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DEVELOPMENT OF A SIMPLIFIED METHOD OF MEASURING SOUND INSULATION

R.K. MACKENZIE AND M.R. WAVRO
HERIOT-WATT UNIVERSITY, EDINBURGH.

INTRODUCTION

Over the past decade there has been a growing awareness by the public to the problem of poor sound insulation in dwellings.

The seriousness of the problem in the United Kingdom was quantified by Sewell and Scholes (1) in 1978 in a paper which indicated that in a survey of 1270 walls built during the early 1970s, 55% failed to reach the performance standard of Section G2 of the Building Regulations. Furthermore, 11% of the walls had very poor performance with average aggregate deviations in excess of 80 dB. In conclusion, this report suggested that, in the short term, overall sound insulation performance could be improved by the better application of existing knowledge in design and in construction.

The causes of the poor insulation include the increasing use of lightweight building materials since the late 1980s and also the degree of poor workmanship associated with the use of these materials. However, the principal reason for this situation being allowed to develop relatively undetected throughout the 1970s until reaching the present widespread proportions is due simply to the fact that, under the U.K. Building Regulations, there is no statutory requirement for an inspection of the building to be carried out in order to check for compliance with standards with regard to sound insulation. Further, it is technically difficult to measure sound insulation and requires specially trained staff, using expensive equipment. Tests, therefore, to ensure compliance with the Building Regulation Standards are rarely carried out with the corresponding result that contractors have little incentive to give the necessary attention to the details which affect sound insulation.

This problem is not, however, unique to the United Kingdom and the lack of effectiveness of noise control requirements on a world wide scale has been reported by Schultz (2). This situation has led to an alternative approach to enforcement being considered by International Technical Organisations. In 1981, the Acoustic Commission W.51 of the International Council of Building gave special emphasis during its meeting to discussion of the subject of simplified test methods and called for member countries to undertake research into such methods. In the same year, the International Standards Organisation established a technical sub-committee, T.C.43/SC2 to 'formulate short test methods for field measurement of sound insulation for quality control purposes.'

Accordingly, in September 1982, an SERC supported research programme to develop a simplified method of measuring airborne sound insulation commenced at the Heriot-Watt University.

Development of a Simplified Method of Measuring Sound Insulation

PROGRAMME OF RESEARCH

The research programme has identified four areas of work for detailed investigation:-

Development of Source Spectrum
Study of Different Methods of Normalisation
Measurement Procedure
Study of Repeatability and Reliability.

Development of Source Spectrum

Four factors are being investigated in order to assess how they affect the optimum shape of the source spectrum:-

i Source Room Absorption
ii Transmission Loss of Wall/Floor
iii Interpretation of which range of AAD values have the most significance
iv Failure probability with regard to frequency.

Study of Different Methods of Normalisation

The question of whether it is necessary to normalise the sound level difference is of major importance, since it adds a measure of complication to what otherwise could be a very simple procedure. The only existing 'simple' test mthod viz. ASTM E 597-77T(3) includes a normalisation procedure in order to achieve a stated accuracy of within 2 dB for 'A' weighted sound level difference. A purely arbitrary target of the same accuracy has been set for the simple test under development, but without normalisation. This can only be achieved by careful design of the source spectrum together with a clearly defined measurement procedure for the operator.

Eight conditions of normalisation are being investigated including:-

i No normalisation
ii By operator estimate
iii By approximate calculation
iv By near field/far field method
v By Reference Sound Power Source
vi By R.T. Measurement using shaped spectrum
vii By R.T. Measurement using selected band (e.g. 125-500 Hz)
viii By R.T. Measurement using the full ISO/B.S. method.

Development of a Simplified Method of Measuring Sound Insulation

Study of Measurement Procedure

i Loudspeaker position and control (remote)
ii Spatial averaging of S.P.L.
iii Temporal Averaging of S.P.L.
iv Addition of absorption
v Max/Min. Vol., Max/Min. areas
vi Background noise
vii Calibration
viii Ergonomics: weight, size, power output.

Study of Repeatability and Reliability

Three factors are being considered here including:-

1. Field results vs computer results

2. Operator error

   (A) Spatial Averaging

   (B) Temporal Averaging

   (C) Conversion of $L_A - L_A1$ into D_{NTW}

3. Instrument error.

The statistical analysis has been considerably enhanced by the addition of the B.R.E. test data from the major study carried out during the 1970s.

The results from the current programme of field tests on 50 furnished and unfurnished pairs of rooms will establish the relationship between various simple test results and the full ISO/B.S. result. Given this information, the relationship can then be re-established using the 2,148 field results held in the data bank.

It is anticipated that the source spectra and associated conversion charts will be available in the second half of 1984. The British Technology Group has taken up the rights to licence the instrument/procedure. Accordingly, publication of test results is restricted by B.T.G. to basic statistical data.

References

(1) Sewell E.C. & Scholes W.E., 'Sound Insulation Performance between Dwellings built in the early 1970s'. Building Research Establishment Current Paper 20/78 (1978).

(2) Schultz T.J., 'Noise Control in Building Codes' - 9th International Congress on Acoustics, Madrid 1977.

(3) Tentative Recommended Practice for Determining a Single-Number Rating of Airborne Sound Insulation in Multi-unit Building Specifications.