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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 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

$$\text{result} = L1 - L2 + K \qquad (1).$$

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

community becomes so highly sensitized to noise that they institute legal action against him. Under such circumstances, it is conceivable that the owner could be called on to explain why he should be permitted to raise the sound level in the adjoining community to any noticeable degree (3 dB), or why he should be allowed to generate as much noise as all other noise sources together in the adjoining community. Therefore, a goal somewhere between the L_{50} and L_{90} seems more reasonable for such a community than the original goal.

EXAMPLES OF NOISE PROBLEMS

A major international corporation bought a very small plant located in the center of a residential area in a small New York state town. The new owner increased the capacity of the plant while at the same time increasing the noise in the neighborhood. The EPA was called in and the plant given one month to solve the problem or to cease and desist operation.

BBN analyzed the problem and found a significant 63 Hz noise problem. We designed a suitable tuned exhaust muffler that was developed, built, and installed within the month. The results of the before-and-after noise measurements are shown in Figure 1, and the muffler concept is shown in Figure 2.

The EPA is now satisfied with the performance of the plant, but one of the neighbors has initiated a civil suit against the company to achieve an even greater noise reduction.

Another major corporation has had a large manufacturing facility located in its present location for approximately 50 years. During the past 5 years $200,000 homes have been located within 200 feet of the plant.

Because of the need for quality control and the reduction of worker exposure to dust inside the plant, numerous pieces of dust collection devices have been installed on the roof. This new equipment has increased the sound level in the community to 60 dBA. The company contracted with BBN to be totally responsible for a reduction of the community noise to the nighttime noise criterion level of 50 dBA, with a frequency spectrum shape as shown in Figure 3. BBN has performed the acoustical analysis, designed the noise control features, and built and installed them. The plant now meets the noise criterion.

REFERENCES

[1] "Motor Vehicle Noise: Identification and Analysis of Situations Contributing to Annoyance," Bolt Beranek and Newman Inc., Report No. 2082, 1971.

[2] A. B. Brodersen, R. G. Edwards, D. F. McCoy and W. S. Coakley, "Proposed State Noise Regulations - An Urban Attitude Survey," Sound and Vibration, December 1981, 8-13.

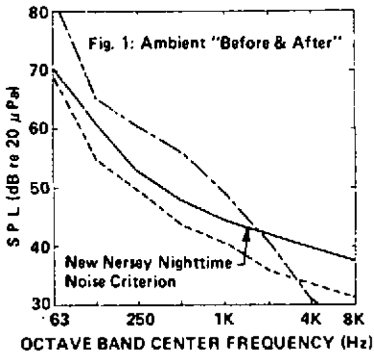

Fig. 1: Ambient "Before & After"

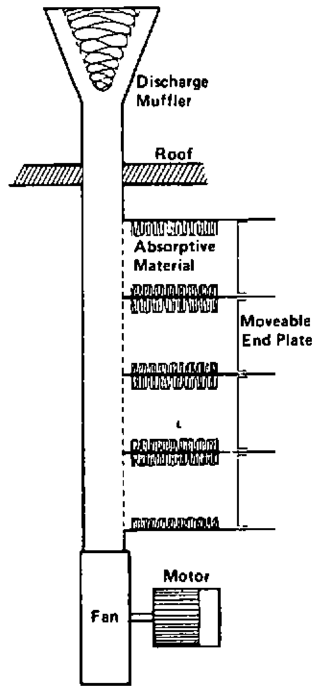

Fig. 2: Tuned Muffler

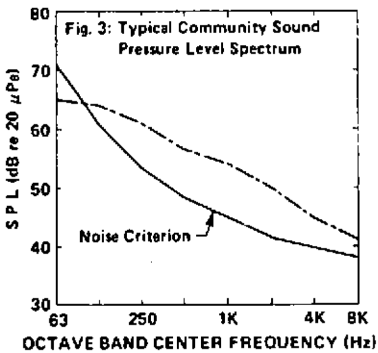

Fig. 3: Typical Community Sound Pressure Level Spectrum