Freefield Measurement

The Acoustic Camera for Environmental Noise Analysis at Glass Collection Points

CHALLENGE

The collection and disposal of waste and recyclable raw materials is a necessary part of daily life. Nevertheless, it can have adverse effects such as bad odors or unpleasant noise pollution. In terms of noise pollution, glass collection containers are particularly annoying. In fact, the disposal of these containers can result in noise emissions with levels of up to 105 dB(A) which are harmful to health. To efficienly reduce the noise pollution, the major sound sources during the emptying of the glass containers needed to be identified.

SOLUTION

The Acoustic Camera is used in research and development to determine the sound propagation paths of sound sources to the sound emmission locations. This can be extremely valuable for the development of noise mitigation measures. In this application, we investigated the noise emission of the emptying of a glass container into a waste disposal vehicle of Berlin Recycling GmbH.

BENEFITS

- Fast and easy
- No interruption of operations
- Not affected by background noise
- Quick result generation

MEASUREMENT

Measurement object	Disposal vehicle during the emptying of a waste glass container
Microphone array	Star48 AC Pro
Additional equipment	Sound level meter Class 1 measurement microphone
Software NoiseImage 4	Acoustic Photo 2D Recorder Interface Advanced Algorithms
Data acquisition	Data recorder mcdRec

The measurements were performed in a quiet environment with a Star48 AC Pro array, an additional Class 1 measurement microphone and a sound level meter. The measurement microphone and the sound level meter were used to record the sound pressure level curve $L_{AF}(t)$. The distance between the array and the truck was 8 m. The containers were 100 % filled before the emptying process.

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RESULTS

During the measurement a maximum level L_{AFmax} of greater than 95 dB(A) was measured. The averaging level of the emptying process L_{Aeq} was 80.5 dB(A). The complete level curve is shown in Figure 1.

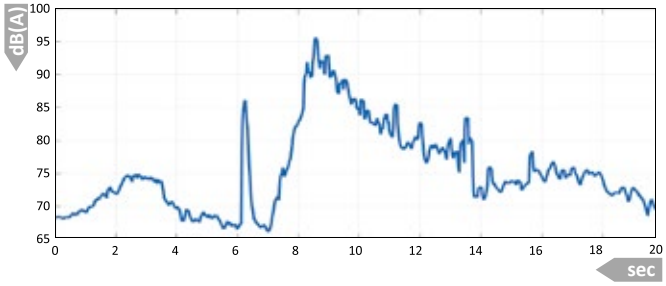

Fig. 1: $L_{AF}(t)$ of the emptying process:
- First steep peak at 6 s: setting the glass container of the bottles in the truck
- Second rise from 7 s: start of the emptying process

The results of the Acoustic Camera in Figure 2 show that, as expected, most of the sound comes from the open ceiling of the truck's collection container (source 1). In addition, a significant sound emission on the wall (source 2) as well as a reflection on the road can be observed (source 3).

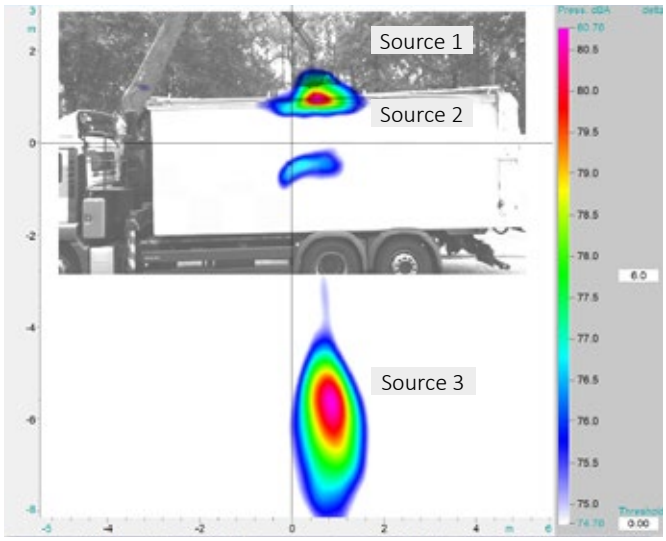

Fig. 2: Acoustic photo of the emptying process.

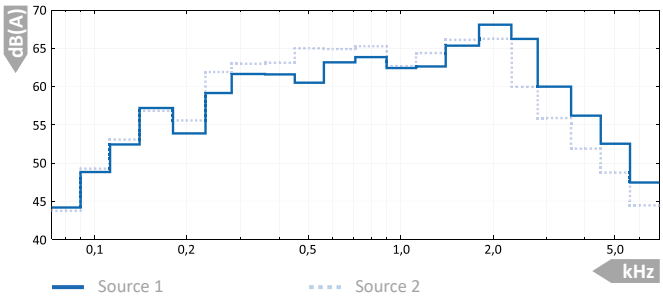

Fig. 3: Third octave spectra of the sources extracted from the Acoustic Photo

The comparison of the third-octave spectra in Figure 3 shows that sound source 1 is dominant above 2 kHz, while the sound emission of the vessel wall (source 2) has significant frequency components between 200 Hz and 1 kHz. These are primarily due to the impact of the bottles against the container wall.

Possible mitigation measures: The sound emission from source 1 could be minimized by noise barriers. This could be achieved, for example, by a folding (or extendable) partial roofing of the container, which is folded up (or extended) during the emptying process (Figure 4). The higher the wall between the sound generating mechanism (in this case, the clanging bottles) the higher the level reduction that can be achieved. Soft materials should be used on the inside of the container wall to soften the impact energy of the bottles. If this is already the case, the use of the materials used should be reconsidered.

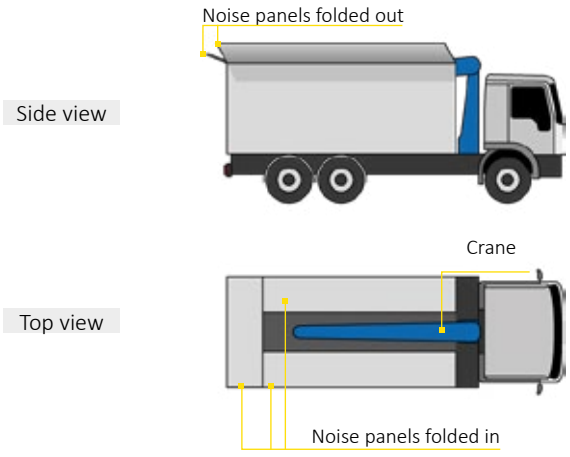

Fig. 4: Folded noise panel for noise reduction

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