

# Comparison between laboratory and in situ Sound Reduction Index measurements

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The paper deals with the results of research concerning the acoustical properties of masonry walls tested both in a laboratory with suppressed flanking transmission and in a laboratory with relevant flanking transmission (in situ). Measurements were aimed at evaluating the difference between Sound Reduction Index in laboratory and in situ and the amount of flanking transmission through different lateral paths. The results confirm the reliability of the flanking transmission calculation model defined by the European Norm and give a contribution to the set-up of the new method of measurement of the vibration reduction index.

## INTRODUCTION

Sound transmission between adjoining rooms is due to energy propagation both through the separating wall and through the lateral structures of the two rooms. The European Norm 12354-1 [1] makes it possible to estimate the acoustic properties of buildings through the calculation of both these forms of transmission. The paper presents the results of research concerning the acoustical properties of masonry walls tested both in a laboratory with suppressed flanking transmission and in a laboratory with relevant flanking transmission (reproducing a typical real building context). Flanking transmission has been evaluated by measuring the vibration reduction index  $K_{ij}$ , whose test method is studied in ISO/CD 10848 [2], and the structural reverberation time  $T_s$  of the partition wall and of the lateral structures.

## DESCRIPTION OF THE TEST WALLS AND MEASUREMENT PROCEDURE

Five different masonry walls were tested in two laboratories with and without flanking transmission.

The laboratory with suppressed flanking transmission respects the recommendations of ISO 140-1 [3], while the other one respects the recommendations of ISO/CD 10848 [2]. The realisation of the walls was carried out in one laboratory by a single firm with a single supervisor and with strictly defined construction procedures. The same thing applied to the other laboratory. Four walls were single layer while the other one (E with reference to table 1) was double layer. A synthetic description is given in table 1. The sound reduction index was measured in laboratory according to ISO 140 - 3 recommendations and in situ according to ISO 140 - 4.

Table 1. Synthetic description and rating of the sound reduction index of the five walls tested.

Wall	A	B	C	D	E
Surface mass ( $\text{kg/m}^2$ )	470	370	400	390	320
Thickness (m)	0,45	0,28	0,21	0,33	0,17 0,03 0,08
$R_w$ (measured in laboratory)	50	53	54	56	52
$R'_w$ (measured in situ)	47	49	48	50	47
$R'_w$ (estimated in situ)	45	46	46	47	45

The vibration reduction index,  $K_{ij}$ , is the new quantity introduced by EN 12354-1 to evaluate the flanking transmission and can be calculated by means of simplified formulas given by EN 12354-1 [1] or measured in situ, according to the recommendations of ISO/CD 10848 [2]. For the estimation, the kind of junction between the test wall and its lateral structures needs to be known. In the research, where all the junctions were rigid,  $K_{ij}$  was both estimated and measured. The sound reduction index of all the lateral structures of the two adjoining rooms were known from previous laboratory measurements. From the measured values of the sound reduction index of the test wall and of the lateral structures and from the measured vibration reduction indexes of all flanking paths, the apparent sound reduction index  $R'$  was calculated. The results obtained were finally compared with the measured values of  $R'$ .

## RESULTS

Table 1 shows the comparison between the estimated and the measured values of  $R'_w$ . It is evident that in the case studied, the estimation model of EN 12354-1, with the measured values of  $K_{ij}$ , gives lower values of  $R'_w$  than in real life. This is due to the presence of some lateral paths which are characterised by very small values of the vibration reduction index and, as a



consequence, by very small values of  $R_{ij}$ . In particular, paths 2-6 and 4-8, concerning the vibration transmission from the two floors of the source room to the corresponding floors of the receiving room, are characterized by much smaller measured values of  $K_{ij}$  than the estimated values.

Figure 1 shows, for two walls, the comparison between the estimated (grey) and the measured (white) values of  $K_{ij}$  (odd numbers indicate the lateral walls, while even numbers the lateral floors).

Figure 2 shows, for the same two walls, the comparison between the measured and the estimated values of  $R'$  and the measured value of  $R$ , as a function of the frequency.

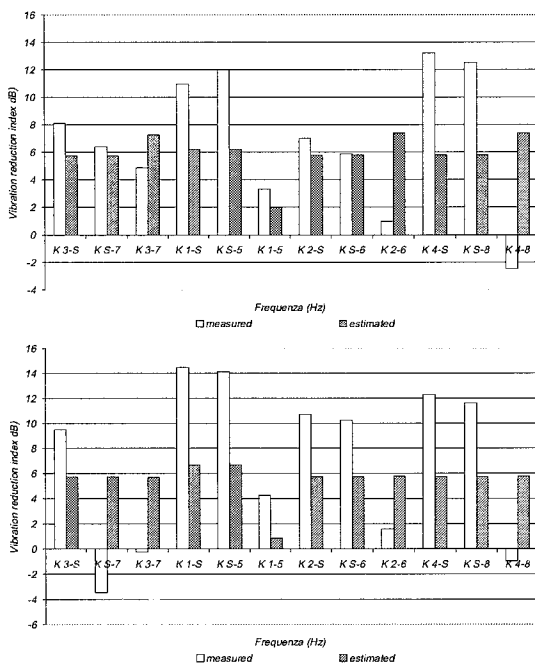


FIGURE 1. Comparison between estimated and measured values of  $K_{ij}$  (mean values between 500 and 2000 Hz) (wall C above and wall E below).

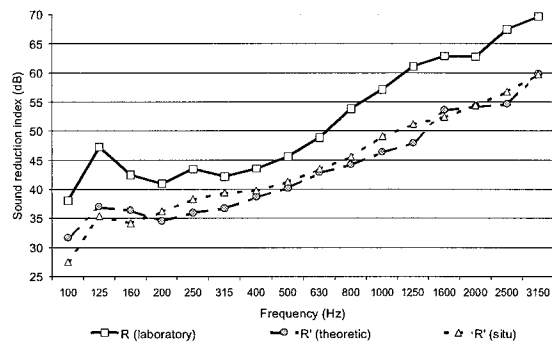
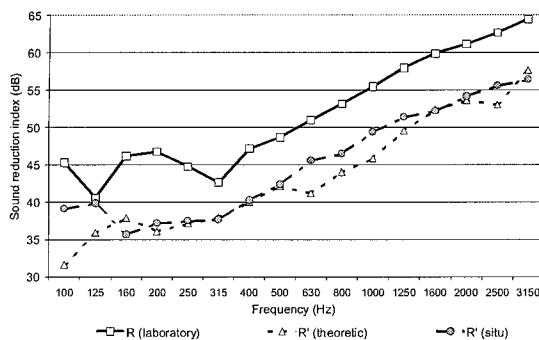


FIGURE 2. Comparison between values of  $R$  (measured) and  $R'$  (measured and estimated) (wall C above and wall E below).

## CONCLUSIONS

The comparison between measured and estimated values of the apparent sound reduction index (figure 2) shows a close correspondence if the differences between the realisation of the walls in laboratory and in situ are taken into account. The estimation model of EN 12354-1, using the measured values of the vibration reduction index, can explain the reduction in the isolation from the laboratory to real life.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. EN 12354-1 Building Acoustics - Estimation of acoustic performance of buildings from the performance of products, part 1, Airborne sound insulation between rooms.
2. ISO/CD 10848, Acoustics - Laboratory measurement of the flanking transmission of airborne and impact noise between adjoining rooms.
3. ISO 140, Acoustics - Measurements of sound insulation in buildings and of buildings elements.



SESSIONS

