ISO 1996 "Acoustics – Description And Measurement Of Environmental Noise" Round Robin Testing

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1. INTRODUCTION

Interest in environmental noise has been steadily increasing over the last several decades in Canada. The availability of accurate and consistent assessment methods are valuable to society in many ways, from the design of residential developments with regard to noise from road, rail and air traffic to the need of industry to obtain approvals for the operation of quiet facilities. As economic growth continues, the trends in urbanization indicate a slowing of urban sprawl with a corresponding increase in intensification and mixed land uses with higher and higher densities. Issues of noise and vibration will thereby continue to grow and develop.

Over the past several years, the the CSA 107.53 Working Group of the Industrial Noise Subcommittee of the Canadian Standards Association has been actively involved in the endorsement of ISO 1996 Standard "Acoustics – Description and Measurement of Environmental Noise" in Canada. As stated in the standard, there is a very large range of different methods currently in use around the world for different types of noise, and this creates considerable difficulties for international comparison and understanding. The broad aim of the ISO 1996 series is to contribute to the international harmonization of methods of description, measurement and assessment of environmental noise from all sources.

The standard specifies methods to assess environmental noise and predict the potential annoyance response of a community to outdoor long term noise exposure. For this purpose it defines a rating level which is the result of applying some adjustment for sound quality to a measured or predicted sound level determined over a reference time interval. Prior to endorsing these methods for use in Canada, the working group decided to conduct round robin testing to determine if it could be applied consistently in the Canadian context.

2. METHODOLOGY

A series of high quality stereo digitized sound effects were audited by the committee and two were chosen for further study. Both the chosen samples, rifle shots and hammering, exhibited highly impulsive characteristics. Both samples were recorded along with a calibration tone onto audio CD's and were distributed to the group for assessment.

Each of the seven round robin participants was instructed to use the measurement equipment and techniques they would normally use in assessing environmental sound. These ranged from fairly simple sound level meters to sophisticated real time analysers. Typically, the line level output of the participant's CD player was fed directly into the analysis equipment via an electrical input, although in at least one instance the sound was reproduced acoustically through a high quality loudspeaker system and fed into the analyser via a microphone.

3. RESULTS

Results were measured and reported in two ways. Firstly in terms of the L_{LM} (Logarithmic Mean Impulse Sound Level) which is presently the accepted means of measuring frequent impulses in Canada. It requires the use of measurement devices equipped with the impulse time weighting feature.

Secondly, the measurements were reported in terms of the Case 1 Rating Level, determined over an hourly time interval from short samples. The rating level is the sum of the measured sound level of each event (SEL) adjusted upwards by 12 decibels (highly impulsive adjustment), adjusted to account for the reference time interval and adjusted for the level of background sound. The results are reported in the following table.

ISO 1996 Round Robin Test Results

#	Gunshots		Hammering	
	RL	L_{LM}	RL	L_{LM}
1	66.9	84.2	67.6	86.0
2	66.3	84.3	67.8	82.0
3	66.4	84.4	65.7	81.1
4	66.4	85	--	84 - 86*
5	67	84.6	67	84.6
6	66.3	84.4	66.2	82.9
7	63.7	82.2	67.1	84.5

* dBAI Max

4. CONCLUSIONS

The gunshot results show excellent consistency, with the possible exception of #7, which used an acoustical signal introducing an expected but unknown degree of uncertainty. The rating level results for hammering showed better consistency than the L_{LM} method which is presently in use. The slightly higher range may be due to the frequency of the impulses. They were so frequent that those participants using simple meters were unable to capture all events. The resolution of this issue may involve the use of a Case 2 rating level for frequent impulses.

The results were seen by the committee to suggest that sufficient consistency was possible among all parties, with suitable controls. A decision was made to extend the testing to use real industrial sounds recorded in an Ontario rail facility. A CD player calibrated at the NRC will be circulated with the test sound for use by all participants for both Case 1 and Case 2 rating levels. The results will be reviewed late this year and may be reported in a future issue of the journal.

5. REFERENCES

[1] ISO 1996-1 Acoustics – Description, assessment and measurement of environmental noise – Part 1: Basic quantities and assessment procedures.

[2] ISO 1996-2 Acoustics – Description, assessment and measurement of environmental noise – Part 2: Determination of environmental noise levels.

[3] ISO 1996-2 Acoustics – Description, assessment and measurement of environmental noise – Part 2: Determination of environmental noise levels. Amendment 1.

[4] ISO 1996-3 Acoustics – Description, assessment and measurement of environmental noise – Part 3: Application to Noise Limits.