Short report to the research project
Flanking transmission of gypsum board metal stud dry walls

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Title

Long title: Flanking transmission of gypsum board metal stud dry walls

Occasion / starting situation

In the course of the revision of DIN 4109 a measurement was commissioned by PTB in 2012 to check the flanking transmission of traditional gypsum board walls in the diagonal test facility of the IBP. The measurement results revealed partly relevant deviations to former data given in DIN 4109:1989. The reasons for the deviations stayed unclear. The given data was to be confirmed and the mechanisms of the flanking transmission were to be examined.

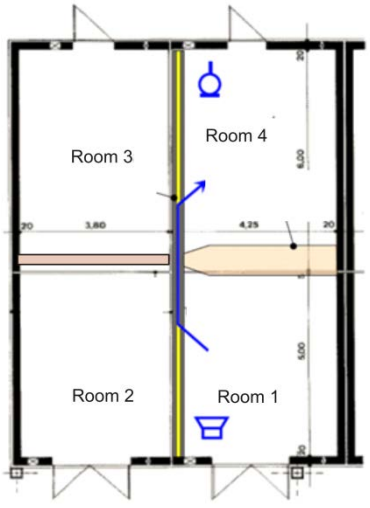

Figure 1: Horizontal section of the diagonal test facility of the IBP.

Matter of the research project

The main issue of the research was the investigation of different gypsum board dry walls. Besides different wall constructions the detailed implementation of the junction between flanking and separating wall in the diagonal test facility of the IBP were investigated.

In the research project two different flanking walls with different implementation of the junction were tested. The first flanking wall was a dry wall consisting of CW 100 metal studs and a single gypsum board surface on both sides. The second wall was constructed by two CW 50 metal studs, separated by 5 mm space, again cladded by a single gypsum board surface on both sides. For both walls, the junction type “inner surface connected” (continuous gypsum board) and “inner surface disconnected”, and for both versions “T-junction” and “X-junction”

were considered. The measurements of the normalized flanking level difference were extended by additional vibration measurements on the surfaces, the diagonal transmission etc., from which information of the transmission mechanisms was deduced.

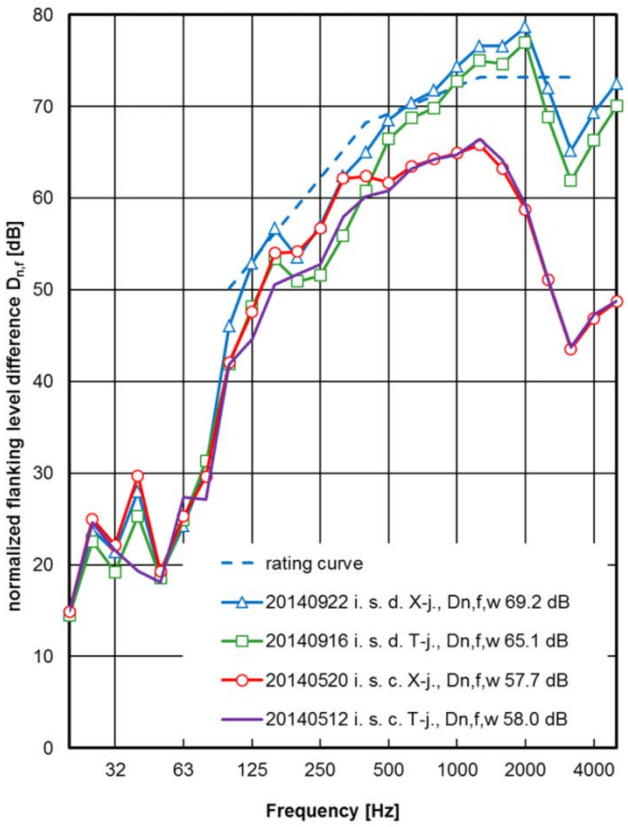

Figure 2: Normalized flanking level difference of the single stud wall CW 100 with single gypsum board surface on both sides and different junction detail “inner surface disconnected (i. s. d.)” and “inner surface connected (i. s. c)” as well as “T-junction (T-j.)” and “X-junction (X-j.)”.

With the performed measurements it was possible to propose a calculation model for the weighted normalized flanking level difference. This model was tested by comparison of the calculation with measured results of two flanking wall constructions with distinctively different construction details. The data for the additional wall constructions was measured at the laboratory of Knauf Gips KG and provided by Knauf.

The main results can be summarised as follows:

- The results of the PTB measurements in 2012 with the “inner surface connected” were confirmed.
- For the wall with “disconnected inner surface” the results of the PTB measurement were lower than in the current investigation. The assumption is that the construction of the separating wall as a wall fraction leads to a distinctive resonance in the flanking transmission. This resonance was avoided in the current project as the wall was a full-sized wall with linings on both sides.
- For the future standardization, six wall-junction combinations were measured as input data for the building element catalogue of DIN 4109.
- The analysis of the measurements showed that the sound transmission for the flanking level difference at the junction occurs by (at least) three paths: the transmission across the outer surface, across the cavity of the wall (including all other possible paths) and across the inner surface of the wall.
- The analysis of the transmission paths enabled the proposal of a calculation model for the weighted normalized flanking level difference $D_{n,f,w}$. In the model the weighted normalized flanking level difference is calculated for all three paths separately. The sum of all paths leads to the total flanking level difference. This

enables the integration of further paths, for example the paths Df and fD of EN 12354, which currently omitted by DIN 4109.

- The calculation model was tested by data of other metal stud dry wall constructions, which were provided by the Knauf Gips KG. The results of the calculation were in good agreement with the measurement results. This raises hope that the calculation model is appropriate to calculate the flanking level difference for other wall and junction constructions in the future.

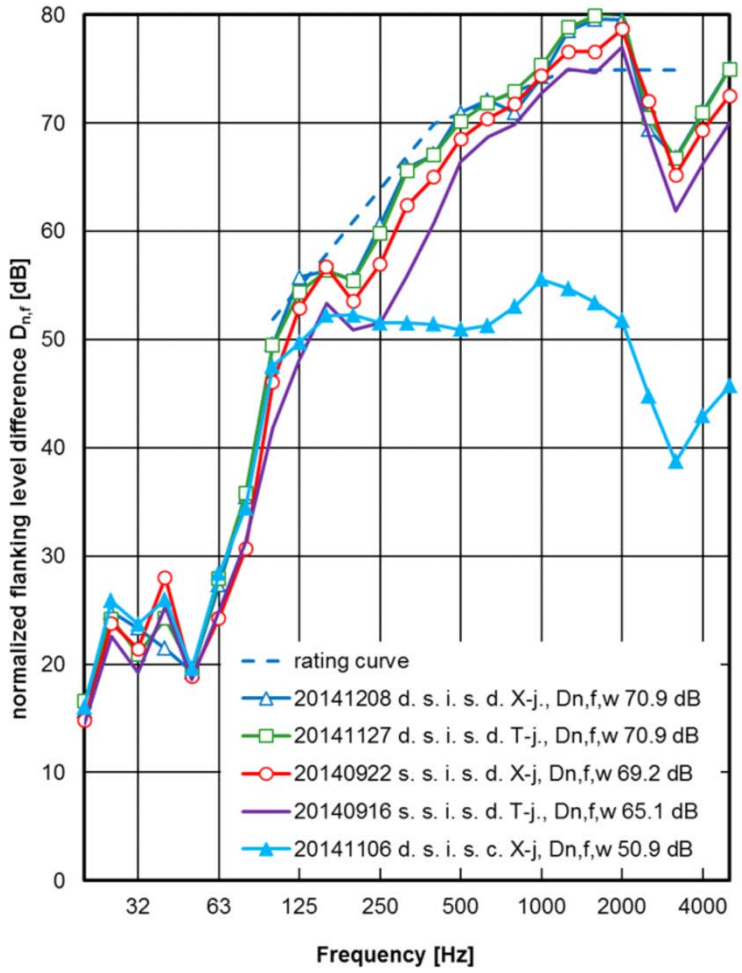

Figure 3:Normalized flanking level difference of the “double stud wall (d. s.)” and for “single stud wall (s. s.)” and different junction details “inner surface connected (i. s. c)” and “inner surface disconnected (i. s. d.)” as well as “T-junction (T-j.)” and “X-junction (X-j.)”.

With this research project a lot of questions about the flanking transmission of dry walls were answered, so that the planning of such walls can be improved. In a few points further research is necessary. This includes especially the construction variability of metal stud dry walls with multiple sheets, different plate material, different plate thickness in combination with single, double or acoustically optimised studs and different junction details. In contrast to the great number of different details of metal stud dry walls, the number of data available in the building construction catalogue of DIN 4109 is very low. Therefore the proposed calculation model should be validated at some more constructions, and if necessary be extended by the paths Df and Fd. Then, the number of necessary experimental investigations of different flanking wall constructions could be greatly reduced and variants of different junctions could be calculated, still giving the full set of data for the planning process of metal stud walls.

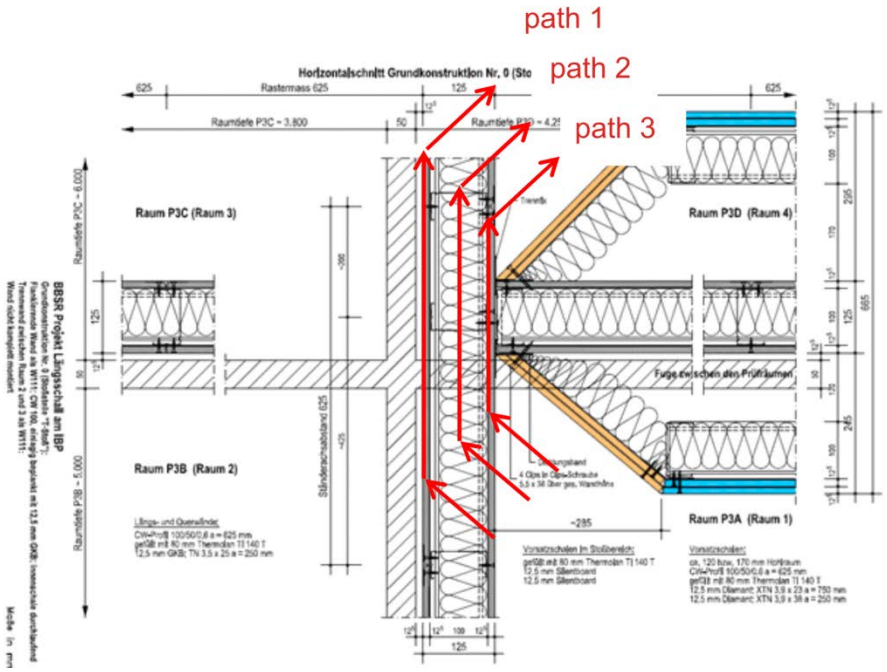

Figure 4: Horizontal section of the junction with the main three transmission paths: path 1 across the outer surface of the wall, path 2 across the cavity of the wall (including all other possible paths) and path 3 across the inner surface of the wall.

Conclusion

The goals of the project, to confirm the given data of the building catalogue of DIN 4109, to add new data, to investigate the transmission mechanisms and to provide a calculation model for the weighted standardized flanking level difference were achieved. This calculation model should be verified in the future and if necessary be extended for the paths Fd and Df, which are still omitted by DIN 4109. With this model it would be possible to calculate reliable data of the weighted standardized flanking level difference for the wide variety of wall and junction constructions without the need to measure all constructions in the laboratory.

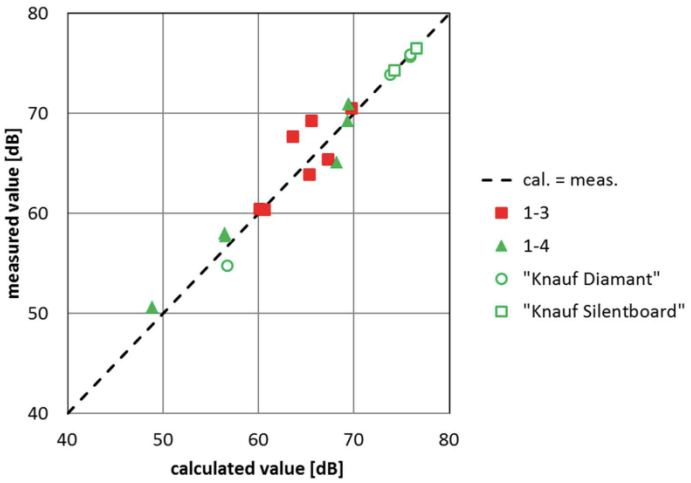

Figure 5:Comparison of the calculated $D_{n,f,w}$ with measured values. Considered is the flanking level difference between room 1 and 4 and between room 1 and 3 (diagonal transmission). Besides the results of the research project additional values of two wall constructions from the laboratory of the Knauf Gips KG are given.

Project data

Kurztitel: Längsdämmung GK-Ständerwände
Forscher / Projektleitung: Dr. Moritz Späh
Gesamtkosten: 175.000,00 €
Anteil Bundeszuschuss: 115.000,00 €
Projektlaufzeit: 15 Monate