Aspects on $L_{n,w} + C_{l,50}$

I) Correlation with impact noise of walking persons

II) Comparison of ISO 717-2 rating with other rating curves using 350 lightweight floor measurements

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Introductory question:

Is $L_{n,w} + C_{l,50-2500}$ an appropriate quantity to assess low frequency noise caused by walking persons?

Important to know in order

- to use existing data base

- to have a quantity for (low frequency) impact sound available now, which can be used

  -- in planning processes

  -- for consultancy
content

0) motivation

I) Correlation of $L_{n,w} + C_{1,50-2500}$ with impact noise of walking persons

II) Comparison of ISO 717-2 rating with other rating curves using 350 lightweight floor measurements

III) summary

0) Motivation: walking vs. tapping machine
0) Motivation: walking vs. tapping machine

- Correlation of $L_{A,F,max}$ with impact sound from tapping machine not convincing

**Objective of current investigations:**

- Find a correlation between standardized measurement data and the subjective rating of walking noise

Subjective rating of impact noise from walking persons

Measurement of tapping machine

- Disturbing
- Almost not perceptible
0) Motivation: walking vs. tapping machine

Measurement of walking noise is difficult:

- Different persons have a different “walking behaviour”
- Bad signal–to–noise ratio
  (at low frequencies noise from disturbance)
- Below 50 Hz the sound pressure is dominated by the receiving room
  (standing waves, resonances of light-weight building components, ..)

Example of a measurement of walking noise
0) Motivation: walking vs. tapping machine

Example of a measurement of walking noise

- Correlation of $L_{n,w} + C_{l,50-2500}$ with impact noise of walking persons

Which quantity should we use to assess walking noise?

- A-weighting and total sound level $L_{AF \ max,n}$
- Loudness level $L_N$ in phon (ISO 226)
- Loudness level $L_{NGD}$ in phon and loudness $N_{GD}$ in sone according to Zwicker

Comparison of:

- 75 ± 10 kg
- Socks, no shoes
- 100 steps /min
- Keep 70 cm distance to borders
- Walk a "∞" to excite a large area
- 30 s measurement time
I) Correlation of \(L_{n,w} + C_{I,50-2500}\) with impact noise of walking persons

**Correlation of \(L_{n,w} + C_{I,50-2500}\) with \(L_{AF\,max,n}\)**

Subjective rating of impact noise from walking persons

\[
\begin{align*}
L_{AF\,max,n}\text{ in } \text{dB(A)} &\quad \text{Knauf} \\
&\quad \text{HS Rosenheim} \\
&\quad \text{ift-Rosenheim}
\end{align*}
\]

Measurement with tapping machine

I) Correlation of \(L_{n,w} + C_{I,50-2500}\) with impact noise of walking persons

Correlation of \(L_{AF\,max,n}\) with loudness level \(L_{NGD}\)

A-weighted maximum sound power level \(L_{AF\,max,n}\) in dB(A)

- \(n = 35\)
- \(r = 0.96\)
- \(\sigma = 1.6\) dB

Loudness level \(L_{NGD}\) in phon

-> the same holds for loudness level accord. to ISO 226
I) Correlation of $L_{n,w} + C_{1,50-2500}$ with impact noise of walking persons

**Correlation of $L_{AF \, max,n}$ with loudness $N_{GD}$**

- **A-weighted maximum sound power level $L_{AF \, max,n}$ in dB(A)**
- **Lautheit $N_{GD}$ in sone**
- **Lautheit $N_{GD}$ in sone**
- **disturbing**
- **almost not perceptible**

### Graph 1

- Data points representing the correlation between $L_{AF \, max,n}$ and $N_{GD}$.
- Linear fit with $n = 35$, $r = 0.97$, $\sigma = 1.5$ dB.
- Loudness range: 0.6 to 4.0 sone.

### Graph 2

- Data points representing the correlation between $L_{n,w} + C_{1,50-2500}$ and $N_{GD}$.
- Linear fit with $n = 35$, $r = 0.86$, $\sigma = 2.9$ dB.
- Loudness range: 0.6 to 7.0 sone.

**Derive sensible values for requests on impact sound**
I) Correlation of $L_{n,w} + C_{1,50-2500}$ with impact noise of walking persons

Investigations on impact sound in Scandinavia

![Graph showing correlation](image)

$y = -4.1717x + 74.402$

- 56 dB for minimum building regulations
- 52 dB for a sound class exhibiting higher acoustic performance
- 48 dB for a sound class exhibiting excellent acoustic performance

[Hagberg 2009]

II) Comparison of ISO 717-2 rating with other rating curves

- chosen rating curves

![Graphs comparing different rating curves](image)

DIN EN ISO 717-2

[Gösele]

[Fasold 1965]

„Dutch method“

[Bodlund 1985]

[Hagberg 2009]
II) Comparison of ISO 717-2 rating with other rating curves

Rating accord. to DIN EN ISO 717-2

\[ n = 356 \]
\[ r = 0.98 \]
\[ \sigma = 2.1 \text{ dB} \]

II) Comparison of ISO 717-2 rating with other rating curves

Alternative Bewertungskurven:

\[ n = 356 \]
\[ r = 0.98 \]
\[ \sigma = 1.9 \text{ dB} \]
Conclusions from our investigations

- Measurements below 50 Hz are not favourable

- $L_{n,w} + C_{f,50-2500}$ of floors correlates quite good with $L_{AF,\text{max},n}$ or loudness levels $L_{GD}$ or loudness $N_{GD}$ from walking persons

- impact sound levels evaluated with other rating curves show a very good correlation with $L_{n,w} + C_{f,50-2500}$

- recommendations on request values for impact sound do agree with other investigations