Abridged version of the research project:

Development of useful sound reduction definitions for the new DIN 4109

The main objective of the project was to precisely define the most important acoustic parameter of building elements, the sound reduction index, and to show the consequences for the measurement and the related uncertainty that result from the definition.
The aim of the measurement was chosen as the starting point of the considerations. Laboratory measurements are carried out to quantify the acoustic properties of a particular type of building element. The population thus comprises the sound reduction of the considered building element for all feasible test facilities. A sample is drawn by the choice of a particular laboratory, which serves as an estimate for the mean value from all possible test facilities. The related uncertainty is the standard deviation of reproducibility, which is 1.2 dB for the weighted sound reduction index. This value was determined from an analysis of many round robin tests as were the other uncertainties mentioned here.

Measurements in buildings, however, are performed to assess the achieved level of sound insulation. The related population is in this case then the sound reduction of the considered building element in the precise building situation. This means that the airborne and structure-borne sound fields concerned remain largely unchanged. The related uncertainty is thus the in-situ standard deviation of 0.8 dB for the weighted sound reduction index.

Predictions, on the other hand, serve the purpose of calculating the sound insulation in a building from the sound reduction indices of the building elements. The uncertainty of the prediction result is yielded from the weighted superposition of the uncertainties of the considered building element properties, plus an additional uncertainty contribution for the prediction method used. The uncertainty of a predicted value cannot be given in general.

In the further course of the project, investigation was made as to why the standard deviations of reproducibility are considerably larger than the in-situ standard deviations and whether there are systematic deviations between sound insulations in buildings and in laboratories. These questions were investigated by measurements carried out on scaled models. It turned out that the insufficient number of structure-borne modes with bending resistant partition walls leads to an additional uncertainty of 0.5 dB for the weighted sound reduction index. Furthermore, the sound reduction between rooms of equal dimensions is systematically smaller than between unequal rooms. The difference is about 1 dB for the weighted sound reduction index. Since equal rooms often occur in buildings and unequal rooms are normative for test facilities, this shows a systematic deviation between sound insulations in laboratories and in buildings. Moreover, a dependency of the sound insulation on the size of the test specimen was observed. A factor of six in the area of the specimen led to a reduction in the weighted sound reduction index by approximately 4 dB.

In summary, it can thus be stated that the essential project objectives have been reached. In the course of the project, however, new aspects were revealed which should be dealt with in future. These mainly comprise the determination of realistic product variations and the uncertainty of predicted values.