combined with mask wearing, in even very moderate noise, is quite startling – as shown by Figure 12. Without a mask the intelligibility is right on the limit with only some words being decipherable[1] . Figure 12 however, shows that if the talker is wearing a mask, then intelligibility is completely lost (mask M8 perhaps being an exception, though its efficacy in controlling droplet emission is doubted).

Visual information:

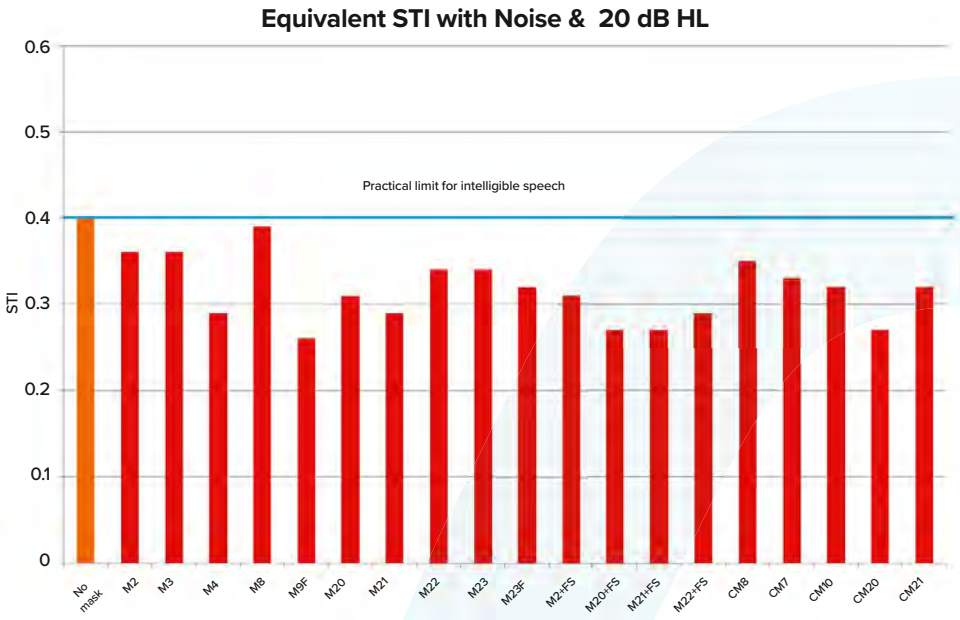
Whilst acoustic attenuation/ transfer function measurements and STI analysis provide very useful information, the acoustic signal itself is only one part of the picture when assessing speech intelligibility. Visual information, such as lip reading, facial expressions and body language also make substantial contributions – particularly when the acoustic or audio signal is degraded, either by transmission or hearing acuity.

We all use these visual cues to a certain degree and the deaf and hard of hearing rely heavily on visual information to augment and enhance the acoustic signal. The majority of face masks however, completely deprive the people who need it most of these vital cues. Clear face masks or those with transparent panels are an attempt to restore some of the visual information by enabling lip reading and other non-acoustic visual speech information to be obtained.

Standard acoustic tests do nothing to take account of these other vital cues. The acoustic data provided in this report for example suggests that clear face masks are no better than fabric types and, indeed, may have an inferior acoustic performance. The effect that vision has on intelligibility has not been widely researched – at least not in terms of STI measurements and typical everyday situations. Furthermore, the ability to lip-read and the gain that this provides, is particular to the individual, their hearing loss and indeed to the speech content itself. P58



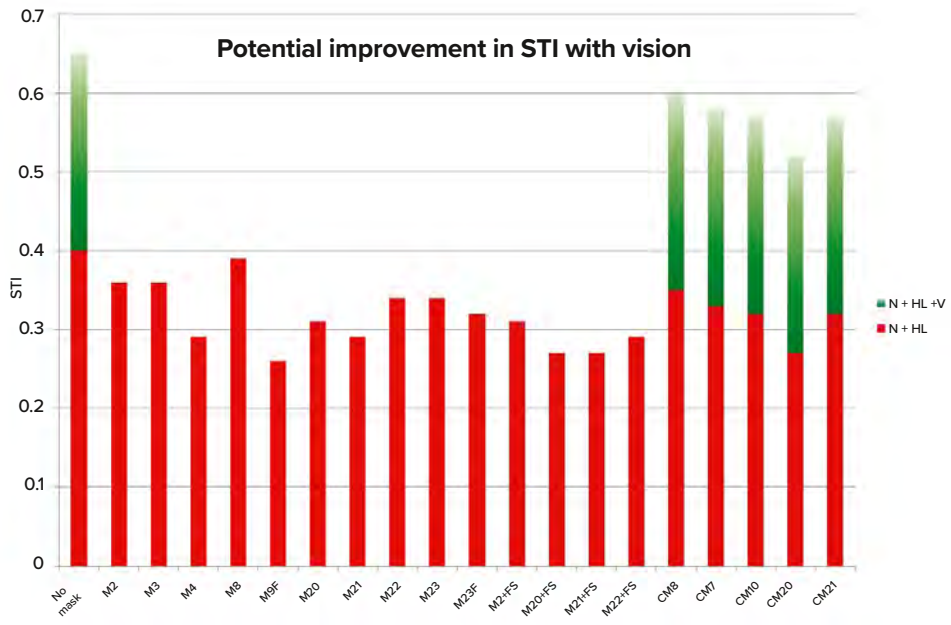
Above:
Figure 11: STI measurement results for quiet (23 dBA) condition and mild (20 dB) hearing loss



Below:
Figure 12: STI measurement results for NR50 condition and mild (20 dB) hearing loss

1. BS IEC 60268-16 provides further information on speech intelligibility and correlations with STI

One study[2] however, does suggest that an improvement in intelligibility equivalent to at least 6 dB snr may be obtained from lip-reading and visual information. Out of interest, this was applied to the STI data presented in Figure 12 (i.e. moderate noise and 20 dB hearing loss). Whereas great care needs to be taken in interpreting the resultant STI results, this does perhaps provide an insight into the value of employing transparent face masks. With the application of the visual information correction factor, all the clear masks now indicate that they can potentially provide satisfactory intelligibility – which is a complete game changer for the hard of hearing or even for those with a mild hearing loss. P60



Above: Figure 13: STI measurement results for NR50 and mild hearing loss, corrected for potential visual improvement

2. Macleod A, Summerfield Q, Quantifying the contribution of vision to speech perception in noise, BJA 21:2 1987

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Summary

The main findings of this ongoing, private research into the acoustic effects of face masks, can be summarised as follows:

- there is no standard measurement method for measuring the acoustic properties or effects of face masks;
- whilst a head and torso simulator is able to provide consistent and repeatable results, acoustically it is quite different to a human head; the surface impedance for example being quite different. In the author's experience, mask measurements, made with human subjects yield slightly different results and generally slightly less attenuation than with HATS but conversely also produce greater variability in the measured data;
- masks generally produce a low pass filter characteristic with a nominally flat low frequency passband. An exception to this latter effect is the stiffer/ denser FFP2 and FFP3 masks, which were also found to exhibit 2-3 dB attenuation centered around 250Hz;
- attenuation gradients, on average varied from approximately 1.5 to 3 dB per octave;
- the stiffer/denser FFP2 and FFP3 masks, the fully transparent types and transparent panel masks produced the greatest attenuations, though some washable masks also exhibited higher attenuations than other fabric types;
- double masking (mask plus visor) produced the greatest attenuation;
- all the transparent masks exhibited a panel resonance centered around 800Hz to 1600Hz;
- many of the visors and transparent masks increased the apparent speech level at the talker's ears;
- STI measurements provide useful insight into mask behavior but in order to be effective require a set of standardised conditions to be agreed/ referenced;
- speech degradation effects and even minor, almost unnoticeable, hearing losses are emphasised when talkers wear a face mask;
- the loss of visual cues and lip reading can have a significant impact on speech intelligibility;
- further study is required into the benefits of talkers wearing visually transparent masks but anecdotally their improvement to intelligibility is overwhelming; and
- other testing (not reported here) suggests that masks may affect the directivity of the voice – particularly where masks incorporate air valves or where they direct airflow and sound escape to the sides.

Comment

Some 11 million people in the UK are deaf or have a noticeable hearing loss and therefore rely heavily on lip-reading to assist them. Just as it is possible to rate a face mask for particle emission, it should also be possible to rate masks for their acoustic performance. However, whilst measuring the acoustic attenuation produced by a face mask is useful, it does not rate the product in terms of intelligibility and loss of communication ability. Equally, whereas measuring the STI under a set of constrained conditions is insightful, it does not rate the overall intelligibility of face-to-face communication as it omits the visual element – which is a very significant and integral factor.

The listener is effectively a passive observer in terms of masked communication – wearing a clear mask for example provides the hard of hearing themselves with no benefit; it is those communicating with them (i.e. the majority of the population) that need to wear a clear mask in order for those with a hearing loss to benefit.

It should also not be forgotten that blind and other sight impaired listeners (approximately two million total in the UK, with more than 360,000 being registered as blind or partially sighted) cannot benefit from lip-reading but, along with others, might benefit from some form of acoustic rating scheme for face masks.

However, the way that the sample masks behaved acoustically, under real conditions, i.e. with speech from a human talker, was found to differ quite significantly at times from testing on a head and torso simulator. Under real speech conditions, the mask membrane was found to stretch and move in a complex manner in conjunction with the normal lip and face movement that occurs when speaking, which an acoustic simulator does not replicate.

Early data suggests that the attenuation produced by some masks may not be as severe and uniform when actually being worn and exposed to real speech and air movement than the HATS testing might suggest.

Clearly a lot more research needs to be done.

Author
Peter Mapp is principal of Peter Mapp Associates, where he specialises in the fields of speech intelligibility measurement and prediction, electroacoustics and room acoustic design. He is also visiting professor of acoustics at London South Bank University and in 2020 was awarded the IOA Engineering Medal for his outstanding contribution to acoustics.

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IOA Noise and Vibration Engineering Group

By Malcolm Smith

Prior to the NVEG group AGM in October 2020, a call for new blood was sent out as a number of members had retired or moved to other groups in recent years. There was a good response to the call, with five applications to join, so that the committee is now up to full strength again.

Given the general move to online conferences and talks, the committee plans to take advantage of the trend by organising a regular seminar series by Zoom. At a recent meeting, it was decided that the format should be a one hour lunchtime seminar with questions. These should be held regularly every three months, with specialist speakers invited from industry, consultancy and academia. It is hoped that this format would appeal to a wider audience than the usual whole day events.

NVEG seminars

The date for the first seminar is 9th February 2021, 13:00-14:00. The topic will be announced in due course, but is likely to have an 'aerodynamic noise' theme.

The second talk will be on 11th May, possibly with an 'automotive' theme.

Watch this space.

Sigicom

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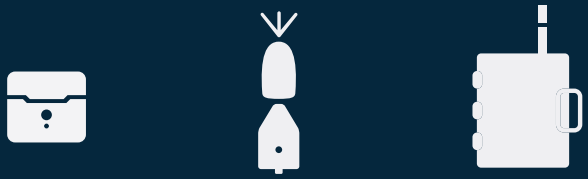

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Early Careers Group

Tomasz Galikowski, Chair of the IOA Early Careers Group (ECG), brings us up to date with the latest quarterly meeting, recent changes at the group and the results of its member survey.

Above: Tomasz Galikowski, Chair of the IOA Early Careers Group

Chris Hunt MIOA retired from his role as the ECG Secretary at the end of 2020. He was in post for the past two years and provided a fantastic service, he will be greatly missed! Adam Woolley has been elected as our new Secretary.

We have welcomed some new ECG representatives: Lee Faulkner MIOA joined the CPD Committee, Ilaria Fichera AMIOA joined the Membership Committee, and Nikhil Benda, Leonard Terry and Aaron Tomlinson will be our main contacts at the South Western branch.

Covid-19 survey

On 30th November 2020 the ECG hosted a webinar open to all IOA members where we published the results of a recent survey aimed at understanding the impact of the pandemic on early career professionals. As is quite common these days, the meeting was held on Zoom, which was kindly facilitated by the IOA. The meeting was attended by a cross-section of the membership as well as a panel consisting of the IOA President, Stephen Turner, the IOA Chief Executive, Allan Chesney and the President-elect, Alistair Somerville. The open forum allowed all attendees to join in with discussions, express views and ask questions.

The survey

The survey was sent by email to all IOA members who identified themselves as Early Careers Group members on their IOA profile. Overall, we received 115 responses out of 420 members (27%). This was a rather good response considering we have experienced some problems with the notification emails reaching all of our colleagues.

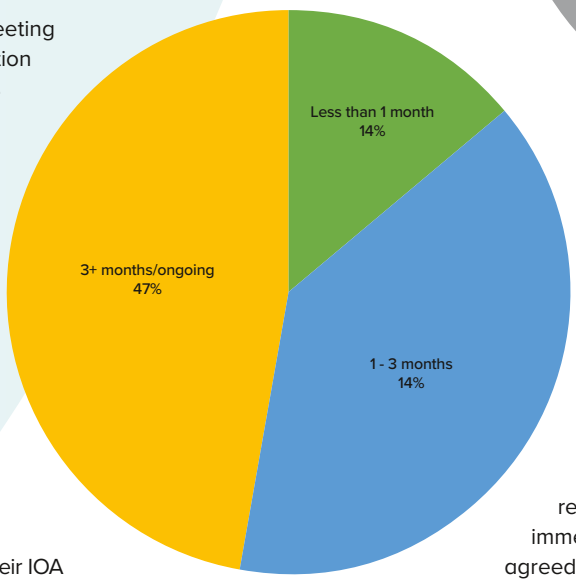
What the survey highlighted is that work emails are used as primary means of contact with the IOA. With furloughs and redundancies, the survey notifications addressed to work emails may have been missed.

The main topics of the survey and the discussion included furlough, redundancies, career and priorities for the future.

Furlough and redundancies

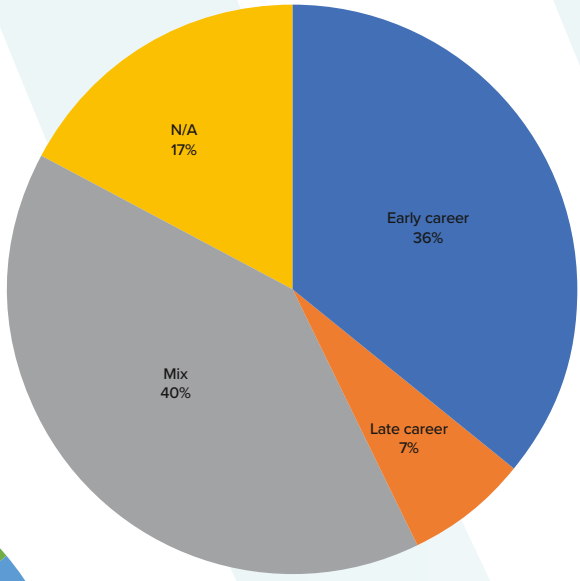
Less than half of survey participants were put on furlough (41%) for varying amounts of time. Most of the participants stated their furlough was three months or longer (some are still on furlough).

HOW LONG?



A large number of participants stated that immediate team members were put on furlough (83%). These team members were a mix of graduates, engineers/consultants and seniors as shown below. This says more about the acoustics industry in general rather than specifically Early Career's Group members.

CAREER STAGES



Approximately 3% of survey participants (four people in total) were made redundant as a result of COVID and only one of those has reported to have found employment within the industry. This suggests that the redundancy rate was low – albeit the reported job losses are immensely regrettable. It was agreed that this is partially due to

the furlough scheme which was brought in by the Government for this exact purpose of avoiding mass redundancies. It is acknowledged, however, that this number may be higher due to the aforementioned issues with emails.

In terms of impact on the early professional careers, there are two negative aspects that stand out:

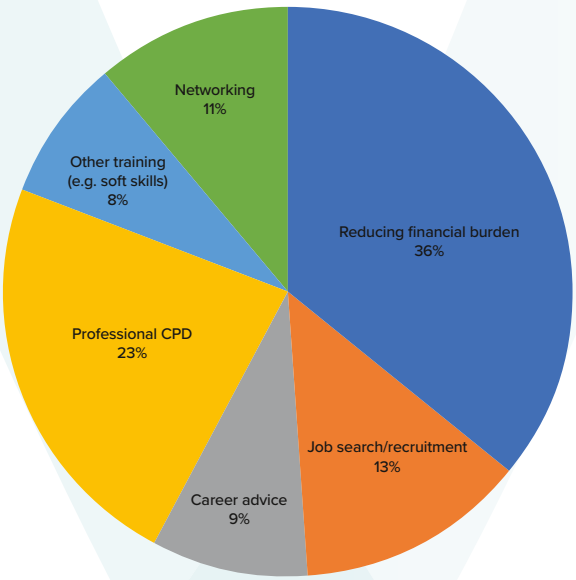
1. Two-thirds of survey participants are/were concerned about being made redundant.
2. Just under two-thirds of survey participants thought their careers have been negatively affected by COVID/lockdown.

Examples of negative impact included putting goals on hold, less networking, hindered progression (with employers 'freezing' promotions and training). There were also some positive aspects though, such as more time for independent study and CPD and more discussion with managers regarding career progression.

Priorities for the future

Understanding priorities of the ECG members was an important part of the survey. When asked what issue requires the most urgent assistance from the IOA, one-third of participants suggested 'reducing financial burden'.

MOST URGENT ASSISTANCE



To further add to how important financial concerns have been, approximately 44% of survey participants were asked/required by their employer to take a temporary pay cut (not including the 80% pay of the furlough scheme if that applied).

Additionally, a point was also made that large IOA events (e.g. Acoustics 2020) should be significantly reduced in price due to the virtual nature of the event (and cost of hosting should be minimal). This point was discussed in detail during the meeting. Although some of the costs are indeed lower (e.g. venue hire), a professionally organised and run event still requires a significant financial input, subsequently driving the costs.

Although the financial matters were the single most selected factor, nearly two-third of participants thought that it was training and career progression that should take priority. This was further supported by responses given in the comment box, which focused heavily on careers. Support, gaining experience, finding a job were all frequently mentioned as well as mentoring/guidance for younger members by senior or retired members.

Networking was another common theme and was deemed as the most urgent item by 11% of responders. Some of the comments stated that a networking group of peers would be useful to facilitate contact with potential employers and to talk to people in similar roles. Virtual networking is difficult but in times when organising face-to-face events is not easy every opportunity should be taken to connect people. To echo this, an overwhelming majority of survey participants stated that they want more virtual events in 2021 (approx. 97%) if physical events are not possible.

What has been done to date and plans for the future

The survey and the webinar provided the IOA and ECG with a wealth of information on how the current pandemic has affected early careers professionals. Finances and job stability are significant concerns and will need to be carefully monitored. Despite this, there is a clear desire from the ECG members to keep up with professional development and network with peers – both at the same level and more senior. There is also a strong willingness to engage in virtual activities.

The IOA has not been idle. The fortnightly Member Forums have given an opportunity to meet fellow professionals. The CPD refreshers that ran during the first lockdown provided a chance to learn or brush up on skills and knowledge. The fully virtual Acoustics 2020 conference was also a success. To aid those searching for work, making job listings free to advertise on the IOA website until end of March will hopefully encourage employers to promote available positions. There are also some resources available to help with the membership fees although these would be assessed on a case by case basis.

As for ECG, we are happy to announce a series of virtual events which will run bi-weekly between the Member Forums on Mondays, beginning with an event on 11th January. The topics and themes for these events will be informed by the results of the survey. In the first place, we will look at various career options for early career professionals and what's on offer at UK universities if anyone is considering further education in acoustics. We will be also looking at specific networking events and career enhancing CPDs.

To stay up-to-date on the most recent announcements – please visit the IOA website and make sure your communication settings on your IOA profile are set to receive ECG emails.

I would like to extend thanks to my colleagues – Taylor Cooper MIOA from Mott MacDonald, Daniela Filipe MIOA from Hoare Lea, Niklhil Mistry MIOA from ISVR and Josie Nixon MIOA from HA Acoustics – for their time and dedication in preparing the survey and organising the webinar.

For more information

The ECG is open to all members of the IOA (both corporate and non-corporate) who shall normally be under 35 years of age or within first five years of their career. The group is always keen to hear from members and non-members alike. To join the Early Careers Group, to find out more information or to voice your concerns, visit **https://www.ioa.org.uk/early-careers-group**

Acta Acustica

Publication of acoustic articles in Acta Acustica, the new open access journal of the European Acoustics Association (EAA), and Acta Acustica united with Acustica archive.

By Paul Lepper, IOA Vice President-International and EAA General Secretary

Increasingly, nationally and internationally funding bodies and industry are requiring work to undergo rigorous peer review and publication under open access formats. UK Research and Innovation (UKRI) which is made up of nine councils sponsored by the Department for Business, Energy & Industrial Strategy (BEIS) currently states: 'Open research embodies the ideas of best research practices by opening up participation in – and access to – the research lifecycle.' With one of its key principles being 'outputs from publicly-funded research should be freely accessible as soon as possible under conditions that maximise re-use to amplify social, economic and research benefits', **(https://tinyurl.com/yxntbvsu).**

In response to this, many of the traditional outlets for publication of current research in the area of acoustics (or, for that matter, any subject) are beginning to offer open access options and, since January 2020, Acta Acustica **(https://acta-acustica.edpsciences.org/)** has been published in a full open access format by EDP Sciences under the terms of the creative Common Attribution License. This gives any reader completely free online access to the most current research being generated around the world and allows authors work to potentially reach significantly wider audiences and influence.

Acta Acustica archive

This new open access format under the name Acta Acustica is building on the old EAA publication of Acta Acustica united with Acustica (Acta Acust united Ac) previously supported by the EAA.

Publication of Acta Acust united Ac stopped in December 2019 and since then, access to its archives has been made available by the previous publisher in a pay mode, contrary to EAA's position for its members. This separation since January 2020 of the new Acta Acustica (open access) and the Acta Acust united Ac archive (non-open access) has been complicated, such that it has resulted in a period where IOA members have not been able to access papers published in Acta Acust united Ac as they had previously as a member of the IOA/EAA.

To expediate this, in December 2020, the EAA resolved to publish the Acta Acustica archive (1996-2019) itself to allow free access to its member institutes returning the previously interrupted service to its members. A project is now underway to allow this publication with the hope that the archive will again be fully available to all EAA members by spring 2021.

In the meantime, what about your new papers and how does open access work? In the past, the reader or their organisation would often pay the publisher to access these papers, this potentially limits the availability and dissemination of new science by placing the cost of publishing on the reader. Publication in open access formats however often shifts these publication costs to the author in the form of an Article Processing Charge (APC). These fees can sometimes be difficult for authors to find and therefore, they may choose to publish in more traditional routes without open access.

How the EAA/IOA is helping

In order to help overcome difficulties for authors in finding APC fees, the EAA has set up a unique process for supporting authors: IOA member authors, as national society members of the EAA, can apply for full or partial support for APC fees from the EAA for publication in Acta Acustica in a full open access format **(https://tinyurl.com/y39znna2).**

IOA members should think; 'would I like to publish my next paper with full open access and get support for the APC fees?' Many of the outstanding papers published in Acta Acustica since the beginning of 2020 have already done so, yours could be next and would also help to support Acta Acustica as a leading journal for acoustics across Europe and the world.

NEWS

Earless moths have acoustic camouflage to protect them from bats

3D representation of a moth wing's acoustic camouflage pattern (Simon Reichel, Thomas Neil, Zhiyuan Shen and Marc Holderied)

Earless moths have sound-absorbent wings that act as acoustic camouflage from preying bats. The moth wings have an ultrathin layer of scales that absorb sound and could be adapted for noise-cancelling technology.

Marc Holderied at the University of Bristol and his colleagues projected sound waves at the wings of two species of earless moths and found that the sound waves that bounced back from the moth wings were much quieter.

By using acoustic topography, the team found that these moth wings have a layer of scales arranged in a repeating pattern that absorbs sound across a wide range of frequencies.

"The moths have developed a stealth coating against the bats' sonar," says Holderied.

Although these wings only absorb sound heard by bats, it could be adapted for human sound frequencies, says Akito Kawahara at the Florida Museum of Natural History. This could prove useful in applications such as sound absorber panels and noise cancelling earphones.

Noise camera technology to be used to prosecute notorious 'millionaire boy racers'

Supercar drivers using London's Sloane Street and the surrounding area as a racetrack could face new punishments after the Royal Borough of Kensington and Chelsea Council took action to curb noisy engine revving in the area.

The street is a magnet for Lamborghinis and Ferraris, with drivers showing off their cars by cruising the local area, and the move comes in response to 35 reports of nuisance noise in the area between June and August 2020.

Lead Member for Transport, Cllr Johnny Thalassites, said: "We have had fines in place for a while now, but this new noise camera technology will make sure we are catching more of the worst offenders.

The council originally requested to be part of a government run scheme for noise cameras but when the borough was not selected to take part, it became the first authority to set up noise cameras and run them directly.

The pilot noise cameras went live in September and store video and sound levels when a filtered sound signal over 80 dB is detected. When the threshold level is exceeded, the cameras record the sound level and provide detailed footage of the offending vehicle to enable prosecution.

'Silent' e-scooters fitted with artificial noise to warn pedestrians

German micromobility firm, TIER Mobility, plans to fit its e-scooters with artificial warning sounds to alert blind and partially sighted people of their approach.

The company has partnered with the Thomas Pocklington Trust – a UK charity for blind and partially sighted people – and will incorporate research from the organisation to design and roll out the new feature across its UK fleet this year.

Fred Jones, TIER's UK General Manager, said: "E-scooters offer lots of benefits to UK cities, but they must be introduced in a considered way, accounting for the concerns of people with visual impairment.

Is the UK doing enough to mitigate aviation noise?

Noise impacts the lives of people living near airports or under flight paths across the UK every day, but how those effects are assessed, managed and mitigated is, at best, inconsistent, and at times non-existent. That's the conclusion of a report on aviation noise metrics and measurement published last summer by the Independent Commission on Civil Aviation Noise (ICCAN).

Multiple metrics are employed to describe noise exposure from aircraft, but the technical nature of the language often renders the methodology and resulting data opaque to those most affected by it.

ICCAN argues that the first step towards better aviation noise management in the UK must therefore be to improve how levels are measured and how the information is shared with the general public.

Rob Light, ICCAN Head Commissioner, said: "The biggest issue is a lack of trust between communities, airports and regulators, and sometimes it seems as if experts have made the language of noise monitoring and measurement so complex that it is only understandable to them, and so clarity of comparable information between UK airports is really important.

"We were also conscious that noise pollution is a very personal experience so airlines and airports must build that into their thinking and planning."

ICCAN's recommendations for UK airports include publishing more noise data online, improving the presentation and explanation around it, and making more temporary noise monitoring available to local communities so they can see the noise levels in their local area and understand the impacts.

Consultants appointed to key trade association role


Louise Beamish

Two specialist consultants have been appointed to the board of the Association of Noise Consultants (ANC).

Louise Beamish of WSP joins the board for the first time, while Rob Adnitt of Adnitt Acoustics, returns to the board after an eight-year hiatus.

An acoustics consultant for more than 20 years, Louise leads WSP's 50-strong team providing advice to a range of clients across many sectors. She said: "I am passionate about my own development and that of others. I believe in creating opportunities for all and look forward to being part of the ANC Board, to feed into the continued success of the acoustics industry."

Having previously served as a board member of the ANC from 2006 to 2012, Rob Adnitt was Treasurer from 2006 to 2010 and Chair from 2010 to 2012. He has worked in acoustics since graduating in 1989 and has worked on a variety of committees and groups within the industry, shaping strategy, reviewing research, generating policy and giving oversight on issues including governance, inclusion and sustainability.

Rob said: "I'm glad to re-join the board now as the upcoming period will be a challenging and interesting time for the acoustics profession.


Rob Adnitt

New Operations, Improvements and Innovation Director for Atkins

Consultant, Atkins, has appointed Dave Bennett as Operations, Improvements and Innovation Director for its UK and Europe business. In his new role, he will be responsible for leading continuous operational improvement across the business and overseeing Atkins UK and Europe's digital transformation.


Dave Bennett

Atkins UK & Europe CEO, Richard Robinson, said: "Dave brings a wealth of experience in running large, complex engineering services organisations, and has an outstanding track record in business and operational improvement.

"This will be invaluable as we continue to evolve to meet the changing needs of clients and help drive up productivity across the wider industry through the effective adoption of digital technology.

Bruel & Kjaer UK Ltd is now Hottinger Bruel & Kjaer UK Ltd

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Following the merger between Hottinger Baldwin Messtechnik (HBM) and Brüel & Kjær, the company has now become Hottinger Brüel & Kjær.

On 1st November 2020, the Bruel & Kjaer UK offices in Royston and Millbrook were renamed as: Hottinger Bruel & Kjaer UK Ltd. The office addresses and direct contacts remain the same but full company details can be found at **www.hbkworld.com/uk**

Firework noise

Issues were raised last November in the assemblies and parliaments of Wales, Scotland and England about noise from fireworks.

There is clear evidence that loud, unexpected noise from fireworks has distressing effects on people with a range of health conditions and disabilities. Loud and high-pitched noises can also adversely affect animals causing substantial distress.

Regulations

The Fireworks Regulations 2004 **(https://www.legislation.gov.uk/uksi/2004/1836/contents/made)** prohibit the sale of excessively loud fireworks and ban the use of fireworks between 11pm and 7am (except for Bonfire Night, when the cut-off is midnight, and New Year's Eve, Diwali and Chinese New Year, when the cut-off is 1am). Further detail on the various regulations governing the sale and use of fireworks (not just in relation to noise) can be found at **https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05704**

Noise levels

On 29th October 2019, the Scottish Government's Minister for Community Safety published an action plan to promote the safe and appropriate use of fireworks **(www.gov.scot/publications/fireworks-action-plan-promoting-safe-appropriate-use-fireworks-scotland)**, building on a public consultation and nationwide survey carried out earlier in the year. The action plan was supported by an evidence review **(www.gov.scot/publications/fireworks-legislation-impacts-international-evidence-review)**. Sections 4.3 and 4.4 of the evidence review focused on noise. They reported that the loud noise created by fireworks can cause distress to those with noise sensitivity, including autistic people, and that the fear response to noise from fireworks can have adverse impacts on animals.

On 5th November 2019, the House of Commons Petitions Committee published the report from its own inquiry into fireworks **(https://publications.parliament.uk/pa/cm201920/cmselect/cmpetitions/103/103.pdf)**. It made a number of recommendations to the UK Government, such as a public awareness campaign and reducing the maximum permitted decibel level of fireworks. However, it stopped short of advocating a total ban on sales to the public.

The UK Government responded to the House of Commons Petitions Committee recommendations on fireworks in March 2020. The response can be read at **https://publications.parliament.uk/pa/cm5801/cmselect/cmpetitions/242/24202.htm**

It stated that OPSS had commissioned a programme of fireworks testing to determine the average decibel level for common types of retail fireworks sold for public use, and that this would help to identify which types of fireworks are associated with the highest noise levels, and whether some types could be promoted as low noise. It also stated that OPSS analysis teams had been considering data available in relation to firework noise and the impacts on health and the environment.

England

Fireworks were debated in the Westminster Parliament on 2nd November 2020. The transcript can be read here: **https://hansard.parliament.uk/commons/2020-11-02/debates/F982D230-02C0-4A8B-8A60-D0C51F952944/Fireworks**

Scotland

On 3rd November 2020 the Scottish Government published the recommendations of its independent Firework Review Group **www.gov.scot/news/tackling-anti-social-fireworks-use**

These include restricting the days and times fireworks can be set off, and the introduction of no firework areas or zones.

In a statement, the Scottish Government's Community Safety Minister welcomed and fully endorsed these recommendations. The transcript of the proceedings in the Scottish Parliament on 3rd November is here: **www.parliament.scot/parliamentarybusiness/report.aspx?r=12914&i=116722**

Wales

On 10th November 2020, in the Welsh Parliament the First Minister of Wales was asked questions on controlling the use of fireworks. You can read what was said by going to **https://record.assembly.wales/Plenary/6618** and scrolling down to 14:13. The subject was raised again in the Welsh Parliament on 18th November, this time with the Minister for Environment, Energy and Rural Affairs. (It is the first question asked at **https://record.assembly.wales/Plenary/6677**) The primary concern in these exchanges is the effect of firework noise on animals such as dogs and horses, and sensitive individuals such as people with autism or PTSD.

Defra

On 23rd November, Defra answered a written question on the effect of fireworks on animals: **https://questions-statements.parliament.uk/written-questions/detail/2020-11-17/116464**

Given the level of public and political interest in the subject, there will no doubt be further developments in this area in the coming months and years.

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Members are reminded that **ONLY** Sponsor Members are entitled to use the **Sponsor IOA logo** in their publications, whether paper or electronic (including web pages).

Committee meetings 2021

Understandably, the committee meeting programme has been severely affected by the COVID-19 virus. For up-to-date information visit: **www.ioa.org.uk**

DAY	DATE	TIME	MEETING
Thursday	7 January	10.30	Meetings
Thursday	14 January	10.30	Membership
Thursday	4 February	11.00	Publications
Tuesday	16 February	10.30	Engineering
Wednesday	17 February	10.30	Engineering
Thursday	25 February	10.30	Diploma Tutors and Examiners
Thursday	25 February	13.30	Education
Tuesday	2 March	10.30	Diploma Examiners (London)
Wednesday	3 March	10.30	Executive
Wednesday	**17 March**	**10.30**	**Council**
Tuesday	23 March	11.00	CPD Committee
Thursday	25 March	1030	Meetings
Tuesday	13 April	10.30	CCWNRA Examiners
Tuesday	13 April	13.30	CCWNRA Committee
Thursday	22 April	10.30	Membership
Thursday	6 May	11.00	Publications
Thursday	13 May	10.30	CCMOEHAV Examiners
Thursday	13 May	13.30	CCMOEHAV Committee
Wednesday	19 May	10.30	Executive
Tuesday	25 May	10.30	Research Co-ordination (London)
Wednesday	**9 June**	**10.30**	**Council**
Tuesday	15 June	10.30	Engineering
Wednesday	16 June	10.30	Engineering
Tuesday	22 June	10.30	ASBA (Edinburgh)

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