CASE STUDY: VIBRATION SERVICEABILITY RESEARCH

A roadmap to develop an international strategy for vibration serviceability research

IfM ECS helped a group of world experts tackle structural vibration as a ‘global challenge’ using its Roadmapping techniques.

Structural vibration is becoming a growing challenge in today’s world. It was 16 years ago that the ‘wobbly’ Millennium Bridge in London, a steel suspension footbridge, was closed on the same day it was opened, due to the unexpected swaying motion caused by high foot traffic. This brought the field of Vibration Serviceability (VS) from obscurity into the limelight. With structural materials becoming stronger and structures lighter, they also become more susceptible to internal movement, wind, over- and under-ground traffic and people walking, running or jumping.

The UK has always been at the forefront of civil structural vibration serviceability research, with the University of Exeter offering a world-renowned centre of excellence, featuring state-of-the-art technology. Its Vibration Engineering Section (VES) research team, led by Professor Aleksandar Pavic, decided it was time to form a new alliance for international collaboration - both to develop a strategy to manage worldwide research effort and to convince national and international funding bodies, government, industry and other organisations that structural vibration is one of the unsolved socio-technological ‘grand challenges’ facing humanity. The group’s ambitions were also to establish an International Vibration Serviceability Institute and to launch a new peer-reviewed international journal for the specialty.

Roadmapping Process

The University of Exeter team, led by Professor Pavic, asked IfM Education and Consultancy Services (IfM ECS) to help them organise a gathering of industrialists and academics from all over the world - 29 international stakeholders from the UK, USA, Canada, Brazil, Australia, Belgium, Switzerland and Germany took part in the two-day event.

The workshop’s objective was to establish a mutual understanding amongst industrial partners, academics and professional bodies concerning the research priorities for improved structural vibration serviceability up to 2030. Landscaping, portfolio management and Roadmapping methodologies were used to identify the key challenges and the potential benefits arising from their resolution. These methodologies are based on extensive research carried out at the University of Cambridge’s Institute for Manufacturing (IfM). IfM Roadmapping techniques were also used to create a plan to get from the current situation to the solution, around which research and delivery partnerships might be established.

Six topic areas were explored:

- Software and modelling
- Damping inherent in the structure
- Human interaction with built environment
- Vibration serviceability community building
- Addition of damping
- Measurement technologies and services

Each topic was discussed in depth to create a plan for the short term (up to 2020) and medium term (2021-2030) as well as a vision for the future, post-2030.

Michael Wesolowsky, Vice President of Swallow Acoustics, Noise and Vibration Control, who travelled from Canada to attend the workshop, said: “I am encouraged to see, for the first time in my experience, an almost equal representation of industrialists and academics. I hope this will be a basis for bridging the gap that has existed for quite some time between theory and reality, between laboratory experiments and practical application in the real world.”
Outcome

The group of structural vibration experts agreed on a strategy for addressing the challenge over the next 15 years, formulated through a formal ideas solicitation process designed by IfM ECS. Research into human interaction with vibration in the built environment was unanimously voted to be the most important and pressing priority for both industry and academia, closely followed by software and modelling, which was high on the agenda of industrialists in particular.

Planned outcomes included:

- Achieving a healthy productive environment with reduced whole life cost by 2025 with reasonably-priced smart buildings monitoring and by modifying the buildings’ dynamic performance
- Creation of an open source platform for VS analysis and design by 2020, with the view to create a software suite in the future
- Creation of a damping estimator tool and establishment of a large-scale monitoring and testing programme
- Launch of a Vibration Serviceability Institute with a view to providing best practice and training as well as having a lobbying function
- Development of technologies to build intelligent structures which can continuously monitor and update dynamic performance

Professor Pavic said: “I am delighted that participants from all over the world were so keen to be involved with this and with us in Exeter, which highlights the importance of addressing the issue. We are really looking forward to continuing to work together, to ensure these issues are addressed across the world over the next 15 years.”

Supporting the commercialisation of research

IfM ECS specialises in helping universities understand which of their research streams have both academic and industrial relevance. Using business tools and processes developed at IfM, such as roadmapping techniques, IfM ECS has designed three types of workshops which help universities and industry develop fruitful collaborations and support the successful commercialisation of research.

The one-day workshops have been designed to bring experts together to share their knowledge and insights and build consensus around a plan of action. These are aimed at:

- helping universities understand which of their research streams have both academic and industrial relevance;
- helping a company solve a particular industrial problem with the help of academics;
- identifying commercial applications

Andrew Gill, Principal Industrial Fellow at IfM ECS, who facilitated the workshop, said: “It was a highly successful exercise and it’s great that the Institute for Manufacturing was able to collaborate with the University of Exeter on this important project. Roadmapping is a really powerful way of bringing together different stakeholders to develop strategy. We were able to convene and draw on the knowledge of civil and structural engineers as well as other researchers with different areas of expertise from all over the world.”