SALFORD OFFERS SOUND ADVICE FOR MCRMA

As noise and its control becomes an increasingly important aspect of building design, the Metal Cladding and Roofing Manufacturers Association (MCRMA) is funding more original research into sound insulation prediction at the University of Salford's Acoustics Research Centre. The partnership with Salford was formed in 1992 when, with the help of Government and MCRMA funding, Professor Yiu Lam developed a new method of predicting sound insulation which was specifically adapted for profiled metal cladding constructions. At that time there were no commercial software packages for predicting sound insulation performance so the computer tool developed by Lam put MCRMA members ahead of the game. Lam's model proved so successful that MCRMA members are still widely benefitting from the software 20 years later.

Salford's third generation Acoustic Laboratories provide a UKAS-accredited test house for industry as well as being home to world class research.

Things have moved on since the 1990s; today's cladding specifications require far more complex structures with multiple layers of insulation, intermediate layers and other features which present particular challenges for acoustic modelling. Customer specifications for acoustic performance have become more demanding and the MCRMA decided that the time was right for a major upgrade of the tool.

Salford was the obvious place to come - the Acoustics Research Centre is home to one of the largest acoustics research groups and Salford's Acoustics Laboratories have over 40 years' experience of testing sound insulation for industry. The labs, which were completely rebuilt in 2005, provide one of the most comprehensive worldwide acoustic test services offering, amongst other things, UKAS accredited sound insulation testing. This real world experience provides the perfect complement to state of the art research capability.

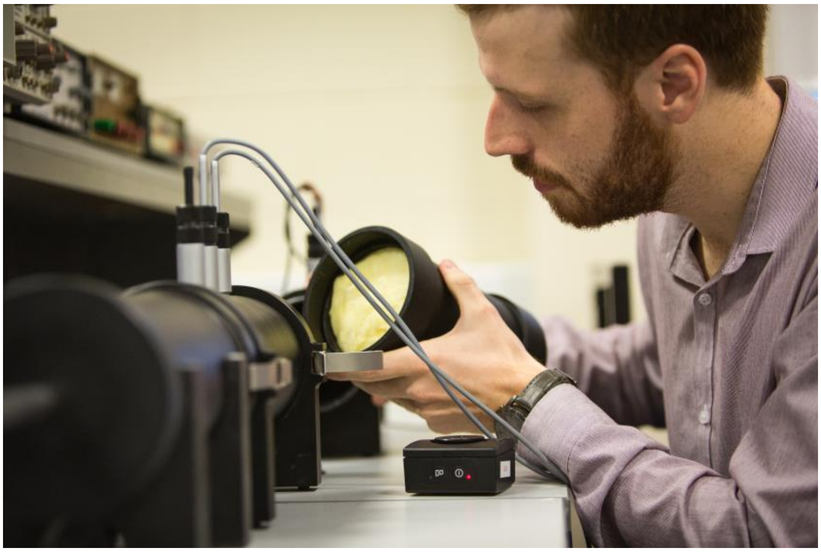
The Salford team, James Massaglia, acoustics graduate; Dr Andy Elliott; specialist in structural acoustics and Professor Andy Moorhouse, project lead recognised the serious challenges posed by modern cladding constructions. The Salford team advised that Lam's approach, which is similar to that used in the most popular commercial sound insulation prediction packages, would become increasingly inaccurate as the complexity of the constructions increased.

They recommended an initial feasibility study before attempting to upgrade Lam's 1990s model. A review of the technical literature revealed that, whilst building constructions had developed beyond recognition in the preceding two decades there had also been significant advances in acoustic theory over this period.

The group determined that a new theoretical approach, the Transfer Matrix method, could potentially be adapted to predict sound insulation performance of cladding structures. Unlike previous theory, which was largely based on test results and which was limited to two main layers, the new theory would allow an unlimited number of layers to be built up without relying on unrealistic assumptions.

Informed by the feasibility study, the consortium decided to try out a new implementation of the Transfer Matrix method with a special adaption for profiled metal sheets. Over the next 12 months the Salford team carefully built up the software routines, checking the predictions at every stage by comparing with actual test results from literature, from the Salford labs and those provided by MCRMA members.

The simplest single skin structures were initially checked; followed by recognised double skin constructions for example, double glazing and plasterboard stud. Only when the results were correct would the next level of complication be attempted.



PhD student James Massaglia prepares a sample of fibre glass for testing - the acoustic properties will go into a data base within the sound insulation prediction tool

Profiled metal inner and outer skins were added and the routine for adding insulation into the cavity was checked. Along the way James Massaglia discovered that assumptions made by previous generations of researchers about the range of angles at which sound is incidence on a specimen in a test lab were not accurate. An improved assumption led to much improved prediction accuracy.

By luck, a new theory for sound transmission through plates connected at periodically spaced points – like the spacers in a roofing system – had been developed independently at Salford. Massaglia was able to implement this theory so as to complement the Transfer Matrix Theory. The result is a powerful theoretical framework capable of handling cladding constructions of far greater complexity than had previously been possible.

This new framework can predict sound insulation performance for double and triple layer~~s~~ constructions with any number of layers of thermal insulation in between. It can also handle composites and point connected structures. Comparison with laboratory test results proves that the theory works better than any previous theory and it has the added advantage that it can be extended to predict other acoustic parameters like absorption coefficient and even, potentially, rain noise.

Phase 3 of the project will see some of this additional functionality developed and custom features will be introduced to the software, for example, allowing users to input the stiffness for their own fasteners and connections. This kind of customisation will really allow the tool to be exploited as a design tool, allowing the user to conduct ‘what if’ design changes without the expense of having to conduct a full scale test until final certification.

Salford's anechoic chamber is so quiet that no currently available microphone is capable of recording the background noise level.

Salford is at the forefront of acoustic research and this work has ensured that MCRMA member companies can advise on the suitability and performance of materials, systems and assemblies to provide the required acoustic performance for any given application and members' details can be found at www.mcrma.co.uk

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This article was written by Andy Moorhouse, professor of engineering acoustics and vibration, University of Salford on behalf of MCRMA

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