inter·noise 83

ON THE PROBLEM OF QUICK MEASUREMENT OF THE INSULATION VALUE OF BUILDING PARTS.

Stoll H.R. + Leutwiler M.

Stoll + Partner Engineering
P.O. Box 45 CH 3000 Berne 15

A study contract from the Swiss Federal Office for Environmental Protection gave us the opportunity to compare various quick measurement methods proposed in the literature with each other and to try out some new ideas of our own.

The large number of published proposals clearly reflects the worldwide need for fast, inexpensive and yet accurate measuring procedures.

Starting from the basic equation

result = L1 - L2 + K (1).

the different methods can be classified as

- Primary - measurement of L1 - L2, level difference
  measurement of K, absorption correction
- Secondary - measurement of an all-inclusive value
  - measurement in thirdoctaves or octaves

Our series of tests were set up as follows:

Airborne sound insulation

1. Microphone position — always 6 positions
2. Level difference per object measured
   - 2.1. Measurement 1 — with thirds noises in all 16 third bands successively according to ISO
   - 2.2. Measurement 2 — with wide-band noises (see Fig.) measured linearly in real time in all thirdoctave bands
   - 2.3. Measurement 3 — pistol shots
   - 2.4. Measurement 4 — same as Measurement 1

3. Absorption per object

3.1.	Measurement 5	classic level drop in individual thirdoctave bands on level recorder
3.2.	Measurement 6	Level drop in thirdoctave bands according to Kuttruff-Schröder method on level recorder
3.3.	Measurement 7	near/remote field method with calibrated loudspeaker and noises according to Gösele measured in real time in all thirdoctave bands
3.4.	Measurement 8	use of a reference sound source, measurement of resultant level in room in real time in thirdoctave bands
3.5.	Measurement 9	same as Measurement 5 but with electronic evaluation
3.6.	Measurement 10	same as Measurement 1

Evaluation was carried out:

4. Per object on the spot

Digital storage of the readings in thirdoctaves for all 10 measurements.

5. Per object by means of computer

5.1. Level difference measurements 1 - 4

a)	evaluations	linear - linear
b)	evaluations	A - A
c)	evaluations	C - A
d)	evaluations	C - C
e)	evaluations	in thirdoctaves
f)	evaluations	in octaves

5.2. Reverberation/absorption measurements 5 - 10

a) As far as necessary, conversion of the measured level differences (measurements 7/8) to reverberation times, taking into account barometric corrections and the Waterhouse correction.

b) Calculation of the value K in Equation (1) for the alternatives

- in thirdoctaves
- in octaves
- as a single-figure value

5.3. Overall evaluation per object

a) Combination of the various level difference results with the various reverberation results.

b) To the extent feasible, evaluation according to ISO curve.

6. Overall evalution

Ranking of the results from 5.3. serially under the assumption that readings obtained in orthodox fashion for

- difference L1 - L2 in thirdoctaves
- reverberation K in thirdoctaves

represent the actual true values.

The results show, that quick but general methods are inferior to quick methods measuring thirdoctaves or octaves in every case.

The fastest and simultaneously most accurate method, which was established at the end of the test series and which we have been employing exclusively ever since, is structured as follows:

6.1. Instrumentation

L1 - L2	- tape recorder/loudspeaker - real time analyzer CR 1995 - computer HP 9815 S
K	- reference sound source Brüel & Kjaer - real time analyzer CR 1995 - computer HP 9815 S

6.2. Measurement

L1 - L2	wide-band real time in thirds
K	wide-band real time in thirds

7. Outlook

At present we are investigation the following alternatives, which would be even more efficient:

a) L1 - L2 use of a very strong reference sound source (EdF) as a wide-band noise source

b) K Measurement of the level drop at the end of each sequence of wide-band noise, storage of the time/level plots obtained in real time on a high-speed real time thirds analyzer, and recording of the reverberation times by thirdoctaves.

References

1.	Leventhall H.G.	Simplified Methods for the measurement of airborne sound isolation. (With many further references) Chelsea College University of London 1977
2.	Dämmig P.	Messunsicherheit bauakustischer Kurzprüfverfahren, Abschlussbericht PTB 1978
3.	ASTM	Determining A-Single Number Rating of airborne sound isolation .... ASTM E 597 77 T
4.	Larsen H.	Reverberation at low frequencies Brüel & Kjaer Techn. Review 4/78
5.	Brüel P.V.	On the enigma of Sound power measurements at low frequencies Brüel & Kjaer Techn. Review 3/78
6.	Kramár O.	Measurement of Sound Absorption of rooms using Reference Sound Source (with further references) Brüel & Kjaer Techn. Review 4/76