



Technical report:
AGAT - Aviation Grade Artificial Turf

April 16 2019

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Measurement and assessment of the sound attenuation effect using Aviation Grade Artificial Turf – AGAT.

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Customer:

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Test location: EKMD - Helipad, Månedalen 3.



Photo: Evergreen Aviation

On April 11, 2019, at the request of Special Projects Liaison Mads Lauritzen from Evergreen Aviation ApS, BitschAkustik has taken measurements of the sound attenuation effect of AGAT in comparison to traditional groundcover such as asphalt or concrete.

The purpose of the measurements is to investigate whether and, if so, to what extent AGAT may reduce noise level to the surroundings, when used as groundcover. Typically, AGAT is laid out at heliports, thereby reducing noise during takeoff and landing, on aprons during engine testing and in the general area while taxiing from gates and hangars to the runway.

In Denmark and abroad, AGAT has proven its excellent properties in terms of wearability, flexibility in applications, minimal or no maintenance as well as being environment neutral. However, the noise advantage has not previously been documented objectively.

Summary:

The purpose of this report is to document, how large a sound reduction can be obtained when sound propagates over a larger distance covered with Aviation Grade Artificial Turf, AGAT.

Does artificial grass (AGAT) have the equivalent effect as that of a natural organic sward?

Figure 1 below compares the impact of Hard Ground, Mixed Ground and Porous Ground on the resulting sound pressure level. The figure shows that it would be possible in a large frequency range to reduce the noise level by minimum 3 dB. In the figure, the distance between source and receiver is 100 meters and the height above ground is 2 meters.

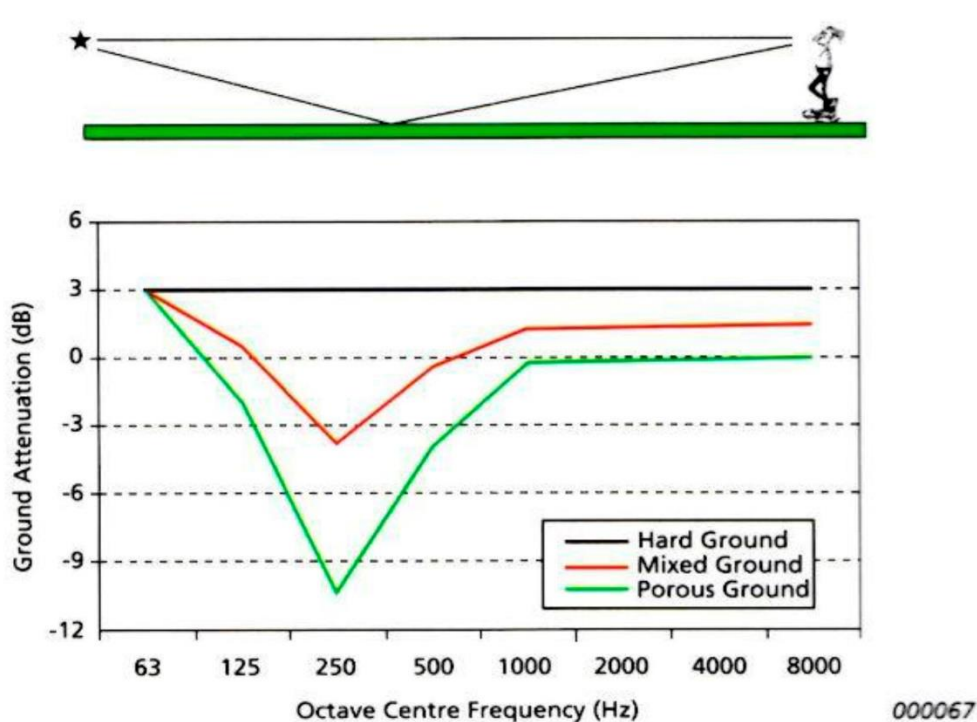


Figure1, Source: Brüel & Kjær

In the experiment that underlies this report we have used an omnidirectional loudspeaker placed 2 meters above ground as sound source. We have conducted measurements on two different groundcovers: P001 has AGAT laid out and P002 has plastic driving plates laid out - see pictures below. In both scenarios we have taken the measurements at 4 points 0, 90, 180 & 270 degrees, with a distance of 5 meters to the sound source and the microphone at the height of 1.5 meters. As you can see in Table 1, on page 4, the noise level on the AGAT is 0.6 dB (A) lower than that of the plastic driving plates.

Measurement P001: AGAT



Measurement P002 : Plastic Driving Plates



The difference of 0.6 dB as measured in our experiment corresponds very well to what is expected, Figure 1 on page 2, as plastic driving plates are acoustically not quite as hard as concrete. It is expected in a comparison with concrete or asphalt and with a greater distance than the 5 meters, that AGAT will show a 3 dB difference corresponding to Figure 1.

Subjectively, a step of 3 dB is audible to most people. In theory, a difference of 3 dB in sound pressure level corresponds to a doubling / a half of the transmitted sound effect. In the working environment context 3 dB is therefore a significant change, as it is the total energy exposure that causes the risk of hearing damage. In Denmark, the Danish Working Environment Authority's recommended limit, is an average sound pressure level of 85 dB (A) for 8 hours (100%).

As shown in Figure 2 below a reduction of the sound pressure level by 3 dB would allow for a 50% increase in exposure time without worsening the risk of hearing damage, i.e. 87 dB(A) for 4 hours corresponds to 84 dB (A) for 8 hours.

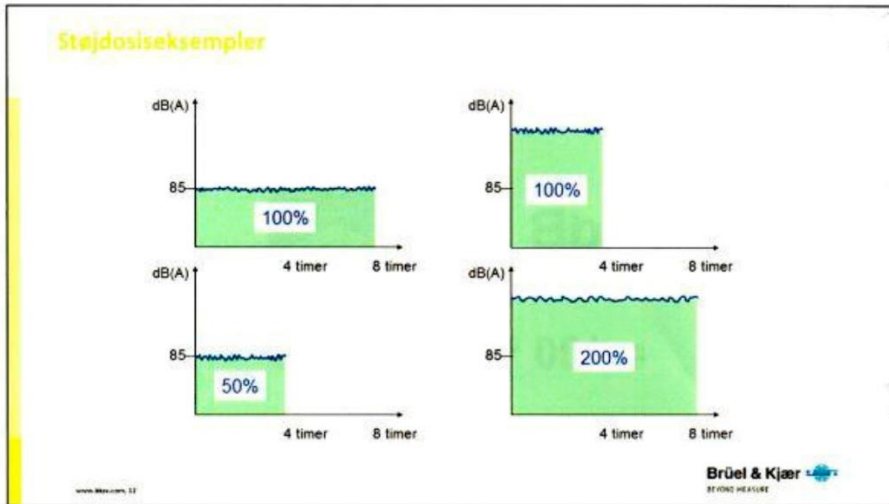


Figure 2, Source Brüel & Kjær

Measurement procedure:

The A-weighted sound pressure levels, LAeq and 1/1-octave frequency analyzes are performed according to DS/EN 61672-1, as the average of 4 positions, 5 meters from the loudspeaker. In each position the sound pressure level is averaged 30 sec. The SLM-microphone is placed on a tripod at a height of 1.5 meters above ground. As the measurements are taken outdoors the microphone has been equipped with a windshield.

The transmitted measurement signals is pink noise. The background noise at the test location is approx. 40 dB (A).

Wind speed approx.. 2-3 m/s, temperature 5 degrees Celsius, no rainfall.

Measurement results:

Table 1 shows the measuring results: P001 (AGAT) and P002 (Plastic driving plates). The individual measurements are show as 1/1-octave spectrum and A-weighted sound pressure level, LAeq, in Appendix 1 at the end of the report.

Table 1:

Hz	63	125	250	500	1000	2000	4000	8000	dB(A)
P001	60	66,6	81	80	77,8	75,9	67,3	61,8	82,8
P002	62,5	67,3	81,7	80,7	78,2	76,9	69,4	62,3	83,4
Difference	2,5	0,7	0,7	0,7	0,4	1	2,1	0,5	0,6

Measurement equipment:

SLM, Brüel & Kjær, Type 2250, sn 3003853. Microphone, Brüel & Kjær, Type 4189, sn 2469923

Calibrator, Brüel & Kjær, Type 4231, sn 2205822

Power Amplifier, Type 2716 with an omnidirectional loudspeaker Type 4296

The SLM is factory calibrated April 2016. The calibrator is accredited calibrated January 2017

The SLM-read out is checked with the calibrator prior to taking the measurements

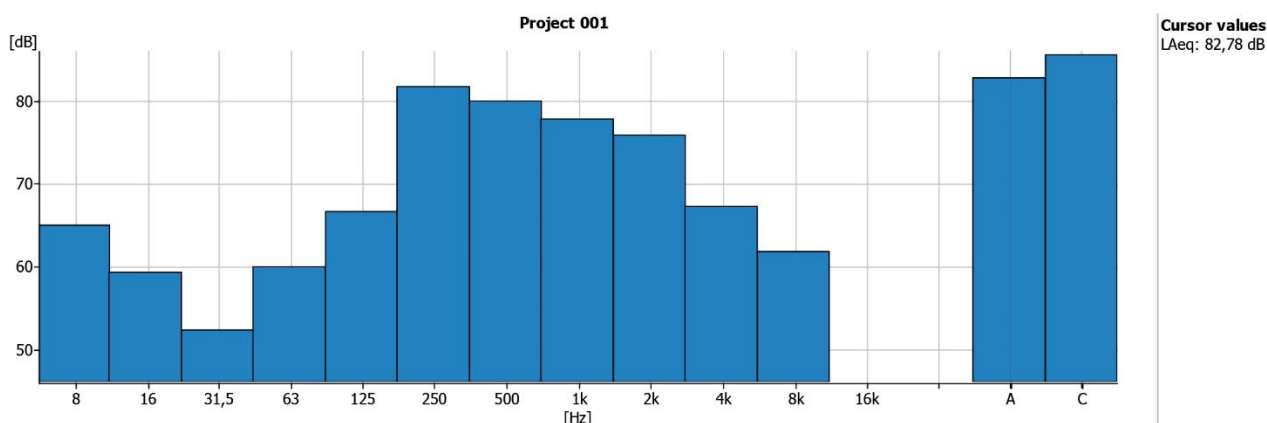
Conclusion and comment:

Table 1 on page 4 demonstrates the acoustic advantage of using AGAT as groundcover to the alternatives, being the traditional hard groundcovers, such as concrete, tiles and asphalt. It is considered likely, that at greater distances (50-100 meters) a reduction of minimum 3 dB will be achieved using AGAT as groundcover. A simple measurement possibly using the noise from a helicopter as the source could authenticate our findings.

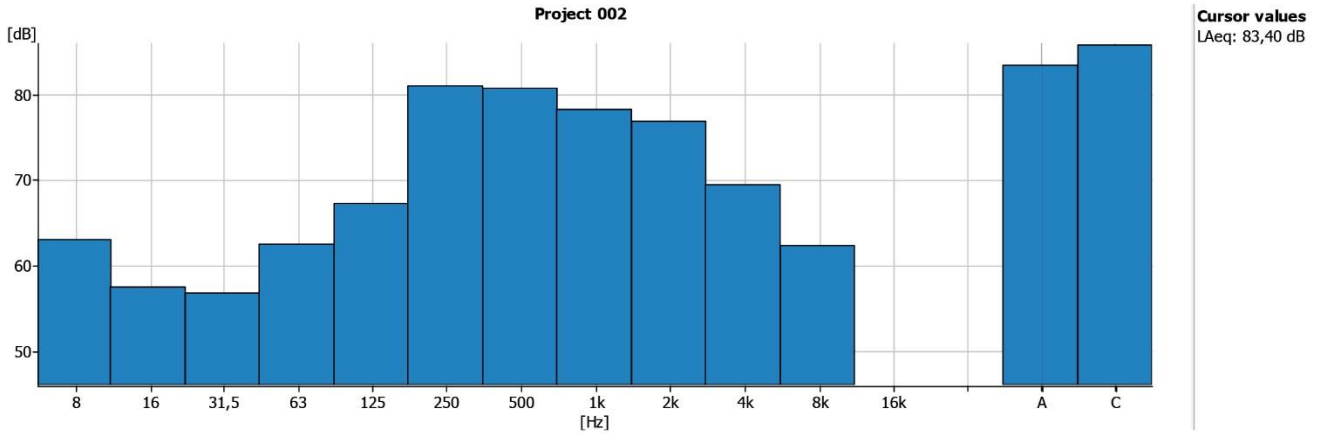
In noisy environments, within the armed forces and at airports, a 3 dB reduction in the noise level would have a significant impact on the work environment and also minimize the risk of hearing damage.

Appendix – measurement results:

Measurement 1: AGAT



Measurement 2: Plastic driving plates



Kind regards

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