

Low Frequency Footfall Noise Problem

There is a significant weight of evidence showing that impact (ie footfall) noise can be a serious problem in dwellings even if the floor has met the Part 'E' minimum performance standard for impact sound insulation.

The issue manifests itself as an unpleasant low frequency (boomy) noise and the reason it passes the test is that the offending noise is (well) below the 100Hz 1/3rd octave band. Despite this, only one European country (Sweden) uses an impact noise requirement for housing which covers frequencies below 100Hz ($L'_{n,w} + C_{1,50-2500} \leq 56$ dB). ISO 19488:2021 Acoustics - Acoustic classification of dwellings enables housing to be rated (A to G) based on their "acoustic performance" (just like white goods are rated for efficiency). This standard includes an impact noise assessment below 100Hz, but only for the **highest ratings** (i.e. A & B). Ratings C to G will be based on the more common $L'_{nT,w}$ parameter.

This ANC working group has investigated this phenomenon in order to establish an appropriate way of identifying this problem during testing. The intention is to propose a repeatable and reproducible test and assessment method for inclusion in the next revision of Part 'E'.

Our very own Mr Iain Critchley has done a significant amount of work in this area to date and he is of the opinion that the problem often occurs at frequencies which are even lower than 50Hz - down to 20Hz in fact. So if you are faced with such a problem, we recommend you take a sound level meter with you which can measure down to 20Hz. And don't worry about recreating the problem on site - you will get an adequate acoustic response from your standard tapping machine.

If you can get someone to walk around the room upstairs, it would definitely be worth measuring the 1/3rd octave impact levels (down to 20Hz) for future analysis, as well as listening and rating the sound subjectively (from 0 = "perfectly acceptable" to 10 = "unbearable").

We would also like to gain a better understanding of the **causes** of the problem so that we can help structural engineers, manufacturers and constructors avoid this problem in the future.

Anecdotal evidence indicates that the problem is most prevalent in lightweight (i.e. timber) floors due to the lack of adequate stiffness. The constant drive to reduce costs is only exacerbating the problem, as any value engineering usually results in lower stiffness (e.g. due to thinner materials, wider spacing of joists, etc). It has also been suggested that open

web timber joists are seemingly “up there” as one of the worst offending components:



Related articles:

[AkuTimber Tackles the Low Frequency Impact Sound Insulation Issue](#)

[Impact Sound Insulation in Timber Frame Flats - Apex Acoustics & Peninsular](#)

[A new metric to quantify and evaluate low frequency impact noise - Loverde & Dong](#)

Correlation between sound insulation and occupants’ perception – Proposal of alternative single number rating of impact sound - Ljunggren, Simmons & Hagberg (Applied Acoustics 85 [2014] 57-68)

An Empirical Study of the Spatial Uncertainty of Rev Time Measurement below 50Hz - Ljunggren, Öqvist & Simmons (Inter-Noise 2016)

Methods of Mitigation:

Reducing impact and structure borne sound in buildings - Ling (Published by BRE)

Potential solutions to improved sound performance of volume based lightweight multi-storey timber buildings - Ljunggren & Ågren (Applied Acoustics 72 [2011] 231-240)

Further reading:

[Accuracy of prediction methods for impact sound pressure levels - Griffin](#)

Low frequency sound transmission in multifamily wooden houses - Hagberg & Bard

Impact sound insulation of wooden joist constructions: Collection of laboratory measurements and trend analysis - Homb, Guigou-Carter, Hagberg & Schmid

Impact sound insulation of CLT/massive wood floor constructions: Collection of laboratory measurements and result evaluation - Homb, Guigou-Carter & Rabold

[A new building acoustical concept for lightweight timber frame constructions - De Geetere & Ingelaere](#)

Unlocking the myth of low-frequency footstep thumping noise in lightweight wood floor construction - Hui (Inter-Noise 2022)