Nor848A Acoustic camera

Measuring Impact of Traffic Noise in Apartment Living Room

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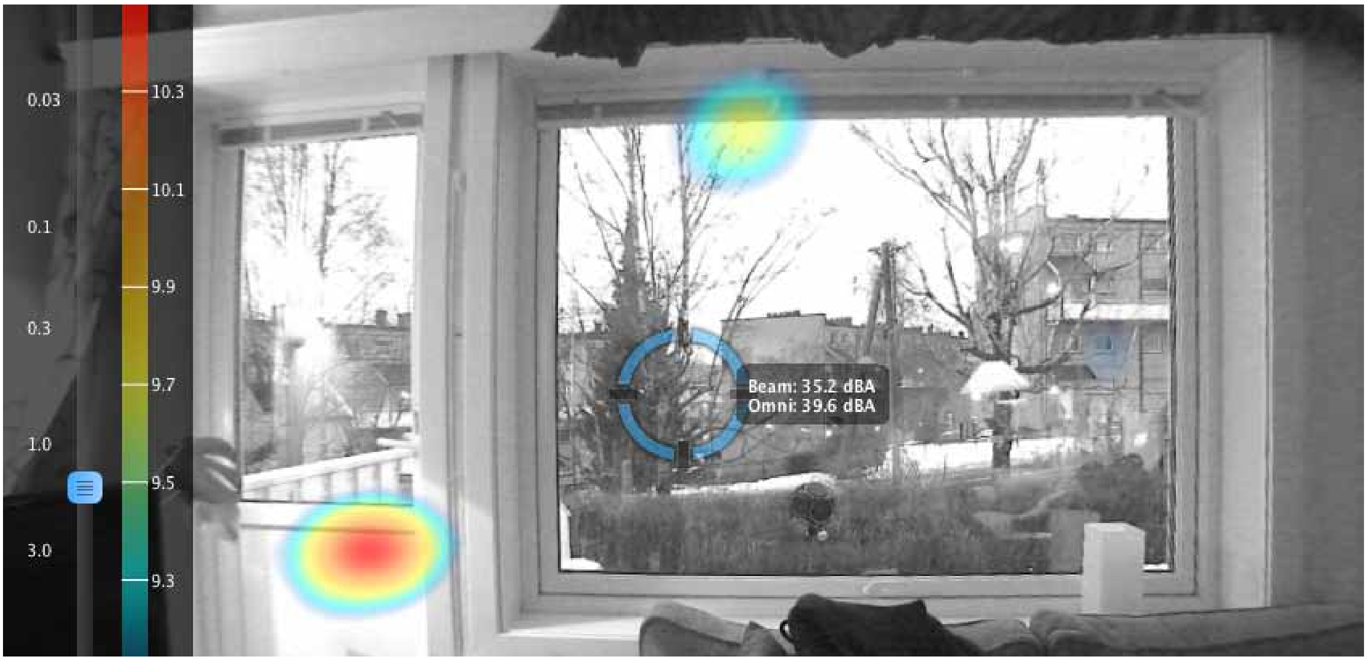

Measurements in apartment Oslo, Norway, February 2016

Problem

An apartment on the ground floor of a two story house in the city lies close to a busy road. The living room in the apartment is facing the road, and the inhabitants are bothered by traffic noise, especially in the morning and the afternoon, when the traffic is the heaviest.

Traffic noise could be clearly heard when standing in the living room. The facade facing the city street consists of a large window and a porch door. It was thought that the main contribution of noise came from these two parts, but it was difficult to verify if those assumptions were true, or exactly where any weaknesses in the structure might be located.

Measurements

The Norsonic Nor848A-10 1.0m acoustic camera with 256 microphones was used for the recordings. The camera was placed inside the living room pointing at the facade facing the street. The living room would hence act as the receiving room, and the outside as the sending room, much in the same sense as the procedure for sound insulation measurements. Weaknesses in the facade would then be possible to be seen as small noise sources in the structure. It was possible to use regular traffic as sound source, regardless whether the traffic was steady, or just a single vehicle from time to time.

In addition to using traffic as noise source, measurements were made by placing a omnidirectional loudspeaker emitting white noise on the outside of the facade. This created a more stationary sound field on the outside of the structure, and made detection of small cracks and gaps in the structure even easier.

Results

Initial recordings when using traffic as noise source displayed a single strongest facade weakness at the top left of the living room wall. This strongest source position was also confirmed when using the omnidirectional loudspeaker as noise source as seen from the images below, where the top image is traffic as noise source, and the bottom image is with noise from the loudspeaker. At this position a ventilation valve was installed, and most of the traffic noise came from this location.

Having determined that the intake valve was the main noise contributor, this spot was covered up with a pillow to remove it from the overall noise field, and try to locate secondary sources. By filtering on a relatively high frequency band around 3 - 4 kHz, it was possible to filter out only the noise being emitted by small gaps and cracks. This produced two new possible weaknesses, one on the porch door, and another on the air valve above the window as seen in the image below.

The next step was to look at those positions in more detail. The acoustic camera was then moved, first to cover the porch door, and secondly to look only at the large living room window. Again the frequency filtering stayed at the approximate same frequency limits. By looking at the coloring, and also listening to the points with the virtual microphone that enables the user to listen to sounds emitted from a single position, these two new noise positions were confirmed as seen from the two images below.

This same procedure with omnidirectional loudspeaker on the outside of the facade emitting white noise, and the acoustic camera on the inside filming an area of interest, could be used on other walls and windows as well. As seen below on a different window and wall, again the main source contribution is visualized as being the air valve above the window.

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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