

ANNEXURE H

NOISE AND VIBRATION

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SITE 13 SYDNEY OLYMPIC PARK
MEASUREMENTS OF EVENTS NOISE IMPACTING ON
PROPOSED COMMERCIAL DEVELOPMENT

TD346-03F02 (REV 3) EVENTS NOISE MEASUREMENTS.DOC

13 MAY 2008

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DOCUMENT CONTROL

Date	Revision History	Non-Issued Revision	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
12-05-08	Non-Issued Draft	Rev 0		RO	JN	
12-05-08	Issued Draft		Rev 1	RO		JN
12-05-08	Non-Issued Report	Rev 2		RO	JN	
12-05-08	Issued Report		Rev 3	RO		JN

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1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct events location measurements for the proposed Commercial Development at Site 13 Sydney Olympic Park and provide an assessment and report of the measurements.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 NOISE LEVELS AT SITE 13 SYDNEY OLYMPIC PARK

2.1 Results of In-Situ Measurements

Sound level measurements were made at the boundary of Site 13 of Sydney Olympic Park and the Sydney Sports Centre between 7.15pm and 8.40pm on 28 April 2008 during a netball competition with approximately 1000 spectators. A summary of the L_{90} representative background noise levels and the L_{10} representative intrusive noise levels during the event are shown in Tables 1 and 2 below. The location of the measurement is shown in the following Figure 1.

The L_{10} representative intrusive noise of the event for the purposes of building façade design is 62dB(A).

Table 1 – L_{90} (Intrusive) Noise Representative Levels for the Measurements at the Site 13 Boundary with the Sydney Sports Centre.

Location	Measurement Time	Overall dB(A)	Octave Band Centre Frequency - Hz								
			31.5	63	125	250	500	1k	2k	4k	8k
Site 13 Boundary	28/4/2008 19:17 - 19:32	54	57	60	57	51	50	51	42	32	30
Site 13 Boundary	28/4/2008 19:34 - 19:49	53	57	59	56	51	49	50	42	33	30
Site 13 Boundary	28/4/2008 19:50 - 20:05	53	57	59	55	50	49	51	42	34	30
Site 13 Boundary	28/4/2008 20:05 - 20:20	53	56	57	55	50	49	51	41	32	30
Site 13 Boundary	28/4/2008 20:21 - 20:36	53	57	58	55	50	49	51	42	32	30

Notes:

Table 2 – L_{10} (Intrusive) Noise Representative Levels for the Measurements at the Site 13 Boundary with the Sydney Sports Centre.

Location	Measurement Time	Overall dB(A)	Octave Band Centre Frequency - Hz								
			31.5	63	125	250	500	1k	2k	4k	8k
Site 13 Boundary	28/4/2008 19:17 - 19:32	59	66	67	64	60	57	55	48	40	33
Site 13 Boundary	28/4/2008 19:34 - 19:49	58	65	65	63	58	54	54	48	39	32
Site 13 Boundary	28/4/2008 19:50 - 20:05	62	68	70	69	64	59	56	49	40	34
Site 13 Boundary	28/4/2008 20:05 - 20:20	57	61	63	61	56	53	54	47	39	33
Site 13 Boundary	28/4/2008 20:21 - 20:36	59	64	66	66	59	56	55	49	40	34

Notes: The principle components of the intrusive noise emanating from the sports centre are the noise from cheering patrons and announcements in the Sports Centre and the noise of spectators arriving and leaving the venue.



Figure 1 – Aerial Map showing the measurement location at the Site 13 Boundary with the Sydney Sports Centre.

2.2 Measured Noise Level during a Rock Concert

Noise measurements at Site 13 during a Rock Concert event were not possible. Consequently noise measurements were obtained at a similar event as shown in the typical L_{10} and L_{90} 'representative intrusive and background noise levels spectra' in Table 3 below. The L_{10} representative intrusive noise levels during a rock concert for the purposes of proposed building façade design was measured to be 70dB(A).

Table 3 – L_{10} (Intrusive) and L_{90} (Background) Noise Representative Levels for an Indoor Rock Concert Venue.

Location	Noise Spectra Type	Overall dB(A)	Octave Band Centre Frequency - Hz								
			31.5	63	125	250	500	1k	2k	4k	8k
Sydney Entertainment Centre	Intrusive L_{10}	70	74	75	71	69	69	65	60	54	45
Sydney Entertainment Centre	Background L_{90}	58	64	70	65	62	54	51	45	37	28

Notes:

The principle components of the intrusive noise emanating from the rock concert venue are the noise of patrons arriving and leaving the venue and noise of the occasional loud sections of the performance.

3 CONCLUSION

Renzo Tonin & Associates have completed an assessment of the noise level at the boundary of Site 13 of Sydney Olympic Park and the Sydney Sports Centre during events at the Sydney Sports Centre. The L_{10} representative intrusive noise at the site boundary, for the purposes of building façade design, is 62dB(A) for a sports event and 70dB(A) for a rock concert.

The events in the Sydney Sports Centre would not have negative noise implications on the quiet and reasonable enjoyment in the proposed Site 13 Building at the Sydney Olympic Park, in accordance with the Australian Standard AS2107 "Acoustics – Recommended design sound levels and reverberation times for building interiors" (for Open Office Interior Design) and the DECC "NSW Industrial Noise Policy", provided that the Site 13 Building has a **minimum** building envelope insulation of **R_w35**.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient Noise The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period The period in a day over which assessments are made.

Assessment Point A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.

Background Noise Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the **L₉₀** noise level (see below).

Decibel [dB] The units that sound are measured in. The following are examples of the decibel readings of every day sounds:

0dB	The faintest sound we can hear
30dB	A quiet library or in a quiet location in the country
45dB	Typical office space. Ambience in the city at night
60dB	Martin Place at lunch time
70dB	The sound of a car passing on the street
80dB	Loud music played at home
90dB	The sound of a truck passing on the street

100dB The sound of a rock band

115dB Limit of sound permitted in industry

120dB Deafening

dB(A): A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.

Frequency Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.

Impulsive noise Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.

Intermittent noise The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.

L_{max} The maximum sound pressure level measured over a given period.

L_{min} The minimum sound pressure level measured over a given period.

L_1 The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.

L_{10} The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.

L_{90} The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).

L_{eq} The "equivalent noise level" is the summation of noise events and

integrated over a selected period of time.

<i>Reflection</i>	Sound wave changed in direction of propagation due to a solid object obscuring its path.
<i>SEL</i>	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
<i>Sound</i>	A fluctuation of air pressure which is propagated as a wave through air.
<i>Sound Absorption</i>	The ability of a material to absorb sound energy through its conversion into thermal energy.
<i>Sound Level Meter</i>	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
<i>Sound Pressure Level</i>	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
<i>Sound Power Level</i>	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
<i>Tonal noise</i>	Containing a prominent frequency and characterised by a definite pitch.