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Hello there everyone,

Welcome to the mid-year edition of Acoustics Australia. This edition is looking to be an interesting mix of technical papers, something for everyone. This must be one of the reasons why Marion Burgess was able to advise me last month that Acoustics Australia has just reached an Impact Factor of 0.625. Not knowing what this means, I had to look it up. In a nutshell it means that more people are looking at and citing articles published in Acoustics Australia. Congratulations must go to the editors past and present, in particular Marion Burgess, Nicole Kessissoglou and Joe Wolfe in achieving this result. Well done! Thank you to the current editorial team Truda King (welcome back!), Marion Burgess and Leigh Wallbank for all your hard work in bringing together this issue.

It was with some satisfaction last month that I was able to watch a television documentary on the Sydney Metro project. It was wonderful to be able to watch something that celebrated not sport or arts, but the collective work of many clever people - engineers, scientists, planners, builders, to achieve.

It got me thinking that there should be more celebration of such achievements, big or small. We are fortunate that we are able to celebrate some of these achievements in our journal, Acoustics Australia. If you have a 'story' to share, don't miss the opportunity to celebrate with us. Your achievements will help to keep this journal interesting and spread the word on the clever things we are doing in acoustics.

The new Membership Database has been finalised and tested with the release of Member invoices for 2016-17. Thank you to our acting General Secretary, Glen Copelin, who has overseen this process, and to Richard Booker for his assistance despite being on holidays! The integration of the new database with the website will make membership renewal more streamlined - you should have received your subscription notice by email (thanks to those who paid so promptly!!). Speaking of the website, you may have also noticed that after a few days off line our website is back up and running more efficiently than ever. Thanks to Vice President and Webmaster Terrence McMinn, our website has received not just an overhaul, but a new engine. Try it out (http://www.acoustics.asn.au/joomla/) and while you are there log in and update your member details to ensure you stay in touch.

The Queensland Division is working tirelessly to bring together the second Australasian Acoustical Societies Conference, which will be held at the Brisbane Convention & Exhibition Centre from 9-11 November 2016 (Acoustics2016). Acoustics 2016 - Innovate for the future will be hosted by QLD Division of the Australian Acoustical Society as well as the Acoustical Society of New Zealand. There looks like there will be over 120 papers on all aspects of acoustics. It should be a great conference and I look forward to seeing you there.

For the rail enthusiasts, the wait is nearly over with the International Workshop on Railway Noise (IWRN12) being held next month in Terrigal NSW from 12-16 September.

This has been my last message as President of the Australian Acoustical Society. Terrence McMinn will be your next President and I hope that you will give Terrence your support as you have me. Thank you to Norm Broner as outgoing VP and Federal Council for their support over the last two years.

Please enjoy this edition of Acoustics Australia.

Tracy Gowen
President AAS
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FROM THE GUEST EDITOR

The management of road traffic noise is critical to the current Australian environmental context. Population growth and major infrastructure developments mean that more vehicles will be on the roads, and more people are likely to live by transportation corridors. The health impacts of road traffic noise are now widely acknowledged, particularly with the publications of key World Health Organization reports on the matter in the last decade.

Australian states and territories have in place a number of policies and practices to manage road traffic noise and its impacts. Some of these policies have been revised in recent years or are currently under review, to better address the current and forthcoming challenges. Road authorities across the country work closely with the acoustic consulting community to implement best practice for noise mitigation and make use of state of the art technology.

The concept of having a special issue of Acoustics Australia on Road Traffic Noise was initiated during the AAS conference held in the Hunter Valley in 2015. From the impressive variety and quality of the papers on topics relating to road traffic noise, its mitigation and its management, Marion Burgess the Chief Editor invited me to be the Guest Editor for a special issue focusing on road traffic noise in Australia. After accepting this invitation, I was pleased to receive strong interest from a number of invited authors. I would like to thank the authors and reviewers who have done a tremendous job in preparing submissions and providing constructive feedback. Unfortunately not all submissions were completed in time for this August issue so there will be additional papers in the December issue. There are five papers and technical notes and one forum article presented in this August issue.

The contributions presented in this issue deal essentially with three broad topics: traffic noise management policy and practice, road surfaces and traffic noise modelling. Regarding policy, Marion Burgess and John Macpherson give a comprehensive review of the noise policies currently in place in the various Australian states and territory. Renzo Tonin provides a review on design and measurement practice for quiet road surfaces. Darren Jurevicius introduces in a technical note, the scheme for façade treatments recently in place in South Australia as part of their 2014 traffic noise guidelines. James McIntosh and I present the latest results of a long term pavement trial conducted on the Mornington Peninsula Freeway that was initiated by VicRoads in 2013. In addition, Neil Huybregts opens a debate on the topic of calibration of traffic noise predictions in a Forum article.

Plenty of food for thought; I hope you will enjoy reading this special issue and remember there is more to come in the December issue.

Marc Buret, MAAS

FROM THE CHIEF EDITOR

Acoustics Australia continues to receive a high number of submissions of papers from around the world. In part this is because our journal accepts papers across the broad area of acoustics. From all these submissions the reject rate continues to be high, with 68% of the 80 submissions received during 2016 being rejected. Maintaining a high standard is essential to achieving a reputation as a good quality journal and to maintain the interest of the readers. While there is no intention to become a primary research journal, it is rewarding to see the Impact Factor continue to increase annually and for the current reporting period it is 0.65. This factor assesses a number of historical as well as current factors and so relates to the work of the previous editors. It is particularly refreshing that of those papers accepted this year, over 50% have been from Australian authors. This ensures that the journal is relevant to and reflective of the acoustic research being undertaken throughout Australia.

We are particularly grateful to the efforts of the special issue editor, Marc Buret, to encourage a number of Australian practitioners to provide papers and technical notes based on the findings of various studies related to traffic noise impact. At best, some of the reports on these studies may reside on the websites of the relevant client agency or some of the content may be included in a conference paper. It is a challenge to take the time to prepare a manuscript but the outcome, with the findings available in the public domain and able to be discovered by various search engines, makes the findings available to a wide audience.

The invited papers on traffic noise will span both this August issue and the December issue. Into 2017, we plan for a special issue on underwater acoustics and a little later in the year an issue on wind turbine noise. At any time, contributed papers on relevant acoustic topics are very welcome and especially those from practitioners.

Marion Burgess
Editor in Chief
**ACOUSTICS AUSTRALIA 44(2), 2016 ABSTRACTS**

The full papers for these abstracts can be found in the online version of Acoustics Australia. Members of the Australian Acoustical Society should access via the member login of the AAS website. Access for all others is via http://link.springer.com/journal/40857

**SPECIAL ISSUE**

**ROAD TRAFFIC NOISE PART 1**

**REVIEW PAPERS**

**OVERVIEW OF AUSTRALIAN ROAD TRAFFIC NOISE POLICY 2016**

John Macpherson, Marion Burgess
UNSW, Canberra, Australia

In common with the rest of the developed world, road traffic noise has been a public policy issue in Australia for many years. From attitudinal studies relating to noise in the environment, it is consistently shown that the higher annoyance scores for noise heard within the home result from road traffic noise. Governments in Australia, at all levels, have responded with a range of traffic noise management measures. At the federal government level, these have primarily related to reducing noise at the source, namely the vehicle. State governments have developed traffic noise policies to guide the design for major roads and to control the planning of new noise-sensitive areas adjacent to major road corridors. Local governments have also considered traffic noise and introduced local traffic management measures on roads they control. This paper reviews and discusses the approaches in the different policies in current use in Australian states and territories for the management of road traffic noise.

**QUIET ROAD PAVEMENTS - DESIGN AND MEASUREMENT: STATE OF THE ART**

Renzon Tonin
Renzon Tonin & Associates (NSW) Pty Ltd, Australia

For motor vehicles travelling at a speed above about 45 km/h, and for heavy vehicles above about 65 km/h, the primary source of noise emission is generally associated with the tyre/pavement interface. There is therefore considerable activity in both Europe and in the US in finding ways of minimising this source of noise. This paper presents an overview of state-of-the-art pavement design solutions being trialled to ascertain effectiveness and long-term viability. Of particular note is the development of low noise concrete solutions which potentially offer a long-term wearing surface. An important aspect of the ongoing effort in pavement noise reduction is the need to have reliable methods to measure the noise emission from those surfaces, not only to compare one with the other but also to assess the ongoing performance of any pavement surface over time. Three methods are described—the SPB method, the CPX method and the OBSI method—each in their own way having advantages and disadvantages, but each method having a formal standard underpinning it.

**MODELLING AND ANALYSIS OF URBAN TRAFFIC NOISE SYSTEM USING ALGEBRAIC GRAPH THEORETIC APPROACH**

Daljeet Singh, S. P. Nigam, V. P. Agrawal, Maneek Kumar
Thapar University, India

An Urban Traffic Noise System can be considered to consist of various subsystems like Road Traffic Subsystem, Human Subsystem, Environment Subsystem, Traffic Network Subsystem and Urban Prosperity Subsystem. These subsystems would include all the relevant parameters which affect the noise in an urban traffic scenario. In the present work, only the Road Traffic System and some of its major parameters have been considered and an Algebraic Graph Theoretic model is presented which emulates the chosen input dataset with a satisfactory level of accuracy, after incorporating the interaction effects. The parameters like traffic volume, street width, height of measuring point above street level and estimated speed with the interactions between them have been identified and modelled as permanent noise function. The evaluation of the ‘permanent function’ as a noise index and its correlation with the experimental values of traffic noise level descriptors, $L_{eq}$, $L_{90}$ and $L_{10}$, is shown with the help of an illustrative example.

**TECHNICAL NOTES**

**A NEW APPROACH TO IMPLEMENTING FACADE TREATMENTS IN CONTEXT OF THE SOUTH AUSTRALIAN ROAD TRAFFIC NOISE GUIDELINES**

Darren Jurevicius, Tom Evans, Matthew Stead
Resonate Acoustics, Australia

With the growing social awareness of the potential health impacts related to high road noise exposure upon communities, government noise policies must strike a reasonable and practicable balance between the needs of building and maintaining safe and efficient road transport infrastructure and the need to provide an appropriate level of residential amenity. Providing this balance in practice presents a challenge to policy makers, planners and designers, particularly in the case of major upgrades to existing infrastructure, where a number of social and economic constraints exist. Recently, the South Australian Department of Planning, Transport and Infrastructure revised its Road Traffic Noise Guidelines to adopt a new approach to the implementation of facade treatments (amongst other amendments). This paper provides insight into the development of the facade treatment approach and also expands with some of the new methodologies developed to implement the approach in practice on a major transport infrastructure project in South Australia.
LONG-TERM ASPHALT TRIAL: RESULTS OF ACOUSTIC TESTS AFTER THREE YEARS
Marc Buret, James McIntosh, Cassandra Simpson
VicRoads, Australia

In 2013, VicRoads initiated a long-term trial to investigate the acoustic performance of various asphalt pavements constructed as variations to the standard specification for Victorian roads (Simpson et al. in Proceedings of the 26th Australian Road Research Board (ARRB) conference, Sydney, Australia, 2014). Acoustic testing of these five variations included statistical pass-by tests, as well as close proximity (ISO/DIS 11819-2 in Acoustics—measurement of the influence of road surfaces on traffic noise—Part 2: the close-proximity method, International Standard Organization, Geneva, 2013) and on-board sound intensity measurements (AASHTO TP 76-12 in Standard method of test for measurement of tire/pavement noise using the on-board sound intensity (OBSI) method. American Association of State Highway and Transportation Officials, Washington, 2012). The data collected from the most recent trials are presented along with that previously gathered over the first 3 years of the trial. The best-performing section of pavement was found to be a wearing surface that was treated by diamond grinding, and that showed a consistent improvement in noise reduction of up to 3 dB(A) over the standard open-graded asphalt.

GENERAL SUBMISSIONS

REVIEW PAPER
THE ORIGINS AND EARLY DEVELOPMENT OF AUSTRALASIAN AUDITORY NEUROSCIENCE
Dexter R. F. Irvine
Monash University, Australia

The impressive achievements of Australasian auditory neuroscience largely derive from the establishment of three major laboratories, at the University of Western Australia, Monash University, and the University of Melbourne, in the 1960s. The research foci of these laboratories, and the achievements of the scientists who established them, and of their colleagues and students, are described in this paper. The early development of auditory neuroscience occurred in a context provided by research activity in a number of other areas of hearing science, among them audiology, otolaryngology, psychoacoustics, and vestibular science. The development of these and some other strands of Australasian hearing science is briefly reviewed.

ORIGINAL PAPERS
EXPERIMENTS ON JET NOISE REDUCTION WITH A LIQUID COLUMN
Lei Zhang, Hao Wang, Wen-jun Ruan
Nanjing University of Science and Technology, China

A liquid column is designed and placed into the tail tube to effectively reduce the gas jet noise of a single rocket. The diffusion and mixing processes of high-temperature high-pressure gas flow in the liquid water column in the air is studied by means of a high speed photographic system. The gas–liquid mixture jet noise has also been measured. The experimental results indicate that, when the liquid water column is put into the tail tube, the jet flow structure is changed and the jet flow parameters (velocity, temperature, etc.) are decreased due to the interaction of the gas jet with the liquid column. In addition, the jet noise is significantly reduced in the presence of the liquid column, compared with the condition without the liquid column. When the mass of the liquid column increases to 1.485 kg, the jet noise is reduced to a minimum in the shooter location. The peak sound pressure level also decreases with increasing polar angle. Most importantly, the thrust performance of the rocket engine is maintained when the liquid column is introduced.

DESIGN OF REACTIVE RECTANGULAR EXPANSION CHAMBERS FOR BROADBAND ACOUSTIC ATTENUATION PERFORMANCE BASED ON OPTIMAL PORT LOCATION
Akhilesh Mimani1, M. L. Munjal2

1The University of Adelaide, Australia
2Indian Institute of Science, India

This paper analyses the transmission loss (TL) performance of rectangular expansion chambers having a single-inlet and single-outlet (SISO) or single-inlet and double-outlet (SIDO) by means of a 3-D semi-analytical formulation based on the modal expansion and the Green’s function approach. To this end, the acoustic field inside the rigid-wall rectangular chamber is obtained as the orthogonal modal solution of the 3-D homogeneous Helmholtz equation. The SISO/SIDO rectangular chamber system is characterised using the uniform piston-driven model in terms of the impedance matrix parameters (equivalently, the acoustic pressure response function) obtained by computing the average of the 3-D Green’s function over the surface area of the inlet/outlet ports modelled as rigid pistons oscillating with uniform velocity. The TL graphs computed using the 3-D semi-analytical formulation are found to be in an excellent agreement with those obtained using the 3-D semi-analytical formulation.
from the 3-D FEA for SISO test cases, thereby validating the technique presented here. A parametric investigation is conducted to study the effect of arbitrary locations of the inlet/outlet ports on the chamber surface on the TL graph. This results in the formulation of guidelines towards designing the axially short and long SISO/SIDO rectangular chambers exhibiting a broadband TL performance in terms of optimal angular and axial location of ports on the appropriate acoustic pressure nodes. In addition, characteristic features of the TL spectrum of a general reciprocal and conservative single-inlet and multiple-outlet muffler system, such as (1) the effect of interchanging the position of inlet and outlet ports and (2) analysis of peaks and troughs, are proved analytically by means of the scattering matrix parameters. These features are corroborated through the analysis of the TL graphs (obtained using the 3-D semi-analytical formulation) of the SIDO rectangular chambers.

PREDICTION OF BUBBLE GENERATION BASED ON ACOUSTIC EMISSION
Li Chen1, Vinh Trinh1, William Yang2, Krishna Mohanangam2
1Defence Science and Technology Group, Australia
2CSIRO Mineral Resources Flagship, Australia

The noise associated with gas discharged from a submerged nozzle is of great interest to many industries because of its important applications. For example, it can be used to size bubbles and to detect gas flow rate. However, the physics associated with the acoustic emission due to bubble formation is complex, particularly when a large number of bubbles are involved, and has not been fully understood. In this study, the dynamics of the bubble formation from a submerged nozzle has been studied experimentally using the Particle Droplet Image Analysis technique. An improved model for prediction of the bubble generation rate and size distribution based on acoustic emission is presented. The experimental study is carried out in a large water tank, of dimensions 10 m × 10 m × 6 m, using multiple hydrophones. The water tank is carefully calibrated in order to provide free-field measurements. The predicted bubble generation rate and size distribution have been compared with the experimental data. It has been found that the predicted results are in good agreement with the experimental measurement, implying that an accurate prediction of acoustic emission associated with a bubbling plume from a submerged nozzle can be achieved by using the model.

UNDERWATER ACOUSTIC SIGNATURES OF RECREATIONAL SWIMMERS, DIVERS, SURFERS AND KAYAKERS
Christine Erbe, Miles Parsons, Alec J. Duncan, Kim Allen
Curtin University, Australia

Non-motorised, recreational water activities were recorded underwater in the controlled setting of a public swimming pool during the off-season. Individuals, one at a time, swam freestyle and breaststroke, snorkeled, scuba-dived, kicked a boogie board and a surfboard, kayaked, and simply jumped into the water. Underwater video and still images were recorded at the same time to interpret the sounds recorded. Most of the sound was due to bubbles generated underwater. Activities involving fins (flippers) were the loudest (boogie boarding and snorkelling), followed by freestyle swimming, surfboard paddling, and kayaking. Breaststroke generated the fewest bubbles and was the quietest. All activities produced bubbles, hence noise, at a characteristic temporal pattern. Scuba-diving exhibited two distinct noise spectra related to inhalation and exhalation. Received levels ranged from 110 to 131 dB re 1 μPa (10–16,000 Hz) for all of the activities at the closest point of approach (1 m). The results might have applicability to the monitoring of pools for security reasons, to performance assessments of swimmers, and to studies of the distances at which humans may be detectible by marine animals in the sea.

2D ACOUSTIC DESIGN SENSITIVITY ANALYSIS BASED ON ADJOINT VARIABLE METHOD USING DIFFERENT TYPES OF BOUNDARY ELEMENTS
Leilei Chen1, Linchao Liu1, Wenchang Zhao2, Haibo Chen2
1Xinyang Normal University, China
2University of Science and Technology of China

Continuous linear and quadratic boundary elements are often applied to numerical solution. Discontinuous higher-order boundary elements are developed for 2D acoustic problems to achieve higher accuracy in this paper. The Burton–Miller formulation is used to overcome the fictitious frequency problem when using a single Helmholtz boundary integral equation for exterior boundary-value problem. The strong singular integrals in Burton–Miller formulation using different types of element discretization are evaluated explicitly and directly, respectively. An example of scattering by an infinite rigid cylinder is presented to compare the performance of different types of elements. The effect of the position of nodes on the performance of discontinuous elements is studied, and an empirical value for optimal nodal position is concluded in this paper. Adjoint variable method is applied to evaluate the sensitivity value of the objective function, and the method of moving asymptotes is used for structural optimization analysis of noise barrier.

TECHNICAL NOTES
SOUND FOCUSING EFFECTS IN HORSESHOE PLAN THEATRE
Gino Iannace1, Maria Di Gabriele2, Fabio Sicurella3
1Second University of Naples, Italy
2University of Sannio, Italy
3Freelance Engineer

This paper is aimed to study the sound focusing effects in the theatre with horseshoe-shaped plan. It was considered as a case study in the theatre “Vincenzo Bellini” in Catania (Italy), a horseshoe-shaped opera house where both opera and symphonic concerts can take place. This configuration, at the time, was considered to be the best solution for both a good sound quality as well as a good view of the stage for the spectators sitting in the boxes. The geometry of the theatre determines some gaps due to a concentration of the early sound reflections on the back of the room, including the last rows of seats, thus causing a non-uniform spread of sound in the theatre. This concentration of reflections does not create optimal conditions for good acoustics due to excessive reverberation and negative influence on the listening to music performances.
CALCULATING REVERBERATION TIME FROM IMPULSE RESPONSES: A COMPARISON OF SOFTWARE IMPLEMENTATIONS

Densil Cabrera¹, Jianyang Xun¹, Martin Guski²
¹The University of Sydney, Australia
²RWTH Aachen University, Germany

In room acoustics measurement, calculating reverberation time from room impulse responses is often done, aided by software. This paper compares the performance of nine software implementations for calculating octave band reverberation time, including two written by the authors. Synthetic impulse responses are used to test decays without and with a steady noise floor, and an impulse response from a real measurement is also used for comparison. Results indicate no significant reverberation time calculation problems for noise-free exponential decays, and for exponential decays leading to a steady noise floor. Frequency selectivity is identified as an area for potential improvement in filter-bank design, and a highly selective octave band filter-bank is shown to be effective without introducing errors. Testing with a real measured impulse response, which had been used in a 2004 study comparing reverberation time analysis implementations, showed greater agreement between software than was found previously. This might reflect an improvement in software performance in the years between the two studies. However, it also might reflect the smaller scale of the present study. Nevertheless, the results can contribute to confidence in current software implementations.

A PROPOSAL ON NEUROLOGICAL DOSE–RESPONSE RELATIONSHIP FOR INCLUSION IN ISO 5349-1 DOCUMENTATION TO BE USED IN TROPICAL ENVIRONMENT

Anselm Ting Su¹,², Setsuo Maeda³, Jin Fukumoto², Nobuyuki Miyai², Shigeki Takemura², Awang Bulgiba⁴, Kouichi Yoshimasu², Kazuhisa Miyashita²
¹University Malaysia Sarawak (UNIMAS), Malaysia
²Wakayama Medical University, Japan
³Kinki University, Japan
⁴University of Malaya, Malaysia

The objective of this paper is to calculate the association between the eight-hour time weighted average vibration exposure, A(8) and years of vibration exposure in the tropical environment using the results of hand-arm vibration syndrome (HAVS) study conducted among a total of 173 male construction, forestry, and automobile manufacturing plant workers in Malaysia. We found that the relationship between A(8) and years of vibration exposure for neurological symptoms in tropical environment is similar to finger blanching as reported in the ISO 5349-1 document. The dose–response relationship of HAVS in a tropical environment is valid for finger tingling and numbness. Hence, we proposed to include the dose–response relationship information for neurological symptoms in the ISO 5349-1 document to facilitate its application in tropical environment.

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AAS NEWS

From the General Secretary

Council resolved in November 2015 to upgrade the subscription payment system for members following the badly designed WordPress website in April 2014 that promised much but delivered little.

AAS now has a new membership database now integrated with the website, which has also had to be upgraded. This process and some of the inevitable problems encountered, delayed the release of invoices for the 2016-2017 subscription year.

Matters were not helped when at the last minute the ISP used by the Society decided it would no longer support the website software which meant changing web hosting providers. The Society’s Webmaster is to be acknowledged and congratulated on successfully managing this integration and upgrade.

The new database will now allow members to pay by credit card on-line via the AAS website through the secure Stripe payment gateway. Members must logon in order to make their subscription payment and will be able to obtain copies of invoices and receipts. Once logged on members should select the “Subscription Details” link under SPECIAL MENU on the Home Page navigation bar to view their payment history.

The new database does not allow for members to be in arrears, consequently in transitioning to the new system 92 members are now regarded as lapsed for non-payment of subscriptions for previous years 2014-2015 and 2015-2016 in spite of numerous reminders sent out. Lapsed members will not be able to log in and if they want to continue membership they will need to contact the General Secretary and pay their arrears in order to be reinstated.

Current membership numbers total 644, with 25 new members admitted since 1/01/2016.

Richard Booker,
General Secretary

NEWS FROM THE DIVISIONS

Vic Division

About forty members of the Victorian Division visited the new CSIRO acoustical facilities in the Melbourne suburb of Clayton at the back of Monash University on the evening of Tuesday 31 May 2016. The new CSIRO acoustical facilities were built to replace the old CSIRO acoustical facilities on the CSIRO site in the Melbourne suburb of Highett, which closed at the end of November 2015.

The new facilities consist of a 200 m$^3$ reverberation room which has been qualified for sound absorption coefficient measurements by the addition of stationary diffusing panels. Below this room is a 100 m$^3$ reverberation room. There is a 3 by 3.6 m floor/ceiling opening between the two rooms for the measurement of airborne and impact sound insulation. There is also a 100 m$^3$ reverberation room adjacent to the 200 m$^3$ reverberation room and a 3 by 3.6 m wall opening between these two reverberation rooms. All three reverberation rooms are vibration isolated from the ground and from each other.

The floor/ceiling opening has a 150 mm thick concrete slab which can be removed using a 5 tonne overhead girder crane. The reverberation rooms are constructed with 300 mm thick concrete walls. The ceiling of the 200 m$^3$ reverberation room has a 200 mm thick slab.

There is also an off-the-shelf anechoic room with a working space of 70 m$^3$ which is anechoic down to 100 Hz. This is used for the testing of smoke alarms and fire warning systems. It can also be used for measuring the frequency response of microphones and loudspeakers and for measuring sound power. The facilities also have a vibration shaker for the testing of smoke alarms.

A single microphone impedance tube and two flow resistance measuring devices were relocated from the old Highett site. The flow resistance measuring devices have not yet been reassembled.

John Davy

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WA Division

The annual Western Australia State Seminar is coming up on October 7, and features a full day of presentations and workshops on a variety of acoustics topics and issues relevant to WA. Members and industry guests are invited to present on areas of current work or interest - it will be held at the Rothschild’s room, Perth Zoo. The cost to attend will be partially subsidised for AAS members and students - all interested parties are welcome to contact the WA Division for further details or the Divisional Notices section of the AAS website.

The Western Australian division is also in forward planning of Acoustics 2017, which will be held from the 19th to 22nd of November, 2017 at the 5-star Pan Pacific Hotel, Perth, supported by the Perth Convention Bureau. For sponsorship and exhibition opportunities please contact Norm Broner or the WA Division.

Luke Zootjens

QLD Division

The Queensland Division has been working hard to ensure that ACoustics 2016 will be a big success. Even with the workload associated with planning the conference, the Queensland Division has still found the time to ensure regular technical meetings are being held for members.

On Wednesday 18th May, Dr Miroslav Dosen of ETMC Technologies took the Queensland Division members on a quick journey in acoustics, data acquisition and signal processing. Drawing on his experience, Miroslav gave the attendees a better appreciation of the capabilities of the sound measurement equipment used by most consultants. Topics covered included the different types of microphones and how they work, the common and not-so-common dangers of data acquisition and why all equipment cannot be considered to be ‘the same’. The talk was found to be very informative by those who attended, with Miroslav being subjected to a number of questions at the completion of his talk.

On Tuesday 19th July, Lloyd Cosstick and Rajeev Nand of Embleton presented a talk on swimming pool isolation. This talk was timely due to the large number of multi-storey residential developments currently underway in Brisbane. The pad and spring methods of isolating pools were discussed along with the specific design considerations required for each method. A number of examples and a case study were presented to show how potential problems can be avoided during the design phase. Test data from an isolated pool were presented and discussed to demonstrate the benefits of a structurally isolated pool. The content of the talk was found by the attendees to be very practical and represented information that is not normally found in textbooks or journal articles.

Michael Hayne

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EXPERIENCES FROM THE 2015 CONFERENCE

The following reports are from four students who received travel grants from the NSW Division to participate in the AAS Annual 2015 Conference.

Paper Title: The effect of a serrated trailing edge on self-noise reduction of a flat plate.

It was the first time I got the chance to attend the AAS conference. ACoustICS 2015 was a professional conference which provided me an opportunity to network with other people in my field, allowed me to feel more integrated into my professional community. Attending this conference helped me to get many ideas about my research project which made my PhD project scientifically stronger. Talking to other experts in the same field and being aware of the ongoing projects related to my research had several advantages. First, I got some ideas to make my PhD project more unique and novel. Moreover, my research project was multidisciplinary and it was really helpful to discuss the issues that I was facing in different aspects of my project with other experts in related fields. It was a well-organised conference and a high quality event. Several of the sessions which I attended were very informative and insightful on their particular subjects. I also enjoyed the seminars delivered by the international keynote speakers, especially the talk by Professor Richard Sandberg. The conference venue was at Cypress Lakes Resort which was very beautiful and the winery tour was also very interesting. All in all, it was a great experience attending the AAS 2015 conference. I am very grateful to Australian Acoustical Society NSW Division for the AAS NSW travel award and for giving me the chance to attend the Acoustics 2015 conference in Hunter Valley.

Mahmoud Karimi, UNSW, Kensington

Paper Title: Improving brake squeal propensity prediction by model updating.

My research is about the analysis of automotive brake squeal. Brake squeal as a recurring problem to the automotive industry owing to warranty-claim related costs, is difficult to model numerically and analyse owing to system inherent non-linearities in combination with uncertainties and system complexity. Often, model components are linearised and not sufficiently experimentally validated. Especially sophisticated contact friction models as well as stiffness in joints are often neglected owing to difficulties in experimental validation. Our study shows a full brake system being properly updated on the component level, then subassembly (pad assembly alone, pad in bracket) level could have potential in improving the numerical prediction of brake squeal. Therefore I truly want to present my work in an academic conference. Fortunately, Acoustic 2015 conference in Hunter Valley held by Australian Acoustical Society provided me with a great opportunity to share my research on the analysis of automotive disk brake squeal with the leading experts on vibration and acoustics all across the world. I benefitted a great deal from the discussion with the participants and gained new knowledge on many other aspects of vibration and acoustics. I would like to appreciate the provision of the NSW AAS student travel grant, which offered me a great chance to broadcast our research and receive constructive feedback from other scholars.

Zhi Zhang, UNSW, Canberra

Paper Title: An assessment of different sized open plan and enclosed kindergarten classroom listening environments.

Open plan classrooms, with up to 200 children in the same space, have recently been gaining popularity in Australian primary schools. However, my research shows that these classrooms are prone to high noise levels because of the large number of children doing different activities in the space. These high noise levels negatively impact children’s ability to hear and process the important new concepts they are being taught by their teacher. Furthermore, studies have shown that children from classrooms with poor acoustics have lower literacy and numeracy skills, are less productive in the workforce, and tend to be in lower paid jobs compared to children from classrooms with good acoustics. Additionally, it is not just the children who suffer; many teachers have difficulty teaching in these classrooms because of the high noise levels, and experience vocal health problems as a result of constantly having to raise their voice above a comfortable level to be heard.

Therefore, receiving an AAS NSW Student Travel Grant to present at the Acoustics 2015 conference was a fantastic opportunity for me to discuss the implications of my research with academics, acoustic consultants, acoustic engineers, and other professionals in the building and architectural acoustics fields. Attending the conference was also a great chance for me to listen to other presentations to extend my knowledge of the acoustics field. Additionally, the conference social events were a great chance for networking and making new connections and friendships, as well as having fun. I hope to attend many more AAS Acoustics Conferences in the future.

Kiri Mealings, Macquarie University

Paper Titles: Quasi-periodic noise barrier with Helmholtz resonators for tailored low frequency noise reduction, and Locally resonant sonic crystal barrier for low frequency noise control.

As a PhD student, I had this opportunity to present two papers in barrier session of the national conference in Acoustics (Acoustics 2015 Hunter Valley), and get the feedback from the panel and audience. Some of the scholars at the noise barrier session asked some questions and I think it was quite helpful as the gaps could be more identified.

I was also able to attend the presentations from other people which gave me this opportunity to see what other research is being conducted in Australia. The questions from the audience at some sessions gave me a hint about the future problems that I might face in my work.

One of the main benefits of attending conferences is to socialize with other people within the same field of interest. This could be industry partners or academic researchers. The national Acoustic conferences in Australia are also a good opportunity for undergraduate and post graduate students to find a job related to their field of interest.

And last but not least, I would like to acknowledge the Australian Acoustical Society NSW Division for supporting me at this conference. Hopefully other students will have this opportunity to win the travel award and attend the next Acoustics conference in Australia.

Samaneh M. B. Fard, UNSW, Kensington
ACOUSTICS NEWS

Standards Australia

Aircraft Noise Information Handbook
SA HB 149:2016

Following the release of the updated version of AS2021 in 2015, the Standards Australia EV-011 committee has worked on providing a Handbook to provide guidance on the preparation of information on aircraft noise for dissemination to the public. SA HB 149:2016 Handbook “Acoustics—Guidance on producing information on aircraft noise” has been released in June 2016. In contrast to AS2021 it is not a land use planning tool but is intended to improve the availability of information about aircraft noise in a form that will allow individuals to make personal judgements about the impact of that noise on themselves.

The guidance provided in this Handbook is intended for use by airport owners and operators, government agencies, and other organisations, when producing and promulgating information on the distribution of aircraft noise around an airport. Provision of information in a format that is meaningful to the public will assist both the agencies presenting the information, and the public for whom that information is provided. The Handbook identifies the key features of that noise as it might affect the public, as follows:

(a) Where aircraft fly.
(b) How often aircraft fly.
(c) How much noise aircraft make.
(d) When aircraft fly.
(e) How widely noise will be heard.
(f) Current and projected future noise impacts.
(g) Other factors.

They may not all be required for every airport, but they should be regarded as the key elements of noise information dissemination and should only be discarded if there is a sound basis for doing so.

Copies of the handbook are available from the SAI Global store:
https://infostore.saiglobal.com/store/Details.aspx?productID=1865417

Digital Transformation Program

Anyone who has had dealings with Standards Australia, either as a committee member or simply wanting to provide comments on a draft standard, is aware of the challenges and frustrations presented by the current systems. From Standards Australia view, the systems are very logical and provide the necessary security. So it is of interest that Standards Australia is embarking on a major digital transformation program. In a recent Standards News the newly appointed Publishing and Content Solutions Manager explained the aims of the project. These include a digital repository which “you can search across and quickly get to the information you want. It should allow you to link between related pieces of information or draw out lists of relationships between parts of the information”. In regard to communication with stakeholders the aims include the opportunity “to find relevant information faster and more comprehensively... use online collaboration tools, allowing more than one author to contribute concurrently while documents are being drafted...improve the tools that allow stakeholders to comment more effectively on draft documents”. While the aims are explained, the time line for implementation is not, so in the meantime we all have to grit our teeth and work with the current system!

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Good Music Neighbours in Victoria
The Good Music Neighbours funding program aims to invest in the co-habitation of venues and residences in our cities and the peaceful and amicable sharing of our great live music culture. The Good Music Neighbours grants help venues be proactive about sound management and offer up to $25,000 per venue in matched funding for responsible design and management of live music sound in Victorian venues to achieve best practice.

Grants must be used to pay for expenses for buildings or works for sound proofing / noise attenuation measures to minimise noise emissions from live music entertainment venues, including obtaining sound proofing advice and capital investment in sound equipment (up to $10,000).

More information:
http://www.musicvictoria.com.au/gmn/aims-and-guidelines

The sound of silence — why Germany lost its subs bid
Recent bids by France, Germany and Japan to build Australia’s submarines have left Germany and Japan as unsuccessful bidders because their submarines were too noisy.

“It was the smallest of sounds, too soft for human ears but deemed loud enough to potentially doom an Australian submarine.

Two weeks ago, behind closed doors in a shipyard in the German port of Kiel, the secrets behind Australia’s $150 billion submarine decision were finally revealed. It was a moment that left the Germans stunned. They were told for the first time that they had lost the bid because their proposed Australian submarine had an ‘unacceptable’ level of ‘radiated noise’.

In the world of submarines, noise equals potential detection and death. France won the largest defence contract in the nation’s history because it had best achieved the sound of silence... the proposed French submarine was seen to be more stealthy than those proposed by Germany or Japan.”

France’s successful bidder, DCNS, proposed a ‘revolutionary pump jet propulsion system, which will replace propellers on the Australian boat, the Shortfin Barracuda.’ This is claimed to ‘give its submarine a higher tactical silent speed than the German Type 216 submarine and Japan’s evolved Soryu-class submarine, both of which would have propellers.’

Extract taken from original item published in THE AUSTRALIAN, 30 MAY 2016 by Cameron Stewart.

New Premier Chamber Music Venue in Adelaide Hills
The Ngeringa Cultural Centre in the Adelaide Hills has been revamped with a new 220-seat Concert Hall for Chamber Music, opened in August 2015. The Concert Hall consists of a reciprocal framed roof structure in a combination of structural steel and timber frame. The acoustical design, led by Arup Acoustics, resulted in an intricate timber ceiling arrangement.

“Without a doubt every musician who’s played in that space has remarked on the acoustics mainly in terms of the fullness and the quality of the sound. Already it’s starting to establish itself as a premier chamber music venue for Australia”, said Adelaide-based architect designer Anton Johnson.

World’s First Silent Opera at Sydney Opera House
The world’s first large-scale, live silent opera performance will premiere in Sydney when Opera Australia stages Sydney Opera House – The Opera: The Eighth Wonder, using the famous building as an opera stage for the first time.
A huge cast, chorus and orchestra will perform the opera live, with the sound transmitted to the 3,000 strong audience through state-of-the-art Audio Technica headphones, a feat not accomplished before with classical music on such a large scale.

The singers will perform on the steps of the Sydney Opera House with the orchestra performing inside and the sound combined.

Opera Australia is combining the traditional art-form and a story about 1960s Australia with the latest in technologically advanced sound design, staging, projection, lighting and 3D printing.

The Sydney Opera House itself will be used as an opera stage for the first time ever. Platforms will glide across the 100 metre-wide steps, delivering the fast-paced action. Giant screens will unfurl to display historic photos. Giant glowing balls of paper, projections and lighting effects will complete the son-et-lumiere spectacle.

More information: opera.org.au

Resonate Acoustics and Savery & Associates Merge in Queensland

Savery Resonate Acoustics brings together Savery & Associates’ almost 20 years of experience and Adelaide-headquartered Resonate Acoustics’ five-year-old business. Effective 1st July 2016, the new Savery Resonate Acoustics will be in operation and for more information see: http://resonateacoustics.com.au/saveryresonate

Taking Listening to a New Level

Your hearing is like your fingerprint - unique to you. A fact that has inspired a Melbourne based start-up company to develop headphones that take personalisation to a whole new level.

Designed by a team that has experience across both engineering and hearing science - Nura plans to produce headphones that will deliver a completely custom listening experience. They feature innovative technology that takes the signals - or otoacoustic emissions - produced by your ear when you are listening, and uses this information to tailor what you hear.

The headphones are a hybrid of in-the-ear and over-the-ear headphones that deliver an immersive sound experience that the outside world can’t listen in on.

More information: http://www.australiaplus.com/international/study-and-innovation/melbourne-startup-plans-to-change-the-way-you-hear-sounds/7626644

UK Design Guide for Acoustics of Schools

Published jointly by the Institute of Acoustics (IOA) and the Association of Noise Consultants (ANC) in the UK, the design guide provides recommendations and guidance to accompany the performance standards for the acoustic design of schools published by the Department for Education UK in December 2014.

The Guide contains chapters on noise control, internal sound insulation, design of rooms for speech and for music, pupils with special hearing requirements, open plan teaching, refurbishment and integrated design.

More information: http://www.ioa.org.uk/news/design-guide-schools-acoustics-published

IOA preferred amplitude modulation method

The Institute of Acoustics (IOA) has published its preferred method of measuring and rating amplitude modulation (AM) in wind turbine noise. Known as the Reference Method, it is essentially a development of the Hybrid Reconstruction Method that was described in a discussion document published by the Institute’s Amplitude Modulation Working Group (AMWG) in April 2015. The recommendation is contained in the working group’s final report, which follows a large-scale public consultation exercise that began with the publication of the discussion document. The document explains how the metric has been derived, and how it is to be technically implemented to derive a value for the level of AM in a wind farm noise signal.

The Institute will be writing to the Department of Business, Energy and Industrial Strategy to inform it of the IOA metric publication, with a view to encouraging its use in planning conditions designed to control AM.

More information: http://ioa.org.uk/publications/wind-turbine-noise and https://sourceforge.net/projects/ioa-am-code/

The Australian Acoustical Society warmly invites you to attend the 12th International Workshop on Rail Noise at Terrigal on the beautiful NSW Central Coast, 12th-16th September 2016. Since its inception in 1976, IWRN has become the premier conference on rail noise and this marks the first occasion it has been hosted in the Southern Hemisphere.

Registration is Now Open

The technical program includes around 100 papers with presentation and poster sessions spread over four days. Registration is now open via the workshop website. iwrn12.acoustics.asn.au
WORKPLACE NOISE AND VIBRATION

The Acoustical Society of New Zealand has recently published a special issue (March 2016) of their journal on Occupational Noise in New Zealand. It contains 3 interesting papers:

A Review of Occupational Noise in NZ; Noise sources, exposures and controls in small enterprises in NZ; and Occupational noise law in NZ – Where will it go?

These will be available on-line to non-members later in the year at http://www.acoustics.org.nz/?q=node/31. In the meantime, if you are interested in reading any of these, contact the editor at: journal@acoustics.org.nz

The Center for Disease Control and Prevention in the USA has recently published a report analysing hearing impairment among US workers between 2003 and 2012. This is the first known study to quantify the disability-adjusted life years attributable to hearing impairment for noise-exposed U.S. workers, and to estimate the prevalence at each level of hearing impairment by industry sector.

More information: http://www.cdc.gov/mmwr/volumes/65/wr/pdfs/mm6515.pdf

The UK HSL has published a case study on reducing hand-arm vibration in the cast stone industry.

More information: http://www.hsl.gov.uk/resources/case-studies/reducing-hand-arm-vibration-in-the-cast-stone-industry

This same industry has been studied in Taiwan with regards to the possibility that organic solvents in the epoxy adhesives used in the process increase the risk of hearing loss.

More information: http://bmjopen.bmj.com/content/6/2/e010533.full

‘Help Musicians UK’ has published the results of its 2015 survey of musicians’ hearing problems and use of hearing protectors.

More information: https://www.helpmusicians.org.uk/working-retired-musicians/musicians-hearing/our-survey-of-musicians-hearing

Swiss researchers have studied the effect of noise on operating theatre communication and have concluded that it may negatively affect the surgical team’s coordination.

More information: http://www.tandfonline.com/doi/full/10.1080/00140139.2016.1159736

Also in hospitals, Swedish researchers have published a study which shows that obstetrics personnel are exposed to noise that leads to effects of tinnitus and sound-induced auditory fatigue.

More information: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4386270/
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They have also recently published another article on validating self-reported symptoms against objective tests. The abstract is at http://www.ncbi.nlm.nih.gov/pubmed/27195802.

A questionnaire survey under the European OFFICEAIR project has assessed the perceived contributing factors to workers' comfort in modern offices. The highest association with occupants' overall comfort was found for “noise”, followed by “air quality”, “light” and “thermal” satisfaction.

More information: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4881069/pdf/ijerph-13-00444.pdf

Three companies in the UK have been fined recently for failing to adequately manage the risks of exposure to hand-arm vibration in their workplaces – one pipe manufacturer http://press.hse.gov.uk/2016/pipe-manufacturing-company-fined-for-safety-failings/?eban=govdel-vibration&cr=17-May-2016 and two construction companies: http://press.hse.gov.uk/2016/two-firms-fined-for-safety-breaches/?eban=govdel-vibration&cr=25-Apr-2016.

These cases highlight the importance of both adequate exposure assessments and regular health surveillance. The UK Health & Safety Laboratory runs a 2-day course on health surveillance for HAVS (something not currently available in Australia). The next one will take place 13-14 September 2016 and is designed for occupational health nurses, occupational physicians, GPs with an interest in occupational health and hand surgeons.

More information: http://www.hse.gov.uk/health-and-safety-training-courses/hand-arm-vibration-syndrome-(havs)

The Audio Engineering Society has published the papers given at its 2015 Conference on Music-Induced Hearing Loss in the March 2016 Edition of its journal. The paper by Murdoch University researcher Johannes Mulder Amplified Music and Sound Level Management: A Discussion of Opportunities and Challenges presents an interesting Australian perspective.

More information: http://www.aes.org/journal/online/JAES_V64/3/

Work is progressing on the WHO/ITU project on Make Listening Safe (in relation to music playing devices), with a workshop in Geneva being held on 6 June 2016 to review existing and planned technical standards for devices and discuss gaps and the way forward. The program and links to presentations can be found here: http://www.itu.int/en/ITU-T/Workshops-and-Seminars/safelisting/Pages/Programme.aspx

A free symposium on “Buy Quiet” has been held on 25 August in Hamburg, immediately following Inter-Noise 2016. This has addressed the pressing need for further efforts to better promote the idea of buying quiet machinery for use in both workplaces and the community. For the preliminary program see http://www.bruit.fr/buyquiet/buyquiet-2016-flyer.pdf

NIOSH in the USA has recently published 1-page on-line summaries of all its research programs including information on priorities, recent achievements and future plans. The programs of particular interest to acousticians are Hearing Loss Prevention; Prevention through Design; Construction; Manufacturing; Mining; Transportation; Warehousing and Utilities; and Surveillance.

More information: http://www.cdc.gov/niosh/docs/ppop/default.html

Ecophon UK has conducted a literature review: People centred offices, A psychological approach to resolving office noise distraction. From the review, several hypotheses were determined linking personality and acoustic preferences to performance in open-plan offices. They plan to follow this up with an intervention study next year.

More information: http://www.ecophon.com/whitepaper

In March, the UK HSL co-ordinated a Hearing Conservation Conference called Listen Up! The programme is here: http://www.hsl.gov.uk/listenup/programme. If anyone is particularly interested in any of the presentations, please contact Pam Gunn at pam.gunn@commerce.wa.gov.au

More information: http://www.hsl.gov.uk/listenup

The UK Action on Hearing Loss has launched a new Speak Easy Campaign calling on the catering industry to take action on reducing background noise in restaurants, cafés and pubs. They have conducted a survey of customers with hearing loss and produced a guide for the industry Speak Easy: How to improve the customer experience, which outlines a number of practical adaptations that venues can make to manage background noise levels and ensure they’re fully accessible to people with hearing loss.

More information: https://www.actiononhearingloss.org.uk/speakeasyreport.aspx

Pamela Gunn has contributed these Workplace Noise and Vibration items.

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Traffic noise modelling is an inexact science – it’s not unusual for measured noise levels to be 2-3dB higher (or less frequently, lower) than the levels predicted by the computer model. From time to time, the difference is greater and in extreme cases, such as when ground effect is significant, or when hilly terrain causes noise levels to be highly sensitive to wind direction, the difference can be as much as 10dB. Now, 2-3dB is not much acoustically. A change of 2-3dB in a steady noise is perceptible, even noticeable if you’re paying attention, but it’s not a huge difference. So why worry?

Traffic noise barriers – not much bang for your buck

Once a traffic noise barrier is high enough to block the line-of-sight between the traffic and the receiver, adding more height to the barrier provides limited returns. My rule-of-thumb is 1 dB of noise reduction per metre of additional height.

I work mainly for developers wanting to build residential estates next to freeways. For a large estate, adding 1 metre to the height of a noise barrier can typically cost $1M. And what do they get for their $1M? An imperceptible change in noise level that equates to only a slight decrease in the risk of non-compliance.

And it isn’t just cost. The higher the noise barriers get, the more likely it is that there will be negative impacts on amenity and overshadowing. In such a situation, it is understandable that acoustic consultants look for ways to reduce the risk of over-design, and one question we ask ourselves on every project is: is there something about this particular site that means I can reduce my safety factors?

Traffic noise prediction method validation studies

Over the years, a number of studies have been conducted into which traffic noise prediction methods are most accurate. The Austroads document An approach to the validation of road traffic noise models [1] provides a review of work up until the 1990s. Since then, very little has been done in Australia or New Zealand, though I understand there will be a paper or two in this edition of Acoustics Australia.

These studies typically compare measured and modelled noise levels at a range of sites. The spread of results is commonly understood to include three components:

- Variation from site to site
- Temporal variations due to changing traffic or meteorological conditions
- Random factors.

The last two are relatively minor and can be minimised by averaging over a range of conditions or limiting the range of conditions for which measurements are included in the analysis. For example, it is typical for traffic noise levels to be expressed in terms of averages over 15, 16 or 18 hours during the day and 8 or 9 hours at night. Noise measurements are conducted over several days, and the results averaged for days meeting certain criteria. Typically, days are eliminated from the analysis where traffic conditions are not normal, such as weekends or holidays, and where meteorological conditions are not good, such as days when it is too windy or raining.

What causes site-to-site variation?

Once we’ve reduced the influence of temporal and random factors by averaging, we’re left with site-to-site variation. The conventional wisdom is that site-to-site variation occurs because of limitations in:

- Building the model: for example, an old paling fence may provide some attenuation, but really, it’s better to neglect it. Maybe there’re reflections from the underside of a carport roof that can’t be modelled. There’s a limit to how much detail is worth including.
- The calculation method: there are many factors that influence the noise level at a receiver, and some of these are very difficult to model. For example, placing a noise barrier in the sound path not only introduces attenuation due to diffraction over the barrier, but it changes the angle and number of reflections of the sound bouncing off the ground, which changes the ground effect. Some methods are better than others at estimating these effects.

But what if you’re only interested in one location – a particular residential development, or a particular road project? Is the variation in the factors listed above more limited at one location than across a range of sites from all over the State or country? The short answer is: never assume it will be. But it seems likely, and so, on a project-by-project basis, we investigate the noise model accuracy.

Project-by-project calibration of traffic noise models

A project-based calibration of a traffic noise model is simply a small-scale validation study undertaken across one location, and the results used to adjust the noise model for that location. In other words, measure the existing noise levels at a number of positions, compare the measured noise levels with the modelled noise levels at the same positions and analyse the results to determine if an offset can be safely applied to the model for that location.

Note that ‘calibration’ can also mean adjusting the model inputs – such as traffic conditions, the road surface type, or the acoustic properties of the ground – to better align the model with the measurements. It’s good practice to review your inputs when the measured and modelled levels don’t align. But once you’re inputs are based on the best available knowledge concerning the physical state of things, any further adjustments would be fiddling with the inputs to achieve a desired output, which is equivalent to determining a decibel offset.

An approach to the calibration of road traffic noise models goes into considerable detail regarding how to undertake a validation study, particularly if the results are to be used to calibrate a calculation method. While this document is intended to be applied to large-scale studies, many of the principles can be applied to project-by-project calibrations of traffic noise models, particularly:

- Conduct measurements at enough positions to be able to quantify the variation across the location
- Understand the variables that affect the risk that the post-project measured noise levels will turn out to be higher than predicted.

It is now common practice on traffic noise barrier projects to conduct a location-specific validation study, and use the results to calibrate the noise model for that project. In the 27 years I’ve been doing traffic noise modelling, I’ve had two jobs where the post-completion measured noise levels exceeded the modelled levels. In one case it was due to a fault in the terrain data and in the other, we couldn’t find anything amiss. In both cases, the highest exceedance was 3dB. In neither case would the use of an uncalibrated model have completely eliminated the exceedance.

Findings from a survey across the industry

In March 2016 I invited representatives of road authorities and acoustic consulting firms to complete an online survey about their ideas, impressions and experiences with project-by-project calibration of traffic noise models. In the end, 31 people filled out the survey.
though not everyone filled out every question. 77% were acoustic consultants, and 23% were with road authorities. The respondents’ level of experience varied, with roughly 40% saying they’d had less than 10 years’ experience with traffic noise projects, 30% with 10-19 years, and 30% with 20 years or more.

A brief overview of some of the responses follows. A more detailed report may become available online, and there are hopes for a workshop at the upcoming Australasian Acoustical Societies’ Conference.

How often are models being calibrated?
Understandably, project-by-project calibrations are more frequent for projects where the road requiring noise mitigation already exists. The table below summarises the responses.

| How often would you calibrate? | Existing roads | New roads |
|-------------------------------|---------------|-----------|
| On every such project         | 41%           | 21%       |
| On most such projects         | 38%           | 25%       |
| About half                    | 10%           | 7%        |
| Rarely                        | 10%           | 29%       |
| Never                         | 0%            | 18%       |

Opinions on calibration for new road projects. Comments included:
- “If the road doesn’t exist yet, there isn’t really a basis for calibration.”
- If it’s a new road, use standard calibration factors such as “the universal calibration factor for Queensland conditions” or the adjustments outlined in Western Australia’s SPP 5.4
- Model existing roads near the proposed new road, particularly those that are included in the assessment, and derive calibration factors from those
- Model a similar existing road and derive calibration factors from that
- Calibration factors need to be more conservative on new road projects, as the factors are derived from other roads

Management of risk. The responses to various questions suggested consideration of the risk of non-compliance varied considerably. Some responses suggested the intent of calibration was to achieve compliance 50% of the time:
- “Average the results, apply the inverse value so average error = 0. (Could be described as ‘best fit correction’)”
- “Lots of averaging – no consideration of risk”

Rules-of-thumb appeared to be common:
- “If model underpredicts noise, bump up the road surface correction, if it over predicts by 1-2dB, leave it in as a safety factor, if it overpredicts by 3+ dB, tone it down after careful review of model and monitor, of course.”
- “Average at each site. Subtract one from the other. Use the lowest value. Once or twice have done statistical analysis, but got nowhere. Will sometimes fiddle the % soft ground to get a result that feels right (neither too conservative nor too risky).”

And yet others touched on risk explicitly. For example:
- “…where a State allows some error in post-construction monitoring (e.g. +/- 2) then normally no risk factor is included as long as the client is OK with this. Obviously some states with harder limits are different and need to add a standard deviation to it to manage risk.”

Experiences regarding outcomes using project-specific noise model calibration. Again, the comments reflected a diversity of opinion:
- “Waste of time.”
- “Generally good as long as the calibration process is appropriate…”
- “Average discrepancy generally within 2dB.”

- Found to be effective where there the validation study identifies issues with the model. “Otherwise it is detrimental.”
- “Mostly good.”

Sixteen participants answered the question “Have you had outcomes where the post-project measured noise levels have exceeded the targets?” Of these, 7 said they had. Confusingly, 16 people also answered the question “If yes, was the calibration a contributing factor?”, so it’s not clear what to make of the fact that 2 of the 16 said yes. My guess is that for 2 out of the 7 respondents who reported having experienced target exceedances, calibration was considered to be a factor.

Is calibration via a decibel offset warranted? Several respondents, particularly road authorities, suggested that the results of any project-based validation study should be used to investigate potential errors in the model or adjustments to the inputs such as the type of road surface, rather than to determine a decibel offset:
- “In most instances attempts made by consultants to ‘calibrate’ a road project is due to the small sample size and not due to issues in model calibration. The median error in the model is already statistically close to zero. Attempts to calibrate will make it worse.”
- “When higher discrepancies between modelling and measurements occur… [this] is usually a sign of issues other than calibration of the model that need to be investigated”
- “I have found that differences from modelling generally relate to micro features not included in the model such as garden fences, or an incorrect road surface assumption. In these cases I correct the model to more accurately represent the physical reality rather than ‘calibrate’ it.”
- “All adjustments should be dully substantiated with an insight on the reasons why an adjustment is considered necessary.”
- “I’m nervous about calibrating noise models due to the chance of adding measurement uncertainty to modelling uncertainty. I rather see it as a check in case something has gone wrong.”

What practices are you aware of in noise model calibration that warrant discussion? Some of the individual comments were:
- “The methods of calibration vary between consultancies. [The road authority] is the overseer of all the noise reports but makes no opinion known on which method it prefers (if any).”
- “The NSW method does not allow for any ‘calibration’ between noise indices. For example, Leq is always L10 -3dB, no matter what differences are measured on site.”
- “Why... the road agencies think it is a good idea to do in the first place!”

Conclusion
Clearly there is a variety of views concerning a range of matters associated with project-by-project calibration of noise models, including:
- Is there a need to calibrate at all?
- How should we design the validation study that the calibration would be based on?
- Is it better to use the results of the validation study as a check on the model rather than to determine a project-specific calibration factor?
- If we do calibrate, by how much do we adjust the model relative to the validation results?

At the time of writing, I am hoping to organise a workshop on this topic for the upcoming Second Australasian Acoustical Societies’ Conference in Brisbane in November. See you all then.

References
[1] Austroads 2002, An approach to the validation of road traffic noise models, (Publication No. AP-T14/02), Austroads Inc., Sydney
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**ACOUSTICS FORUM**

**CUMULATIVE LIFE-TIME NOISE EXPOSURE AND TINNITUS**

W Williams¹ and L Carter²

¹ National Acoustic Laboratories, Sydney
² The Hearing Cooperative Research Centre, Melbourne

**Introduction**

Over the last decade there has been increasing comment from health authorities [1] and the popular press [2] concerning a possible increase in hearing loss and hearing health difficulties amongst adolescents and young adults - related to excessive leisure noise exposure, in particular from personal listening devices, live concerts and dance clubs. With funding from the Australian Commonwealth Government, Office of Hearing Services, Department of Health and Ageing, the National Acoustic Laboratories examined this public health concern. A cross-sectional, population survey of 1,420 male (54%) and female (46%), 11 to 35 year old Australians was undertaken, examining current and past hearing health and estimating participant’s cumulative, life-time exposure to high level noise [3,4].

Ethics approval was provided by Australian Hearing Human Research Ethics committee and the NSW Department of Education and Training – Student Engagement and Program Evaluation Bureau.

**Outcomes**

Detailed statistical analysis could not establish any direct relationship between cumulative life-time noise-exposure and measured hearing threshold levels or otoacoustic emissions. However, when the median total noise exposure of participants in each tinnitus frequency-threshold levels or otoacoustic emissions. However, when the median total noise exposure of participants in each tinnitus frequency-experience group were compared, a positive relationship was evident. Median noise exposure for the group reporting constant tinnitus was higher compared with those who reported less frequent tinnitus. Table 1 summarises the overall findings:

| “Have you ever had tinnitus?” (i.e. “ringing” buzzing”, or other sounds in your ears”) | Number | Median total noise exposure (total energy) * (kPa²h) |
|---|---|---|
| Did not respond | 61 (out of 1420) | - |
| No | 530 (37%) | 0.49 |
| Yes (total number before breakdown) | 856 (63%) | - |
| • Yes, sometimes | 751 (55%) | 1.02 |
| • Yes, often | 69 (5%) | 1.52 |
| • Yes, all the time | 36 (3%) | 2.25 |

*Note: For detailed calculation of exposure see Williams, W, Carter, L, Seeto, M Pure-tone hearing thresholds and leisure noise: Is there a relationship? Noise & Health September – October 2015; 17: 358 – 363

Table 1: Experience of tinnitus in relation to cumulative life-time noise exposure

Direct comparison with other surveys of tinnitus experience is hampered by variation in specific questions asked among studies, and differences in the populations of interest, which may affect the way in which questions about tinnitus experience are interpreted and answered. However, where the current data were compared with studies that were reasonably similar in design, some consistencies in findings emerged.

The findings of the current study indicated that around 63% of the population 35 years and under reported experience of tinnitus. It is of concern that 8% of participants in this relatively young age group reported experience of tinnitus as ‘often’ or ‘always’. Frequent tinnitus can have significant negative impacts on quality of life and may herald development of other hearing problems later on.

Medical and hearing health professionals are constantly trying to raise community awareness of the risk of hearing loss due to excessive, long-term noise exposure. To do this successfully, health campaigns require a facilitator that acts as an action trigger at the individual level. That is, a tangible experience that allows the individual to understand that a risk applies to them and not simply to their general peer group. This is critical, as it has been shown that young people have a tendency to see themselves as less vulnerable than their peer group to the consequences of risky activities.

If health professionals are concerned about a patient’s exposure to possibly hazardous noise, discussing the individual’s experience of tinnitus symptoms may be a productive path for educating the individual and achieving improved preventative action in maintaining hearing health.

**References**

[1]  WHO (2015) Make Listening Safe, Department for Management of NCDs, Disability, Violence and Injury Prevention (NVI), World Health Organization, Geneva, available at http://www.who.int/pbd/deafness/activities/MLS_Brochure_English_lowres_for_web.pdf last accessed May 10th 2016

[2]  AFP (2016) Dementia, deafness and assault: The many problems of AC/DC http://www.hindustantimes.com/music/dementia-deafness-and-assault-ac-dc-isplagued-with-problems/story-fHzoTZWG5Gxf2ip43djyUN.html AFP New York last accessed March 26th, 2016

[3]  Carter, L (2011) Prevalence of hearing loss and its relationship to leisure sound exposure, report of a study carried out by the National Acoustic Laboratories through a grant provided by the Office of Hearing Services, Department of Health and Ageing, Canberra, available at https://www.google.com.au/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8&q=Carter%2C+L+%282011%29+Prevalence+of+hearing+loss+and+its+relationship+to+leisure+sound+exposure%2C last accessed March 22nd 2016

[4]  Williams, W (2011) Life-time profiles of sound exposure – what is a safe exposure? Final report prepared for the Office of Hearing Services, Department of Health and Ageing by the National Acoustic Laboratories, funded through the Hearing Loss Prevention Programme, available by searching http://www.hearingservices.gov.au
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BOOK REVIEWS

Environmental Methods for Transport Noise Reduction
Editors Mats E Nilsson, Jorgen Bengtsson, Ronny Klaeboe
CRC Press, Taylor and Francis, 2015. ISBN 978-0-415-67523-9

“Environmental Methods for Transport Noise Reduction” provides the main findings from a number of projects that comprised the European Union sponsored project on Holistic and Sustainable Abatement of Noise by optimized combinations of Natural and Artificial means with the resultant acronym as HOSANNA. The aim was to provide guidance for reducing road and rail noise with a combination of vegetation, soil and other recyclables with traditional measures.

Each of the ten chapters brought together in the book have been written by different groups of authors who have investigated different aspects of traffic noise reduction, between the road and the receiver buildings. The first chapter provides an introduction to traffic noise abatement and this forms the basis for the other chapters. Each chapter is essentially complete, so can be read in isolation. Chapter 2 on Innovative Barriers provides a wonderful resource of options for barriers that are not concrete walls. In the discussion of the various types of ‘barriers’, there is guidance on estimated performance and recommendations and the final section is a summary of conclusions.

Each of the chapters deals with the topics in a little different manner depending on the authors, but the content is presented in a similar clear and comprehensive manner. Chapters include discussions on performance of vegetation, trees, surface roughness, buried resonators and urban streets. One chapter discusses perceptual effects and the concluding chapter is an economic analysis.

The strengths of the book lie in its broad range of topics, which makes it valuable as a reference for acoustic consultants and road planners looking to achieve mitigation but in a different manner. It is a great achievement to produce a useful reference book like this to consolidate the findings, rather than reply on the outcomes of the project being a balance between research to achieving a solution to a real problem encountered by industry.

The first chapter explains the role of sound absorption for noise control and room acoustic design. This is followed by chapters explaining in detail the various means of absorption – passive, panel, microperforated and Helmholtz resonators. Then chapters deal with interference silencers and absorbers with active components followed by a discussion on integrating sound absorbers in the room. Having explained the concepts, a long chapter discusses sound absorbers in rooms and another describes them in test facilities. The final chapter deals with silencers in flow ducts.

The book is easy to read, well laid out and with a comprehensive index. With one author, the style remains the same through all the chapters, making it easy to dip into different parts. Photographs supplement the diagrams and clarify the applications being discussed in the text. Each chapter contains an extensive reference listing.

Overall this is an excellent reference book and recommended for the shelves of any office where there is a need for staff to understand the background concepts of the options for sound absorption, the methods for selecting and installing the more appropriate materials. It can be inspiring to see some of the examples of effective applications.

Marion Burgess

Marion Burgess is a Research Officer in the School of Engineering and Information Technology at the Canberra campus of the UNSW Australia.

Applied Acoustics: Concepts, Absorbers, and Silencers for Acoustical Comfort and Noise Control
Helmut V Fuchs
Springer, 2013. ISBN 978-3-642-29367-2

The sub title for this book “Alternative Solutions – Innovative Tools – Practical Examples” provides a clear hint that the book is not just a theoretical analysis but contains real examples of improving comfort and achieving noise control from the experience of the author. Hemut Fuchs has spent over 25 years working out ways to achieve the noise control requirements; not just finding the right absorber or silencer ‘off the shelf’ but thinking and analysing the problem deeply. This has been at the Fraunhofer Institute of Building Physics, which achieves the balance between research to achieving a solution to a real problem encountered by industry.

The book consists of five parts and 20 chapters. The first part is concerned with background information such as ideas, concepts and a historical overview about studies on vibrational communication. Chapter 1 is a general motivation chapter and sets the foundation for the coming four introductory chapters. It is well written and easy to understand for those readers new to the field. The second chapter then eludes on shared core concepts of vibrational communication in the framework of T. Kuhn’s Structure of Scientific Revolutions to place vibrational communication in the context of general animal communication. Chapter 3 represents an introductory historical excursion into the study of vibrational communication of Hemiptera to employ plant-borne or air-borne vibrations for their communication channel. The fourth chapter honours H. Strübing’s research on vibrational communication, in particular the mate selection in small Auchenorrhyncha. This laudation chapter is rather short: an...
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introduction for the fifth chapter on sound production and mate selection of the delphacid plant hopper Calligypona lugubrina.

Part II introduces important concepts and frontiers in vibrational communication. Chapter six highlights the connection and interdependency of acoustic and vibration signals and the necessity for more study on biomodal acoustic signals and their interactions. Examples of katydids, mole crickets, white-lipped frogs and African elephants are presented. Chapter 7 illustrates the role of vibrational communication networks in light of eavesdropping and the presence of biotic noise. The eighth chapter defines the active communication space and the role of the amplitude in plant-borne vibrational communication. Chapter nine then illustrates the importance of mutual behavioural adjustment in vibrational duetting during courting. The tenth chapter covers the high frequency filtering capabilities of stinkbugs and their ability to perceive signals in narrow band frequency windows. The authors highlight that by using narrow band frequency signals the signal-to-noise ratio is increased but that species-specific signals are difficult to evolve for the low frequency range. Part III covers practical and technical aspects important for conducting research in vibrational communication. The physical aspects in vibrational communication are reviewed in Chapter 11, with a focus on wave propagation, energy budget and animal sensing. The author explains in a technical section how to measure extremely fine structures using vibration testing equipment and discusses potential pitfalls. Particularly interesting is the discussion of wave propagation in soils and different substrates and whether animals in particular insects can make sense of different waveforms, which belong to different substrate materials. Chapter 12 discusses the effect of substrate heterogeneity and wave types of different substrate materials. The issues arising in playback experiments with living plants are reviewed in Chapter 13. While the techniques and methodologies applied are universally varied for other substrate material, it is highlighted that the signal itself changes through the measurement equipment and the characteristics of the substrate.

Part IV is dedicated to the ability of animals to detect vibrations and to these signals for orientation and localisation. Chapter 14 details the physiology; namely the functional morphology relative to evolutionary diversity of animals. In mechano-reception as an ancient communication modality, cells respond to mechanical stress by sending information to higher sensory centres; the role of structural and molecular adaptions is discussed in context with sensing sensitivity in insects. Chapter 15 reviews the capability of whirligig beetles to use surface waves, e.g. via echolocation or also static deformations of the water surface. However, experiments conducted were only strengthening the hypothesis that echolocation (perception of own reflected waves) plays a role, with more experiments being required. Ant lions are predators, which respond to vibrations in sand, a substrate material with great vibration attenuating properties. Ant lions rely on low frequency vibrations and waveform time differences to locate their prey using highly sensitive hair receptors for these signals, which are found on lateral parts of the meso- and meta-thorax. The fifth part covers the biology and evolution related to vibrational communication for some taxa, especially for bees. Chapter 17 reviews in particular the role of air-flow-induced vibration signals on foraging workers and communication between workers and the queen. Here, the discussion of bi-directionality of airflows caused by bees’ sounds is especially interesting, as is the difference to bees conducting the waggle dance, which causes the airflows to be unidirectional. Chapter 18 illuminates the functioning of pulsed thoracic vibrational communication in stingless bees. The importance of the temporal pattern and the signal occurrence correlates to the net gain of food per foraging trip. Depending on the transfer path, the signal of the thoracic pulses changes their meaning. The next chapter, 19, elaborates on the role of frequency on vibrational communication in Orthoptera. The
ability to detect low frequency vibrations is stressed and evolutionary pathways of the communication in crickets are discussed. The last chapter, 20, covers the evolution of the tympanal organ in arthropods, in particular that of Hemiptera and highlights the ability of plant hoppers and many other bugs to communicate over substrate-borne vibrations. These taxa are suggested to be named Tymbalia based on their unique capability to communicate.

Owing to the complexity of the topic the editors were well advised to concentrate their efforts on vibrational communication in arthropods, in particular insects. However, this focus is not clear from the title of the book. Also, the chapters are not ideally connected, owing to the complexity of the experimentation involved, the interdisciplinary nature of the research field as well as the number of different authors. Nevertheless, each chapter itself is a pleasure to read; with much experimental detail being provided and well-illustrated and described examples. The technical detail is superb, especially as illustrated in Part III and will provide many doctoral candidates or postdoctoral experimenters with useful hints. The importance of the role of the substrate and research associated with it is highlighted, as well as the necessity to develop innovative experimental approaches. Part IV is concerned with evolutionary aspects, physiology and the role and detail of sensing organs; from the book it appears that much work remains to be done especially in the area of electrophysiology, which is a bit under-represented. The book is easy to read with very few typographical mistakes. For postgraduate students, researchers and practicing bio-acousticians, who would like to learn about the actual mechanics of communication and the biology this book, will benefit with this comprehensive piece of work.

Sebastian Oberst
Sebastian Oberst has been a researcher at the UNSW Canberra investigating the vibroacoustic signals from termites

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**FUTURE CONFERENCES**

**IWRN12**
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12th International Workshop on Railway Noise (IWRN)
The Australian Acoustical Society warmly invites you to attend the 12th International Workshop on Rail Noise at Terrigal on the beautiful NSW Central Coast, 12th-16th September 2016. Since its inception in 1976, IWRN has become the premier conference on rail noise and this marks the first occasion it has been hosted in the Southern Hemisphere.

Registration is now open via the workshop website. The technical program includes around 100 papers with presentation and poster sessions spread over four days. Exhibition spaces are still available – please refer to the website if you are interested in showcasing your business at this premier event.

More information: http://iwrn12.acoustics.asn.au

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**Second Australasian Acoustical Societies’ Conference**
ACOUSTICS 2016 will be held on the 9th to 11th November 2016 at the Brisbane Convention and Exhibition Centre, which is located in South Bank, Brisbane.

Over 155 abstracts have been accepted for the Conference. Based upon the number of papers submitted for peer review to-date, a packed conference programme will be provided. The Technical Programme will commence Wednesday afternoon with the welcome plenary talk followed by a reception function. The Conference will have four plenary talks, six keynote talks and over a dozen invited talks as detailed on the Conference website. Several workshops are scheduled on a variety of topics throughout the technical programme to promote the exchange of expertise and ideas.

**Short Courses**
Three short courses will be run on Wednesday 9th November between 9:00am and 3:00pm. The topics covered by the short courses are:

- Classroom Acoustics - How Innovative Learning Environments are Changing the Educational Playing Field;
- Sound Perception - Application to Acoustic Practice and Design; and
- Noise Control Hints & Success.

These short courses represent a valuable opportunity for acoustic professionals to update and expand their skill set and should not be missed. Details regarding the learning objectives and content of the short courses can be found on the Conference website. The short courses represent great value and both delegates and non-delegates can attend.

**Technical Tours**
Places are filling for technical tours that will be held on the morning and early afternoon of Wednesday 9th November. Technical Tour 1 will consist of a short presentation in the Boulevard Auditorium...
followed by a walking tour of the South Bank precinct, while Technical Tour 2 will be a visit to the Centre for Hypersonics at The University of Queensland St Lucia Campus. Places for both of these tours are limited so to make sure you reserve your place it is recommended that you register for the Conference sooner rather than later.

Sponsors
The Organisers of ACOUSTICS 2016 would like to welcome Megasorber as the Diamond Sponsor of the Conference and CSR as the Platinum Sponsor. Gold Sponsors include Embelton, Ortech Industries, Autex and GIB. Bronze sponsors are Pyrotek and Kilargo. There are still several opportunities for Silver and Bronze Sponsorship of the Conference for any interested parties.

Trade Show
The Trade Show will occur on the Thursday and Friday of the Conference. All of the 35 available booths have been sold. To increase delegate interaction with the Trade Show exhibitors, delegates will have the opportunity to enter competitions and win prizes, with the major prize being an iPad provided by the Conference Organisers. The iPad will be drawn at the closing ceremony on Friday afternoon and the delegate will need to be present to win the prize.

Social Events and Activities
In addition to the welcome function a 3-course dinner will be held Thursday night at the Convention Centre. For people wanting to socialise with colleagues, friends and family outside of the Conference, South Bank contains one of the highest concentrations of restaurants and bars in Brisbane.

South Bank contains some of the most popular tourist attractions in Brisbane. Within 5-minutes’ walk of the Brisbane Convention and Exhibition Centre are the South Bank Parklands, the Queensland Museum, Queensland Art Gallery, Queensland Performing Arts Centre, ABC Brisbane Studio, the State Library and the Gallery of Modern Art. Overseas and interstate visitors might also want to consider extending their stay to visit one of the nearby beaches, the food bowl of the Scenic Rim, theme parks at the Gold Coast or the beaches in the hinterland of the Sunshine Coast before or after the Conference.

More information: www.acoustics2016.com.au

ICA 2016
ICA 2016 has the theme Acoustics for the 21st Century. The International Congress on Acoustics provides the opportunity once every three years for all those around the world who are working in all areas of Acoustics to meet, discuss and exchange ideas. The 22nd International Congress on Acoustics will be held in Buenos Aires, Argentina, on September 5-9, 2016.

ICA 2016 is organised by the Ibero-american Federation of Acoustics (FIA) and the Argentinian Acousticians Association (AdAA), in cooperation with the Chilean Acoustics Society (SOCHA), under the endorsement of the International Commission for Acoustics (ICA).

The plenary lecturers include Michael Vorländer, Samir Gerges’, Barbara Shinn-Cunningham, Chen-Fen Huang and Frank Russo’

As well as the technical program of contributed papers there will be an extensive technical exhibition highlighting the latest advances in acoustical product and a vibrant social program.

The International Symposium on Music and Room Acoustics will be held September 12-14, in the nearby city of La Plata

More information: http://ica2016.org.ar/

ICBEN 2017
The 12th ICBEN congress on Noise as a Public Health Problem will be held June 18-22, 2017 in Zurich, Switzerland. The congress will take place on the campus of ETH Zurich (the Swiss Federal Institute of Technology) in the very heart of the city.

ICBEN 2017 welcomes contributions from the following fields: Noise-induced hearing loss, Noise and communication, Non-auditory health effects of noise, Effects of noise on cognition, perception and behavior, Effects of noise on sleep, Community response to noise and noise annoyance, Noise policy and economics, Noise exposure assessment in health effect studies and Special topics related to noise effects.

The congress is organized under the auspices of ICBEN, by the Swiss Acoustical Society (SGA-SSA), in collaboration with the Federal Office for the Environment (FOEN), the Swiss Federal Laboratories for Materials Science and Technology (Empa), and the Swiss Tropical and Public Health Institute (Swiss TPH).

More information: http://icben2017.org

WTN2017
The seventh conference of the series will be held on May 2-5, 2017 in Rotterdam, in collaboration with TU Delft and supported by NAG (The Acoustical Society of the Netherlands) and NSG (The Dutch Noise Abatement Society). The call for papers has been issued and abstracts can be submitted any time before 25th November 2016.

More information: https://www.windturbinenoise.eu/content/conferences/1-wind-turbine-noise-2017/

ICSV24
The 24th International Congress on Sound and Vibration (ICSV24) is to be held in London from 23 – 27 July 2017. The Congress is organised by the International Institute of Acoustics and Vibration (IIAV) and the UK’s Institute of Acoustics. This congress is a leading event in the area of acoustics and vibration and provides an important opportunity for scientists and engineers to exchange ideas and research in these fields. The congress will feature high-level technical papers from across the world and plenary lecturers will present recent developments about future trends.

More information: http://www.icsv24.org/
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| ASSOCIATION OF AUSTRALIAN ACOUSTICAL CONSULTANTS |
| www.aaac.org.au     |
| BORAL PLASTERBOARD  |
| www.boral.com.au/plasterboard |
| BRUEL & KJAER AUSTRALIA |
| www.bksv.com.au     |
| C-MAC INDUSTRIES (AUST) Pty Ltd |
| www.cmac.com.au     |
| CSR BRADFORD INSULATION |
| www.bradfordinsulation.com.au |
| EMBELTON            |
| www.vibrationisolation.com.au |
| HOWDEN AUSTRALIA    |
| www.howden.com      |
| IAC ACOUSTICS (AUSTRALIA) |
| www.iac-acoustics.com/au/ |
| INSTYLE CONTRACT TEXTILES |
| www.instyle.com.au  |
| JACOBS              |
| www.jacobs.com      |
| KNAUF AMF AUSTRALIA PTY. LTD. |
| www.amfceilings.com.au |
| MASON MERCER AUSTRALIA |
| www.masonmercer.com.au |
| NSW ENVIRONMENT PROTECTION AUTHORITY |
| www.epa.nsw.gov.au  |
| PYROTEK NOISE CONTROL |
| www.pyroteknkc.com  |
| REGUPOL (AUSTRALIA) PTY LTD |
| www.regupol.com.au  |
| SOUNDSCIENCE        |
| www.soundscience.com.au |
| THE P.A. PEOPLE PTY LTD |
| www.papeople.com.au  |
| VIPAC ENGINEERS AND SCIENTISTS |
| www.vipac.com.au    |
DIARY

2016

5 - 9 September, Buenos Aires, Argentina
22nd International Congress on Acoustics (ICA 2016)
http://www.ica2016.org.ar/

12 - 14 September, La Plata, Argentina
International Symposium On Music And Room Acoustics
http://www.ica2016.org.ar/

12 - 16 September, Terrigal, NSW, Australia
12th International Workshop on Rail Noise (IWRN)
http://iwrn12.acoustics.asn.au/

19 - 21 September, Leuven, Belgium
ISMA2016 Noise and Vibration Engineering Conference
USD2016 Uncertainty in Structural Dynamics
www.isma-isaac.be

9 - 11 November, Brisbane, Australia
2nd Australasian Acoustical Societies Conference
www.acoustics2016.com.au

28 November - 2 December, Honolulu, USA
172nd Meeting of the Acoustical Society of America joint with the Acoustical Society of Japan
http://www.acousticsociety.org

2017

2 - 5 May, Rotterdam, Netherlands
Wind Turbine Noise 2017
www.winturbine-noise.eu

18-22 June, Zurich, Switzerland
12th ICBEN congress on Noise as a Public Health Problem
http://icben2017.org

25 - 29 June, Boston, USA
Acoustics 2017
Joint meeting of the Acoustical Society of America and the European Acoustics Association – Forum Acusticum
http://www.acousticsociety.org

23 - 27 July, London, UK
24th International Congress on Sound and Vibration (ICSV24)
www.iscv24.org

27 - 30 August, Hong Kong
Inter-Noise 2017
http://www.internoise2017.org/

18 - 20 December, Honolulu, Hawaii
International Congress on Ultrasonics (ICU 2017)
http://www.icultrasonics.org/

2018

27 - 31 May, Heraklion, Crete, Greece
EURONOISE 2018
https://euracoustics.org/

26 - 29 August, Chicago, USA
INTER-NOISE 2018
www.i-ince.org

2019

8 - 13 September, Aachen, Germany
23rd International Congress on Acoustics (ICA 2019)
mvo@akustik.rwth-aachen.de

Meeting dates can change so please ensure you check the conference website: http://www.icacommission.org/calendar.html

Acoustics 2016

9-11 November
Brisbane, Australia

FULL TECHNICAL PROGRAMME
PLENARY, KEYNOTE & INVITED SPEAKERS
SHORT COURSES
TECHNICAL TOURS
WORKSHOPS
SOLD OUT TRADE SHOW

See www.acoustics2016.com.au for details and to register