Nor848A Acoustic camera

Filming Sound Leakages in Highly Reflective Office Environment

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Measurements in office complex Lier, Norway, April 2016

Problem

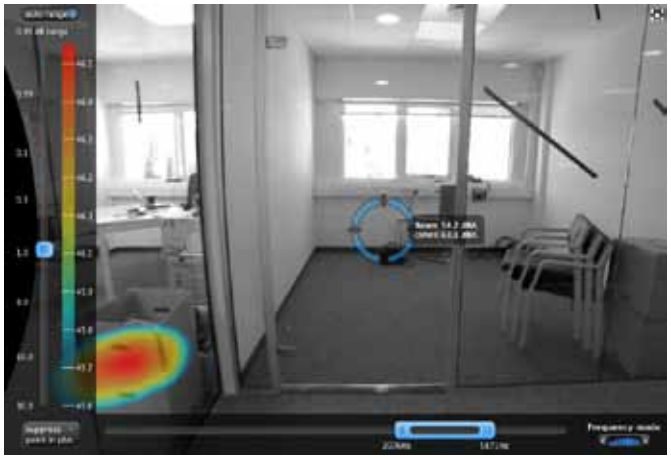
A newly built office complex is designed with glass facades between the offices and the hallway. The glass facades include a glass door. Although the glass structures themselves have a sufficient sound reduction value, the sound insulation between office and hallway was measured at 19 dB, which was far below the sound insulation criteria for offices given in the regulations. It was therefore important to find out where any weaknesses were introduced in the overall structure.

Measurements

A common way to detect cracks and gaps in barriers is by placing an omnidirectional loudspeaker emitting white noise in the sending room, and use the acoustic camera in the receiving room pointing at the structure of interest. For this situation the Norsonic Nor848A-10 1.0m acoustic camera with 256 microphones was placed on the outside of the glass facade filming directly at it. Gaps and cracks in the structure should then be detectable by being visualised as small noise sources in the structure.

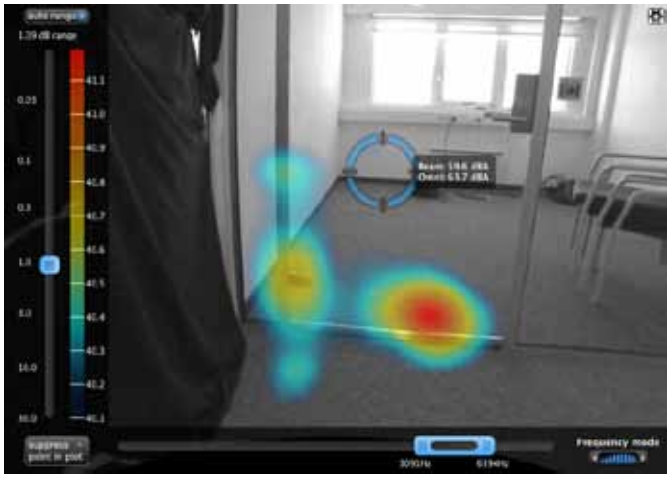
Results

The first results from the initial recordings proved disappointing. Although it was possible to hear clear differences by using the virtual microphone, which enables the user to listen to specific points in the image, the coloring of sources was only seen on a glass facade standing perpendicular to the wall of interest, as seen on



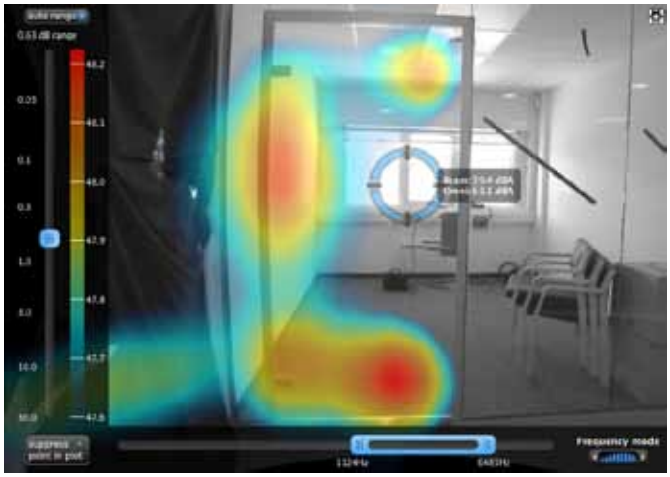
the left side in the image above. Clearly this was a strong acoustic reflection and not the main source itself.

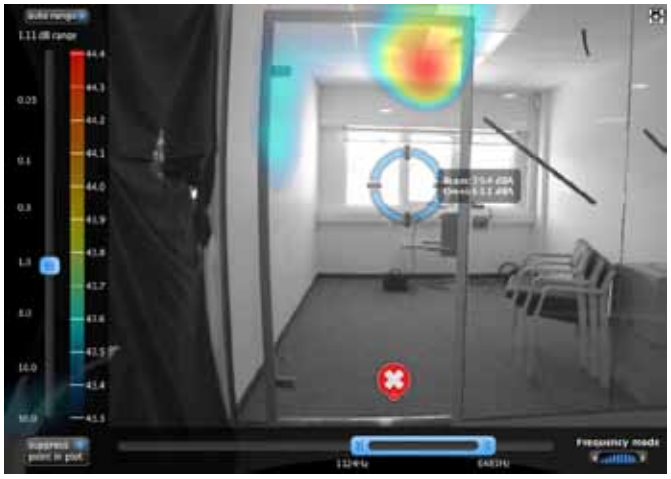
Since the recording environment was highly reflective, a good approach was to try to dampen the influence from surronding structures. By using a piece of cloth to cover parts of the reflective wall, the acoustic reflection was absorbed enough so that the sources of interest could be visualised as seen in the image below. Now various weak points in connection with the door frame became apparent. Sources were seen between the door and the floor, and



especially around one of the door hinges. By studying the hinge in detail, one could easily see how the rubber seals weren't completely sealed off around the hinge, but left a small gap as seen in the image below. This gap allowed noise to leak through.

In addition to the main weaknesses being the door hinge and the seal between the door and the floor, also the top right corner of the door wasn't closed tightly enough, so that noise leaked through here as well. This weakness could be clearly heard with the virtual microphone. Since it was weaker than the two main sources, it was better visualised in the image by using the acoustic eraser to try to remove the main sources from the visualisation as seen in the images below.





By closer inspection one could see how the rubber strip around the door edge wasn't completely sealed shut in this position as seen from the image below.

Nor848A Acoustic camera

The Norsonic Nor848A acoustic cameras sets a new standard for acoustical cameras. The large number of microphones eliminates the problems of ghost-spots, compared to traditional acoustical cameras where the relatively low number of microphones increases the side lobe effect, resulting in the so called ghost- spot effect: You "measure" a non-existing source.

The Nor848A software is extremely intuitive and easy to use. Just after a few minutes of training, the user is able to operate the system and do real measurements. Three camera frontends are available, all varying in number of microphone sensors and size, where a larger array size ensures better resolution for lower frequencies: A 0.4 meter array holding 128 microphones, a 1.0 meter array holding 256 microphones and a 1.6 meter array with 384 microphones.

The digital microphone elements are protected behind a disc-shaped carbon fibre enclosure, and a dust and water repellent mesh is protecting the microphones from dust and moisture. The robust and sturdy construction also ensures that all microphones are kept in the correct position – important for field applications. The small distance between the microphones in the inner circle is important for low spatial aliasing at higher frequencies. The large number of microphones also contributes to the wide measurement range and the low self-noise. The signal in the selected direction is based on the weighted average of all microphones and is therefore far below the self-noise from a single microphone.

The system enables the user to perform noise analysis with a clear view of where the different noise sources are located in real time. The system is ready to measure in just a few minutes after entering the site. By moving the cursor in the picture you may analyze and listen to the sound in the selected directions while doing the measurements. This enables the user to identify the problem, whether it is an annoying sound, a leakage or other difficult noise problems in just a fraction of time compared to traditional methods.

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