

Report on Hearing Conservation Consultancy to Elder Conservatorium

10-11 April, 2014

1.1 Overview

The primary purpose of this visit to Elder Conservatorium was the training and education of musicians, studio users and staff regarding hearing conservation both for themselves and those in present/future ensembles directed by them. A secondary aim of the consultancy was to spot check sound levels within two ensembles and observe engineered control measures evident in a third ensemble.

Three training sessions were carried out. The first session was delivered to a 'super forum' of staff and students covering hearing, hearing damage, risk of excessive noise exposure to musicians in various settings and effective hearing conservation techniques and management for musicians.

The second training session focused upon sound exposure mitigation and management in studio and live-sound situations and was delivered largely to music technology students. The final training session was delivered to staff and music education students responsible for ensemble direction.

Details of the findings of dosimetric spot checks are reported below.

2.1 Methods

All sound level measurements were taken according to requirements as stipulated in AS/NZS1269.11. Seven Casella CEL460 Class II data logging dosimeters and three Casella CEL632 Class I integrating sound level meters were used. All units were calibrated prior to and at the conclusion of each individual measurement session.

All of the units were belt-worn by individual musicians, with the microphones mounted on the shoulder close to the ear being measured. Musicians chosen for dosimetry were those in known 'hot-spots' according to established research and as such data presented here represents the highest expected exposure over time for each ensemble.

Measurement commenced when students arrived to warm up, and as such some durations were slightly longer than others for the same rehearsal. Additionally, players who finished their duties prior to the completion of the rehearsal returned their dosimeters at this point. If a break or rest period occurred during a rehearsal the units continued to gather data to include exposure during this rest period as per guidelines in the standard.

Artefacts (such as incidental microphone bumps) were removed on analysis by examination of profile graphs and comparison with profile graphs of neighboring units.

Each venue was inspected and the investigator discussed specific issues with each of the ensembles' directors and with a selection of students in each ensemble, particularly those playing typically high exposure level instruments.

2.2 Glossary of Terms

2.2.1 'Decibel' and 'dBA'

The decibel (dB) scale is used to measure sound. The scale itself is logarithmic to accommodate the large variations in sound pressure or intensity. Sound levels over time are usually measured using the 'A' filter (hence 'dBA') as this broadly represents the sensitivity of the human ear.

2.2.2 dBALEQ

Noise levels over time are expressed in what is known as 'level equivalent' decibels, or 'LEQ'. This is simply a representation of the total amount of sound energy experienced over the duration of sound level measurement. It may also be thought of as the level of steady state sound that would represent the same amount of sound energy actually experienced by the fluctuating sound levels typical of music rehearsal.

2.2.3 Noise dose

Because noise induced hearing loss occurs over time, the agreed level of acceptable or 'safe' dBALEQ is based upon duration. 100% of a daily noise dose is considered to be 85dBALEQ over eight hours. As duration reduces, this allowable level increases at logarithmic rate. Hence 88dBALEQ is double 85dBALEQ and considered safe for half the time (four hours). 91dBALEQ is considered safe for two hours and so on. 112dBALEQ is considered safe for approximately one minute of exposure.

2.2.4 dBC Peak

For very high transient sounds (such as a cymbal crash) the safe allowable level is measured using a C (or relatively flat) decibel weighting, which is considered more accurate at extremely high intensities. The maximum allowable peak level is 140dBC.

3.1 Noise level readings, observations and recommendations

3.1.1 Brazilian Band

Description: 14 players - Kit, bass, Gtr, Keys, 2 perc, 3 tpt, 1 trom, Alto, tenor, bari, electric vln., director.

1100hrs, 10th April 2014

Room: Madley B22 [carpet, low ceiling with one section of ceiling lower (air-conditioning duct), acoustic treatment (absorptive panels) on walls, otherwise cinderblock.

Circular configuration

Repertoire: *Various*

Instrument	Duration (mins)	dBALeq	dB(C) Peak	% of daily noise dose during rehearsal
Director	90	89.7	115.3*	55%
Tenor/Baritone Sax	93	91.5	123.0	86.3%
Trombone	92	91.9	124.3	93.1%
Drum Kit	92	92.4	136.1	105.1%
Extra percussion	91	92.0	134	94.7%
Trumpet 1	91	92.4	124.3	106.7%

* peak of 128.1 dismissed as probable artefact

Table 1. Sound level measurements of Brazilian ensemble

Hearing conservation measures evident: custom moulded ear plugs (25 dB attenuators) used by drum kit player. Part of rehearsal rhythm section only – others took a break (~11:55-->12:05). Quieter pieces interspersed with louder pieces throughout rehearsal.

Band layout was effective for all musicians in the space available, with the exception of the director who would benefit from a more lateral band layout and reduced proximity to the brass.

Recommendations: A larger room would be more suitable for this style of band/rehearsal. The band are unable to use part of room with lower ceiling which effectively reduces the footprint of band and increases the proximity of musicians to each other and to the director. The use of screens would be ineffectual with the current setup of the band. Greater use of earplugs should be encouraged generally and in particular for the principal trumpet.

3.1.2 Elder Conservatorium Symphony Orchestra

1630hrs, 10th April 2014
Elder Hall
Small orchestra
Repertoire: Mozart *Requiem*

Instrument	Duration (mins)	dBALeq	dB(C) Peak	% of daily noise dose during rehearsal
Trumpet 1	54	89.1	117.5	29%
Timpani	56	85.4	125.7	12.6%
Trombone	87	86.3	113.7	24.2%
Violin 2 (rear)	139	82.1	111.3	14.5%
Viola	143	87.0	118.9	47.6%
Bassoon	138	84.6	123.7	25.7%

Table 2. Sound level measurements of ECSO

Hearing conservation measures/controls evident: Appropriate layout of ensemble for repertoire was observed including use of risers and distance between sections. Rehearsal was structured in such a way as to limit exposure to musicians at higher risk (no brass for 2nd half of rehearsal).

3.1.3 Elder Conservatorium Wind Orchestra

This rehearsal was not monitored although an observational assessment of band layout was carried out. The layout could be slightly improved by positioning the bassoons away from the front of the trombones (further to the left if possible, otherwise behind clarinets). Distance between brass and next row of winds appeared to be well over one metre, however increased distance between brass and percussion would be appropriate in reducing peak levels (and comfort) to the brass.

4.1 Conclusions

The Elder conservatorium appears to have made great strides in noise mitigation and sound exposure management in the two years since this consultant's previous report. Regular education and training sessions, the availability of risers and personal wrap-around screens, the reported and observed use of earplugs and the high level of awareness demonstrated by students, ensemble directors and staff has ensured the conservatorium is one of the most proactive tertiary music institutions in Australia regarding hearing conservation.

Clearer strategy articulation (which is evidently underway) and further attention to administrative controls such as developing formal planning and reporting frameworks for rehearsal scheduling and programming may be of benefit, as would ongoing education and training of those students in known 'hot-spots' may help to further advance the existing culture of hearing awareness observed at the Elder Conservatorium.

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