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

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A study contract from the Swiss Federal Office for Environmental
Protection gave us the opportunity to compare various quick measure—
ment 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

\[ \text{result} = L_1 - L_2 + K \] (1)

the different methods can be classified as

- **Primary** - measurement of \( L_1 - L_2 \), 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 - 6

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

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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 evaluation**

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

- difference $L_1 - L_2$ 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**

- $L_1 - L_2$ - tape recorder/loudspeaker
- real time analyzer CR 1995
- computer HP 9815 S
- reference sound source
  - Brüel & Kjær
  - real time analyzer CR 1995
  - computer HP 9815 S

6.2. **Measurement**

- $L_1 - L_2$ wide-band real time in thirds
- $K$ wide-band real time in thirds

7. **Outlook**

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

a) $L_1 - L_2$ 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

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