We help ideas meet the real world

Technical Note

Measurement of emitted noise from SAFEFLOOR ApS MUGA COURT 10 m x 20 m with fencing modules of 100 cm x 150 cm

Performed for Safefloor ApS

TC-100944
Project no.: I100977
Page 1 of 12

10 May 2016

DELTA
Venlighedsvej 4
2970 Hørsholm
Denmark

Tel. +45 72 19 40 00
Fax +45 72 19 40 01
www.delta.dk
VAT No. 12275110

Title

Measurement of emitted noise from SAFEFLOOR ApS MUGA COURT 10 m x 20 m with fencing modules of 100 cm x 150 cm

Journal no.	Project no.	Our ref.
TC-100944	I100977	LSS/HSO/ilk

Client

Safefloor ApS
Bjødstrupvej 10
8410 Rønde
Denmark

Client ref.

Christian Svendsen

Laboratory

DELTA
Agro Food Park 13
8200 Aarhus N
Denmark

Test conditions

Guideline IS-1693	Helsedirektoratet “Veileder for støyvurdering ved etablering av nærmiljøanlegg” 2006, rev. 4/2009

Summary

The maximum A-weighted noise level $L_{p,AFmax}$ for a leather football kicked at a SAFEFLOOR ApS MUGA COURT 10 m x 20 m has been measured, for ball velocities between 30 and 90 km/h. At a ball velocity of 80 km/h, the $L_{p,AFmax}$ is 75 dB.

Remark

The test results apply only to the tested objects.

DELTA, 10 May 2016

Lars S. Søndergaard

Lars S. Søndergaard
Specialist, Acoustics

Contents

1. Test object

The test object is a SAFEFLOOR ApS MUGA COURT 10 m x 20 m with fencing modules of 100 cm x 150 cm.

SAFEFLOOR ApS Multi Use Games Area (MUGA) uses rubber compound planks as fencing. The rubber used in the planks is mostly recycled rubber.

Standard fencing modules are H100xW150 cm and consist of 6 rubber planks, each weighing 12 kg. The frame is constructed of hot dipped galvanized steel, with a density of 7850 kg/m^3.

The floor in the court was made of SAFEFLOOR SFCB rubber surfacing. See photos in Annex 2.

2. Acoustic environment

The measurement was carried out in open air with approx. 30 m between the microphone and any acoustically reflecting surface. The ground surface between the fence and the microphone was almost flat, 20 % paved and 80 % grass. See photos in Annex 2.

3. Measurement setup

The measurements were carried out in accordance with IS-1693. 1 microphone was positioned at a height of 1.5 m, 10 m behind the chosen fence. A small microphone wind screen was used. See photos in Annex 2.

The ball was kicked inside of the fence from a distance of 5 m (marked on the ground surface with duct tape) perpendicular to the fence. The ball was aimed for the centre of the fence – defined as the area between the posts. Hits outside the desired area were not included in the analysis.

In series of 10-20 kicks the sound was recorded for offsite analysis. The recordings were monitored and the impulse sound of kicks to the ball and when the ball hits the fence were marked and elapsed time noted to be used for calculation of ball velocity.

A Select Fifa football with a weight of 430 grams was used. The pressure of the ball was (by Safefloor ApS) estimated to approx. 1 bar.

Safefloor ApS was responsible for shooting the ball. The aim was ball velocities 30-110 km/h as evenly distributed as possible, see Annex 1. In total 82 shots were included in the analysis.

4. Meteorological conditions

Weather:	Clouded (~3/8)
Temperature:	8-10 °C
Wind velocity:	1-3 m/s

5. Instrumentation

See Annex 3.

6. Results

For calculating the velocity of the ball the following equation was used (from IS-1693):

$$v = \frac{D \times 3.6}{T + \frac{D}{330}}$$

v = Velocity of the ball [km/h]

D = Distance from where the foot kicks the ball and to the fence [m]

T = Time difference between the foot kicks the ball and to the ball hits the fence [s]

The elapsed time was noted with a resolution of 2 ms resulting in a velocity resolution of 0.14 km/h.

Maximum A-weighted noise level, $L_{p,AFmax}$, for each of the 82 shots are shown as a scatterplot in Annex 1. For all results included in the analysis, there were more than 10 dB to the background noise. Applying linear regression (least square method) for the data, a line (shown in red) can be drawn representing the maximum A-weighted noise level, $L_{p,AFmax}$ for different ball velocities.

The line can be described by the following equation:

y = 0.287x+52.351

At a ball velocity of 80 km/h, the maximum A-weighted noise level, $L_{p,AFmax}$ at 10 m distance is 75.3 dB.

In the table below is shown the average 1/1-octave, A-weighted spectrum corresponding to $L_{p,AFmax}$ = 75.3 dB at a ball velocity of 80 km/h:

[Hz]	32	63	125	250	500	1000	2000	4000	8000	16000
[dB]	34.0	55.2	67.3	65.3	66.8	70.4	67.5	64.1	58.5	43.8

Annex 1 – Measurement results

Date: 22 March 2016

Measuring period: 10.00 a.m. to 12.00 a.m.

Site: Multi Use Games Area at Feldballe, Djursland, Denmark

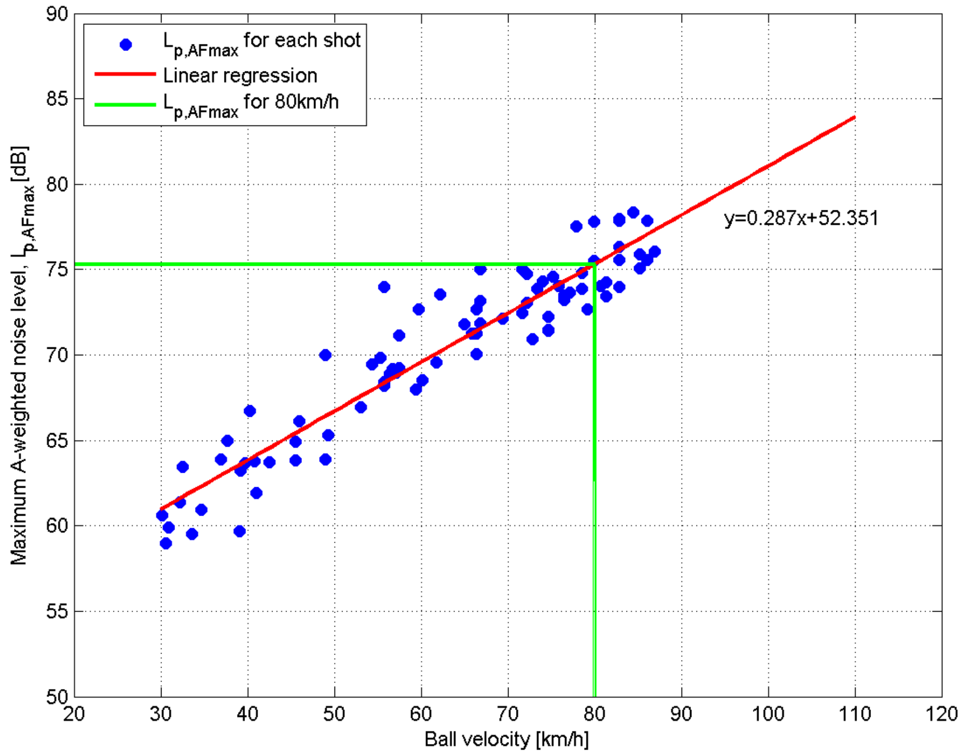

Figure 1
Maximum A-weighted noise level, $L_{p,AFmax}$, shown as a function of ball velocity.

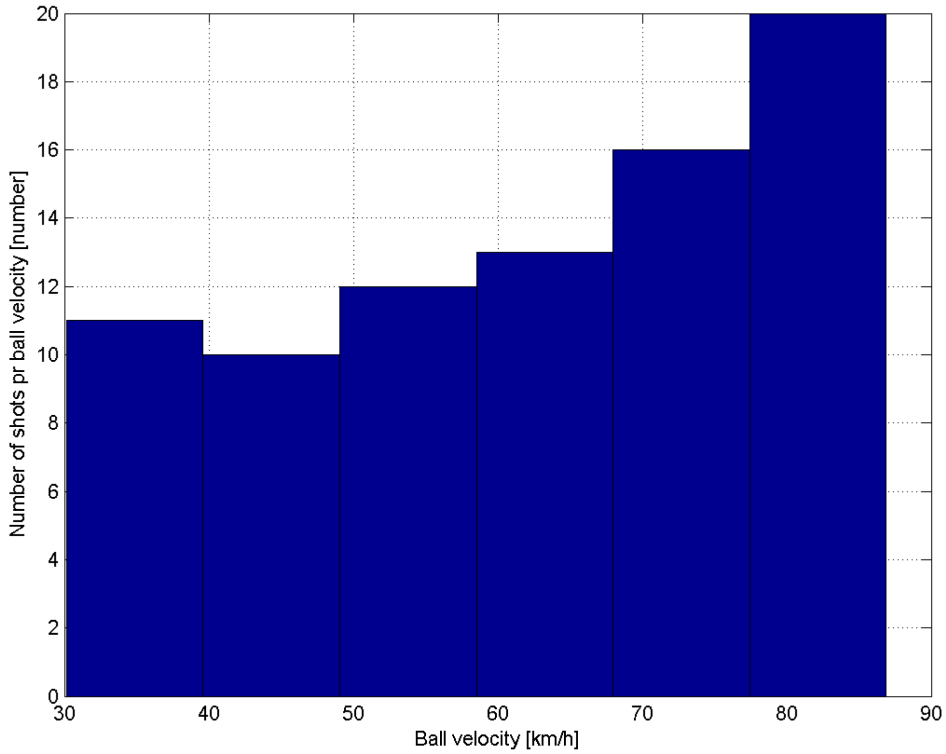

Figure 2
Number of shots per ball velocity.

Annex 2 – Measurement environment and measurement object

Figure 3
Photo of the fence and the microphone (shown from east).

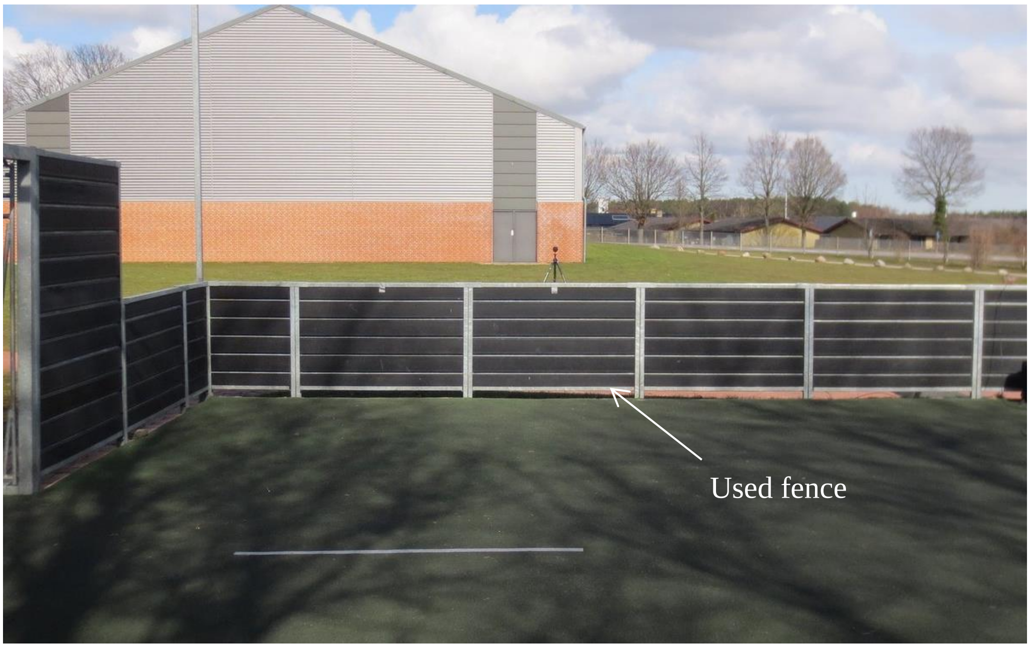

Figure 4
Photo of the fence (second full fence from the left was used) and the microphone (shown from south).

Figure 5
Photo of the fence and microphone (shown from west).

Figure 6
Photo of the microphone and the fence behind the microphone (shown from north).

Figure 7
Photo of the used football.

Figure 8
Close-up photo of one of the rubber planks (from Safefloor ApS).

Figure 9
Close-up photo of one of the rubber planks (from Safefloor ApS).

Annex 3 – Instrumentation

No.	Equipment	Make	Type	Calibration	
				Previous	Next
09L037	Preamplifier	G.R.A.S.	26CF	05 May 2015	May 2016
06L061	½" Microphone	G.R.A.S	40AE	07 Apr. 2016	Apr. 2017
02L023	Calibrator	Brüel & Kjær	4231	03 Jan. 2016	Jul. 2016
14L006	Data aq. Card	National Instruments	NI9233	22 Jan. 2015	Jan. 2017

For recording and analysis the programmes noiseLAB 3.0 and noiseLAB batch processor 3.1.1.4 from DELTA were used.

All instruments and programmes are calibrated regularly.