

Abridged version of the research project: Accounting for uncertainties with impact noise in the new DIN 4109

Uncertainties of impact noise measurements in laboratories and in-situ are influenced by different effects. The sum of all effects is automatically included in the results of round robin tests. A comprehensive analysis of existing results from interlaboratory tests revealed that the standard deviation of repeatability (same team, same equipment, same laboratory or in-situ situation) is on average 0.5 dB for the weighted impact noise level. A value of 1.0 dB results for the in-situ standard deviation (different teams, different equipment, same laboratory or in-situ situation). This is the uncertainty for the determination of a weighted impact noise level in the same situation which may be a laboratory or an in-situ situation. There is no data under reproducibility conditions available since no construction was measured in different laboratories. The standard deviation of reproducibility can therefore only be estimated. Its value of 1.5 dB is to be used as the standard uncertainty which is associated with measured weighted impact noise levels of building elements.

For weighted impact noise reductions, a value of 1.0 dB was determined from round robins. This value may be used as the standard uncertainty for weighted impact noise reductions.

The contribution of the ISO tapping machine was investigated as a separate influence within the project. It turned out that tapping machines emit a broadband spectrum in a wide frequency range. Only at the low frequencies (timber joist floors up to about 200 Hz, concrete slabs up to 50 Hz) does a 2 Hz line spectrum occur. Thus the line distance is so small in comparison to the bandwidth of structural modes that one can always assume a sufficient excitation of all structural modes. A measurement with four different tapping machines on different receiving plates revealed furthermore that the uncertainty of the emitted sound power contributes 0.4 dB to the uncertainty of the weighted impact noise level.

Besides that, it was tested as to whether the use of certain specimen sizes in laboratories leads to an increased uncertainty when the results apply to other specimen sizes in real buildings. These investigations were carried out experimentally on a model scale. In contrast to airborne sound insulation, the impact noise level turned out to be independent of the specimen size. This is valid for homogeneous concrete slabs but also for timber joist floors. But when a solid ceiling covers several rooms, the vibration energy spreads over the whole ceiling, so that the impact noise level decreases with increasing ceiling size. The effect amounts to 2.4 dB per doubling of the ceiling size. It can be accounted for by an appropriate correction.

The uncertainties of predictions were also investigated. It turned out that the simplified calculation with single number values leads only to a small uncertainty contribution. The magnitude of observed deviations between predicted and measured weighted impact noise levels could be explained. The main uncertainty contributions are due to the building element properties, especially the impact noise reduction of floating floors.