Noise and Sound Services

Hastings Community Sports Centre - Acoustical Assessment

At:-
Hibbard Drive
Port Macquarie
NSW 2444

July 2013

Report No. nss 21915 – Final

Prepared at the request of:-

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C O N T E N T S

SUMMARY

A noise assessment has been carried out for the proposed development of an expansion to Hastings Community Sports Centre at Hibbard Drive, Port Macquarie, NSW 2444.

The development relates to the expansion of the existing community sports centre by Port Macquarie – Hastings Council. Operational activities at the extension to the centre that potentially may generate and contribute to environmental noise levels relate to sporting events within the multi sports court hall, outdoor air conditioning equipment and increased traffic flows.

The nearest residential properties are located on the eastern side of Hibbard Drive. The nearest residential boundary to the existing sports centre is approximately 22 metres from the sports hall building.

The noise emission goals for the development ($L_{Aeq,\ 15\ minute}$) for each day, evening and night period is 43 dBA, 37 dBA and 35 dBA respectively.

The predicted noise level through the structure during peak periods of activity exceeds the noise goal by 1 dB for the day period and by 7 dB for the evening with the proposed construction of *'Colorbond Spandek'* and *'Aircell'* insulation to the roof with a clear path through the northern ventilation louvre.

Recommendations have been provided to increase the sound transmission loss performance of the roof to R_w 39 dB in order to achieve the required noise reduction at 125 Hz octave band centre frequency which controls the resultant 'A' weighted broadband sound pressure level. Additionally, an acoustic louvre should replace the proposed weather louvre on the northern facade or be located behind the weather louvre with a plenum separation.

Outdoor air conditioning units, should be designed to not exceed 35 dBA ($L_{Aeq,\ 15\ minute}$) at the nearest residential boundaries. To comply, the combined sound power level (re 10^{-12} watts) of all equipment should not exceed 73 dBA.

Potential noise emissions from the relocated and extended car park have been calculated and are predicted to comply with the day and evening noise goals.

The predicted increase of traffic noise emissions during peak periods south of the entrance on Hibbard Drive is less than 2 dB which complies with the noise goal of existing traffic noise plus 2 dB.

The recommendations provided within this report will ensure noise emissions from the development comply with the NSW Government guidelines and the acoustic amenity of nearby residential properties will not be adversely affected.

1. INTRODUCTION

Noise and Sound Services was requested by the Facility Design Group, Architects of 19, The Terrace, Cambewarra NSW 2540 to carry out a noise assessment for the proposed development of an expansion to Hastings Community Sports Centre at Hibbard Drive, Port Macquarie, NSW 2444.

The development relates to the expansion of the existing community sports centre by Port Macquarie – Hastings Council. The purpose of the noise assessment is to provide an independent and accurate assessment of the effect of noise from the centre on the existing neighbouring properties in line with the requirements provided by NSW Government noise policies.

2. SITE AND DEVELOPMENT DESCRIPTION

2.1 Site Description

The existing site, surrounding land and properties are shown below in Figure 1. Figure 2 demonstrates the location of the noise logger and the location of attended measurements in relation to the nearest residential properties.

Hibbard Drive is a local road connecting to Hastings River Drive which is considered to be a sub-arterial road. Intermittent residential traffic typically occurs along Hibbard Drive with frequent and often, during the day, continuous residential and commercial traffic on Hastings River Drive. Traffic volumes increase on Hibbard Drive, between Hastings River Drive and the first entrance to the sports centre car park, during peak periods of sporting activity such as late Friday afternoon.

The nearest residential properties are located on the eastern side of Hibbard Drive. The nearest residential boundary to the existing sports centre is approximately 22 metres from the sports hall building.

Typically, the noise environment of the area is influenced by local and distant traffic, aircraft landings and take offs, and fauna. Aircraft types are typically single or twin propeller aircraft.

Figure 1: Site Location. Source: Google Earth.

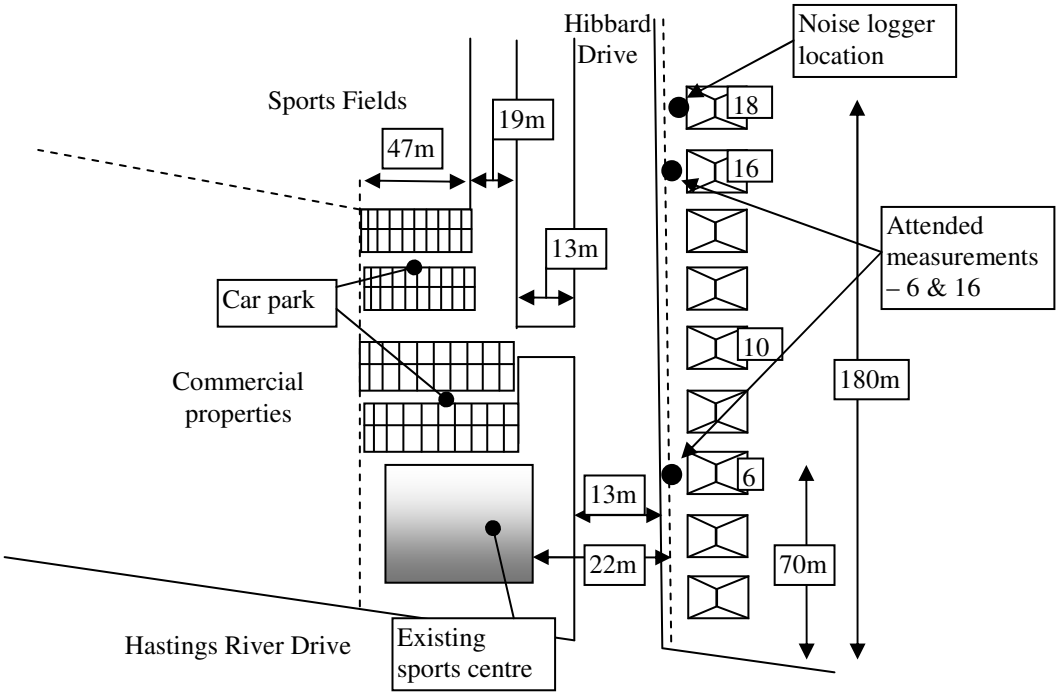


Figure 2: Environment Layout and Measurement Locations. Not to Scale and Dimensions are Approximate.

2.2 Development Description

The proposed extension of the sports centre is shown in drawings numbered A01 to A05, issued 8/5/2013 and produced by Facility Design Group. The development includes a multiple sports court hall, multi-purpose rooms, activity rooms, lounge areas and utilities. The existing car park will be extended as shown in Figures 3 and 4. The location of the building development in relation to the existing layout is shown in Figure 3. The centre is expected to operate 7 days per week, 10.00 am to 10.00 pm.

Activities at the extension to the centre that potentially may generate and contribute to environmental noise levels relate to sporting events within the multi sports court hall. Outdoor air conditioning equipment and increased traffic may also influence existing environmental noise levels and will be considered within the assessment.

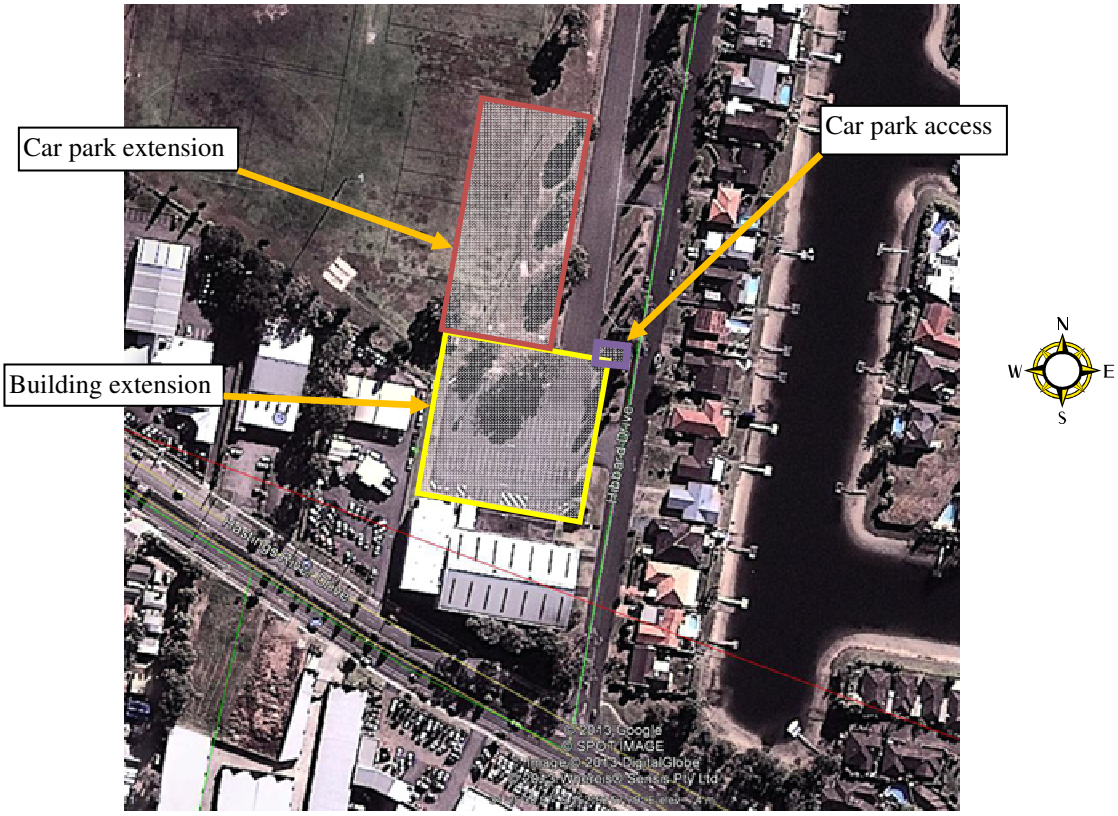


Figure 3: Location of Proposed Extended Sports Hall and Car Park. Not to Scale.

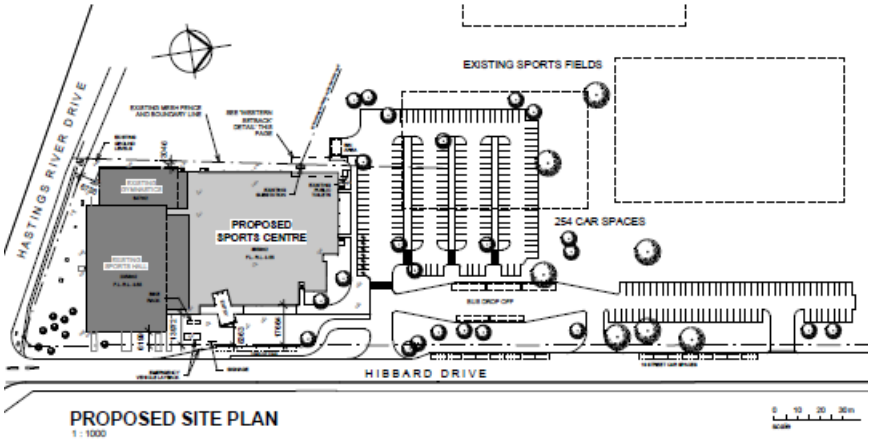


Figure 4: Site Plan reproduced from architectural documentation produced by Facility Design Group.

3. CRITERIA

There are no specific Council, State or Federal criteria for noise emissions from sport centres. However this section reviews the NSW Government criteria for other noise sources and developments. These may be used as a basis for realistic noise goals for sport centres.

3.1 NSW Government Criteria

The NSW Government, via the Environment Protection Authority (EPA), provide guidelines for many industrial, commercial and domestic types of noise sources. The primary aim of environmental noise control is to minimise the occurrence of offensive noise in the community. To be both effective and equitable, the determination and application of environmental noise control measures must take into account many factors for example: -

- the variation in response between individuals to any noise;
- the inherently noisy characteristics of many activities;
- the circumstances within which the noise occurs;
- the technical and economic feasibility for noise control; and
- the social worth of the activity.

Offensive noise is defined in the NSW Protection of the Environment Operations Act 1997 (POEO Act) as being noise:-

a) that, by reason is of its level, nature, character or quality, or the time at which it is made, or other circumstances:

i. Is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or

ii. interferes unreasonably with (or is likely to Interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

b) that, is of a level, nature, character or quality prescribed by the regulations or that is made at a time or in other circumstances, prescribed by the regulations.'

The NSW Government, also state that social surveys have indicated that noise from any particular source will be audible to many people in the community when that noise exceeds the background level by more than 5 decibels (dB). The noise may have characteristics which are pleasant or unpleasant to the listener.

Technically the background is found from the noise level that is present for 90% of the time of the measurement periods (usually 15 minutes each) and this is known as the $L_{A90,\ 15\ minute.}$ The source noise is found from the average of the sound energy (again usually 15 minutes samples), which is known as the $L_{Aeq,\ 15\ minute.}$ The 5 dB over background criterion is primarily aimed at industrial or commercial machine noise or domestic machine noise such as air conditioners.

3.2 NSW Noise Guide for Local Government

It has been stated in the NSW Government's Noise Guide for Local Government (NGLG) that, *'A noise source is generally considered to be intrusive if noise from the source, when measured over a 15 minute period exceeds the background noise by more than 5 dB'*. It is assessed at the most affected point on or within the neighbouring residential property (unless that residence is more than 30 metres from the boundary). Intrusive noise is not the same as offensive noise as defined in the POEO Act 1997. Intrusive noise can represent offensive noise, but whether this is always the case depends on the source of the noise, noise characteristics and cumulative noise levels.

3.3 NSW Government Industrial Noise Policy

The assessment procedure for industrial and commercial noise sources given in the Industrial Noise Policy (2000) has two components:-

- **Controlling intrusive noise impacts; and**
- **Maintaining noise level amenity;**

In assessing the noise impact of industrial or commercial noise sources both components must be taken into account for residential receivers, but, in most cases, only one will become the limiting criterion. The project-specific noise goals reflect the most stringent noise level requirement. It is derived from intrusive and amenity criteria and this is used to set a benchmark against which noise impacts and the need for noise mitigation are assessed.

3.3.1 Intrusive Noise Impacts

The NSW Government in their Industrial Noise Policy (2000) states that:- *'The intrusiveness of an industrial noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the L_{Aeq} descriptor) measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB.'* Thus, when considering the environmental consequence of noise from a specific source, any increase above the background sound pressure level, which exceeds 5 dB, may be offensive.

The perception of noise and its level of offensiveness depend greatly on the broader situation within which it occurs. Noise that might intrude into a resting or sleeping place may be found offensive whereas the same noise occurring in a market place or noisy working area may pass unnoticed. The concept of *'background + 5 dB'* derives from this consideration.

The NSW Government state that where the existing background noise level at the receptor is less than 30 dBA, as may occur in a quiet suburban or rural area, then 30 dBA should be assumed to be the existing background noise level.

Where the noise source contains characteristics such as prominent tonal components, impulsiveness, intermittency, irregularity or dominant low-frequency content, adjustments to the measured level are applied to allow for the increase in the annoyance value.

3.3.2 Protecting Noise Amenity

In the Industrial Noise Policy it is stated that *'To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1."*

The relevant part of the NSW Government's recommended levels are given in Table 1 below:-

TABLE 1 – RECOMMENDED NOISE LEVELS FROM INDUSTRIAL NOISE SOURCES

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level (dBA)	
			Acceptable	Recommend Maximum
Residence	Rural	Day Evening Night	50 45 40	55 50 45
Residence	Suburban	Day Evening Night	55 45 40	60 50 45
Residence	Urban	Day Evening Night	60 50 45	65 55 50
Residence	Urban/Industrial Interface – for existing situations only	Day Evening Night	65 55 50	70 60 55
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

According to the Industrial Noise Policy, Hibbard Drive, Port Macquarie, is classified as located within a suburban area. Hence the acceptable amenity noise level (L_{Aeq}) for a suburban area is **55 dBA** for the day time, **4**5 **dBA** for the evening and **40 dBA** for the night.

3.4 NSW Government Criteria for Road Traffic Noise.

The NSW Government has produced criteria for road traffic noise *'NSW Road Noise Policy'* (RNP) March 2011. This provides criteria for land use developments with potential to create additional traffic on local roads. Here the criterion is 55 dBA $L_{Aeq,\ 1\ hour}$ for day time (7:00 hours until 22:00 hours) and 50 dBA $L_{Aeq,\ 1\ hour}$ for night time (22:00 hours until 07:00 hours). The RNP states:- *"Where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. A secondary objective is to protect against excessive decreases in amenity as the result of a project by applying the relative increase criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person."* These criteria refer to additional traffic created by the development not to the existing traffic or traffic from other developments.

4. NOISE SOURCE MODELS

Noise models have been prepared for the occurrence of noise emissions from the sports centre. This section provides details of the calculations and noise models for each scenario.

4.1 Noise Modelling Specifications

The source noise has been modelled using the International Standard ISO 9613-2 (1996(E)) '*Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation'*. This Standard specifies methods for the description of noise outdoors in community environments. The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of attenuation. The method allows for downwind propagation conditions namely:-

- wind direction within an angle of ± 45° of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region with the wind blowing from source to receiver, and
- wind speed between approximately 1 m/s and 5 m/s measured at a height of 3 m to 11 m above the ground.

4.2 Basic Noise Modelling Equation

The equivalent continuous downwind sound pressure level (L_{Aeq}) at each receiver point for noise generated within a building structure has been calculated using the equation,:-

$$\mathbf{L_{Aeq} = (L_{Aeq,\,int} + 10\log_{10} S - R) - 14 + D_c - A}$$

Where: $L_{Aeq,\,int}$ is the sound pressure level within the space;
S is the area of the building envelope radiating noise;
R is the sound reduction index of the building envelope component;
D_c is directivity correction; and
A is the attenuation that occurs during the propagation from source to receiver.

The attenuation term *A* in the equations above is given by, $\boldsymbol{A = A_{div} + A_{atm} + A_{gr} + A_{bar} + A_{misc}}$

Where: A_{div} is the attenuation due to geometric divergence;
A_{atm} is the attenuation due to atmospheric absorption;
A_{gr} is the attenuation due to the ground effects;
A_{bar} is the attenuation due to a barrier; and

A_{misc} is the attenuation due to miscellaneous other effects.

The last term (A_{misc}) generally refers to miscellaneous propagation through foliage, industrial sites and areas of houses. Due to the vicinity of the development to the neighbouring dwellings the attenuation due to atmospheric absorption, ground effects and other miscellaneous effects are of minor significance at this site.

4.3 Noise Models

Noise models have been developed to assess the potential noise emission from indoor sports and car park activity. Indoor sporting activity is based on previously measured noise levels recorded at the edge of a basketball game within the Hornsby Police & Community Club. The result shown below is a 'snapshot' of the typical L_{Aeq} noise level generated during a game.

TABLE 2 – INDOOR BASKETBALL NOISE LEVELS.

Descriptor	dBA	Octave Band Centre Frequencies - Hz							
		63	125	250	500	1k	2k	4k	8k
$L_{eq,15\ minute}$	73	73	77	71	69	70	65	58	48

For the new sports hall 3 dB is added to the above values to account for full occupancy of each playing area.

4.3.5 Car Park Activity

The proposed development includes a relocation/extension of the car park to the north to provide 387 parking spaces. Table 3 below gives measured noise levels of intermittent and impulsive noise from typical car activities, normalised to 5 metres. Specific potential distances to residences will be considered in the assessment for traffic noise to be provided at a later date.

TABLE 3 – SOUND PRESSURE LEVELS AT 5 METRES FOR CAR MOVEMENTS.

Source	Sound Pressure Level ($L_{A1,\ 1\ minute}$) at 5 metres (dBA)
Car Starting	57
Car Door Closing	65
Car Accelerating	65

5. AMBIENT NOISE MEASUREMENTS

Existing ambient noise levels have been monitored over a period in excess of 7 days. Additionally attended measurements were carried out during the afternoon of Friday 15th March 2013 to gain a greater appreciation of the noise environment in the vicinity of the existing sports centre. Measurement procedures and instrumentation are detailed below.

5.1 Ambient Noise Monitoring - Instrumentation

The instrumentation used for monitoring of the existing environment consisted of an 'ARL' - Type 2 Environmental Noise Logger, serial number 194550. This instrument conforms to Australian Standard 1259 "Acoustics - Sound Level Meters", (1990) and has an accuracy suitable for both field and laboratory use.

The instrumentation used during the attended noise measurement consisted of a Brüel and Kjær sound level meter model 2250 (serial no. 2446904). The 2250 conforms to Australian Standard AS IEC 61672.1-2004 : '*Electroacoustics - Sound level meters – Specifications*' as class 1 precision sound level meter and has an accuracy suitable for both field and laboratory use.

The calibration of the logger and the meter was checked before and after the measurement period with a Brüel and Kjær acoustical calibrator model 4231 (serial no. 2445349). No significant system drift occurred over the measurement period.

The sound level meter, noise logger and calibrator have been checked, adjusted and aligned to conform to the factory specifications and issued with conformance certificates within the last 24 months as required by the regulations. The internal test equipment used is traceable to the National Measurement Laboratory at C.S.I.R.O., Lindfield, NSW, Australia.

5.2 Ambient Noise Monitoring Procedure

Free field continuous noise monitoring was carried out from Friday 15th March 2013 through to Sunday 24th March 2013. The noise logger was located within the front garden of 18 Hibbard Drive, Port Macquarie, approximately 1 metre in front of the facade to the dwelling (see Figure 2 for location).

Weather conditions during the monitoring period were generally acceptable for the representation of typical noise levels with an occasional light rain shower occurring:

- Monday 18/3/2013 between 2.00pm and 2.30pm, 12.00pm and 11.00pm
- Wednesday 20/3/2013 between 12.00 am and 12.03 am.

Wind speeds were not significant during the period and temperatures ranged from 19º to 31º C.

Attended noise measurements were carried out alongside the Hibbard Drive residential boundaries of 6 and 16 Hibbard Drive, approximately 3 metres from the road edge. Three 15 minute period measurements were taken at 6 Hibbard Drive between 3.00pm and 3.50pm and two 15 minute period measurements were taken at 16 Hibbard Drive between 4.00pm and 4.40pm of Friday 15th March 2013. The 'A' frequency weighting and the 'fast' time weighting were used exclusively.

Background and ambient noise levels in the area are dominated by traffic along Hastings River Drive and Hibbard Drive, community noise and native fauna.

5.3 Background and Ambient Noise Monitoring Results

Long term measured ambient noise levels are assessed according to the NSW Industrial Noise Policy in terms of L_{Aeq} and L_{AF90} for the time periods defined as: Day: 7:00 am – 6:00 pm, Evening: 6:00 pm – 10:00 pm and Night: 10:00 pm – 7:00 am.

The recorded L_{AF90} levels determine the Rating Background Level (RBL). The RBL is defined as the median value of the tenth percentile value for the recorded L_{AF90} levels for the complete monitoring period of 7 days. The tenth percentile is also referred to as the Assessment Background Level (ABL). The resultant RBL (L_{A90}) and ambient (L_{Aeq}) levels for each period are summarised below in Table 4. The full statistical noise measurement results are shown in graphical form in Appendix A.

As shown within the graphs of Appendix A, an unusual noise event occurs at the logger location at approximately 7.30 pm each night except Sunday. This noise event may be generated by vehicles, domestic appliances or garden irrigation and is considered as extraneous noise and as such removed from the logged data for the calculation of the RBL (L_{AF90}) and amenity levels (L_{Aeq}).

Additionally a charity event occurred on the playing fields during Saturday and Sunday the 16th and 17th March 2013. The event attracted an increased number of vehicles and people and potentially influenced the typical noise environment of the area. The RBL (L_{AF90}) and ambient (L_{Aeq}) levels for each period have therefore been assessed with and without the logged data for Saturday and Sunday. The noise assessment is based upon the results without the data for Saturday and Sunday as shown in Table 4.

TABLE 4 – SUMMARY OF EXISTING NOISE LEVELS

Time of Day	Rating Background Noise Levels (L_{AF90}) dBA	Log Average Existing Ambient Noise Levels (L_{Aeq}) dBA
Day (07:00 – 18:00)	38	56
Evening (18:00 – 22:00)	32	54
Night (22:00 – 07:00)	29	48

Note 1- All levels rounded to the nearest whole decibel

Whilst noise levels generated during the charity event are not applicable to the noise assessment for the sports centre development, the change in environmental noise levels occurring have been calculated and are presented below in Table 5. The only change of significance occurred during the Saturday evening with a 10 dB increase of the L_{AF90} background level.

TABLE 5 – CHARITY EVENT INFLUENCE ON NOISE ENVIRONMENT

Period	Descriptor	Saturday with Charity Event[3]	Following Saturday[3] 23/3/2013	Change in level with event
Day	ABL[1] - dBA	40.5	36.5	+4
	Amenity[2] - dBA	57.7	56.3	+1.4
Evening	ABL - dBA	42.5	32.5	+10
	Amenity - dBA	60	58.8	+1.2
Night	ABL - dBA	31	30.5	+.5
	Amenity - dBA	50.5	48	+2.5

Notes: [1] Assessment background for the period.
[2] L_{Aeq} level for the period.
[3] Extraneous noise included.

Attended noise measurement results are shown below in Table 6.

TABLE 6 –ATTENDED MEASUREMENTS FRIDAY 15/3/2013

Location	Time of Day	Sound Pressure Level		Comments
		dB $L_{Aeq, 15\ minute}$	dB $L_{AF90, 15\ minute}$	
Boundary of 6 Hibbard Drive	3.00pm – 3.15pm	61	50	No activity at centre
	3.20pm – 3.35pm	61	51	17 cars north 11 cars south
	3.35pm – 3.50pm	61	50	25 cars north 11 cars south 21 cars to car park
Boundary of 16 Hibbard Drive	4.05pm – 4.20pm	62	46	22 cars north 9 cars south 30 cars in car park
	4.25pm – 4.40pm	61	44	9 cars north 9 cars south 40 cars in car park

Note 1- All levels rounded to the nearest whole decibel

The following observations were noted during the noise measurement periods:

- Initially local infrequent traffic on Hibbard Drive, increasing after 3.30 pm.
- Frequent continuous traffic along Hastings River Drive.
- Maximum (L_{AFmax}) noise levels from propeller driven aircraft taking off and landing ranged from 58 to 61 dBA.
- Activity outside the sports centre increased from 3.30pm with outdoor athletics commencing from 4.30pm (Friday).
- By 4.45pm 59 cars in car park and 8 cars parked on Hibbard Drive alongside the centre. Steady flow of cars into car park from 4.30pm at a rate of approximately 25 cars in 15 minutes.

$L_{Aeq, 15\ minute}$ noise levels measured at the boundary of 6 and 16 Hibbard Drive were 3 to 4 dB higher than the levels recorded at the logger location. The logger was located approximately 11 metres inside the boundary of 18 Hibbard Drive and a reduction of traffic noise (relates to traffic on Hibbard Drive) by 3 to 4 dB can be expected between the boundary and the logger location.

Background $L_{AF90, 15\ minute}$ noise levels were found to be 6 dB lower at the logger location (18 Hibbard Drive) than at the boundary of 6 Hibbard Drive. This demonstrates the influence on the background level of continuous traffic noise

generated along Hastings River Drive. 6 Hibbard Drive is approximately 70 metres from Hastings River Drive whereas number 18 is approximately 180 metres.

5.4 Existing Road Traffic Noise

Ambient 15 minute energy average ($L_{Aeq,\ 15\ minute}$) noise levels recorded by the noise logger are the result of traffic noise generated on Hibbard Drive and Hastings River Drive. The location of the logger permits the recorded levels to be assessed according to the procedures provided by the NSW Road Noise Policy (RNP) March 2011.

The first calculation determines the $L_{Aeq,\ (15\ hour)}$ level for the period 7.00 am – 10:00 pm and the $L_{Aeq,\ (9\ hour)}$ for the period 10:00 pm – 7.00 am. Whilst the results do not apply to the residential properties for this project the values are shown below in Table 7 for comparison. Extraneous noise events occurring during most evenings and road traffic noise occurring during the charity event has been removed from the logged data for the calculation to provide a reflection of typical traffic noise levels.

TABLE 7 –ROAD TRAFFIC NOISE ($L_{Aeq,\ (period)}$)

Location	Day Time Noise Level dBA - $L_{Aeq,\ (15\ hour)}$ (7.00am – 10.00pm)	Night Time Noise Level dBA - $L_{Aeq,\ (9\ hour)}$ (10.00pm – 7.00am)
18 Hibbard Drive	58	49

Note 1- All levels rounded to the nearest whole decibel

The noise assessment criteria for existing residences affected by additional traffic on existing local roads generated by land use developments is $L_{Aeq,\ (1\ hour)}$ 55 dBA for the day (7.00 am – 10.00 pm) and 50 dBA for the night (10.00 pm – 7.00 am). The measured levels are therefore assessed for the one hour period.

The day and night $L_{Aeq,\ (1\ hour)}$ is defined as the median value of the tenth percentile value for the logarithmic averaged $L_{Aeq,\ (1\ hour)}$ levels for the complete monitoring period of 7 days. The results are shown below in Table 8. Extraneous noise events have been deleted.

TABLE 8 – ROAD TRAFFIC NOISE ($L_{Aeq, (1\ hour)}$)

Location	Day Time Median Value **dBA - $L_{Aeq, (1\ hour)}$ (7.00am – 10.00pm)**	Night Time Median Value **dBA - $L_{Aeq, (1\ hour)}$ (10.00pm – 7.00am)**
18 Hibbard Drive	59	55

Note 1- All levels rounded to the nearest whole decibel

Analysis of night time road traffic noise indicates that the tenth percentile for each night time period is controlled by the increase in traffic occurring between 5.00 am and 7.00 am which will be unaffected by the development of the sports centre.

6. NOISE GOALS

As discussed in section 3.3 the assessment procedure given in the Industrial Noise Policy (2000) has two components to determine project-specific noise goals: Intrusive noise impacts and noise level amenity. The noise goals relevant to each assessment period are given below.

6.1 Intrusive Criteria

To ensure that on-site stationary noise sources are not intrusive, the $L_{Aeq, 15\ minute}$ noise level due to stationary sources should not exceed the RBL (refer section 5.3) by more than 5 dB when measured at the affected residential property boundary. The intrusive noise criterion ($L_{Aeq, 15\ minute}$) for each day, evening and night period is therefore 43 dBA (38+5), 37 dBA (32+5) and 35 dBA (30+5) respectively. The $L_{Aeq, 15\ minute}$ noise criterion (night) of 35 dBA applies to noise emissions from mechanical services whereas the $L_{Aeq, 15\ minute}$ noise criterion of 38 dBA applies to noise emissions through the development structure resulting from operations at the centre such as basketball games.

6.2 Amenity Criteria

The amenity criteria are used to limit the maximum ambient noise levels within an area from stationary noise sources associated with the proposed development. To protect the acoustic amenity of land users the combined noise from all stationary noise sources should not exceed the Acceptable Noise Level (ANL) calculated according to the procedures as given in chapter 2 of the NSW Industrial Noise Policy. The amenity assessment relates only to industrial-type noise and does not include road, rail or community noise. Modifications are

made to the recommended ANL to account for the existing level of industrial (or commercial) noise. Where existing levels are unaffected by industrial noise the ANL will apply. In this case the measured existing amenity level is the result of traffic noise and is unaffected by industrial or commercial noise. The ANL therefore applies.

The amenity criteria for the development are shown in Table 9 below.

TABLE 9 – SUMMARY OF AMENITY CRITERIA

Type of Receiver	Time of Day	Recommended Acceptable Noise Level ($L_{Aeq, period}$)	Existing Amenity Level ($L_{Aeq, period}$)	Amenity Noise Criterion ($L_{Aeq, period}$)
Residence Suburban location	Day	55	58	55
	Evening	45	56	45
	Night	40	49	40

Note - All levels rounded to the nearest whole decibel

6.3 Project Specific Noise Criteria

Applying both the amenity and intrusive criteria to the development and adopting the more stringent of the two, determines the project specific noise levels. Project specific noise criteria for stationary noise sources are given below in Table 10.

TABLE 10 – PROJECT SPECIFIC NOISE CRITERIA

Time of Day	Intrusive Noise Criteria dB - ($L_{Aeq,15\ minute}$)	Amenity Noise Criterion dB - ($L_{Aeq, period}$)	Project Specific Noise Criterion dB - ($L_{Aeq,15\ minute}$)
Day (07:00 – 18:00)	43	55	43
Evening (18:00 – 22:00)	37	45	37
Night (22:00 – 07:00)	35	40	35

Projected operating hours of the centre are from 10.00 am to 10.00 pm. The noise goals ($L_{Aeq, 15\ minute}$) for operations within the centre are therefore 43 dBA for the day and 37 dBA for the evening at the nearest residential boundaries. Mechanical services should be designed to not exceed 35 dBA $L_{Aeq, 15\ minute,}$ at the nearest residential boundary, to account for potential ongoing operation of services beyond closure of the centre.

7. NOISE ASSESSMENT

Noise sources associated with the development include noise generated within the multiple sports court hall, mechanical services and car park activities. Each source is assessed below.

7.1 Multiple Sports Court Hall

The assessment considers the worst case scenario of the sports courts fully occupied for basketball and the weakest path for sound transmission through the steel clad walls at high level and the roof. Painted precast concrete panels will be installed at the lower level. A further consideration is noise within the sports centre generated by rain and the expansion and contraction of the metal roof.

The roof area exposed to the east is calculated to be 1406 m^2 and the wall area exposed to the east 133 m^2 which includes the northern facade. The ventilation opening on the northern facade is 13 m^2 and 8 roof mounted turbo vents are included in the calculation. The steel roof and walls are proposed to be constructed of *'Colorbond Spandek'* with 10 mm thick *'Aircell'* insulation to the inside/underside.

Based on an internal L_{Aeq} sound pressure level of 76 dBA for 3 courts occupied for basketball, the predicted $L_{Aeq,\ 15\ minute}$ sound pressure level at the nearest residential boundary to the east is 44 dBA. The calculation includes 0.42 mm thick *'Colorbond Spandek'* to the roof and walls with *'Aircell'* insulation.

The predicted level exceeds the noise goal by 1 dB for the day period and by 7 dB for the evening. The proposed metal wall and roof construction provides a noise reduction of R_w 20 dB and a clear path through the ventilation opening on the northern wall. The sound transmission loss performance of the roof should be increased to R_w 39 dB to achieve the required noise reduction at the octave band frequency centred on 125 Hz. This frequency band controls the resultant 'A' weighted broadband sound pressure level.

The required noise reduction of Rw39 by the roof can be achieved with the following construction.

- 0.42 mm thick *'Colorbond Spandek'* roof
- 50 mm thick mineral wool with a density of 80 kg/m^3
- 13 mm thick gypsum plasterboard, 150 mm below the metal roof.

The 150 mm cavity between the plasterboard and metal deck may be increased to suit the construction. Additional thermal or moisture barriers may be required and advice should be sought from qualified thermal engineers.

The 80 kg/m^3 mineral wool should be installed hard against the underside of the *'Spandek'* roof to achieve the added benefit of reducing rain noise and expansion/contraction noise. Installation instructions provided by the roof supplier (such as '*BlueScope Lysaght'*) should be followed.

The additional insulation and plasterboard as described for the roof is not necessary for the walls.

A 300 mm deep acoustic louvre should replace or be installed behind the louvre proposed for ventilation on the northern facade. A 300 mm deep plenum should be located between the acoustic louvre and the outer louvre if the outside louvre is to be retained. The louvre when installed should provide the following minimum decibel acoustic performance as given in Table 11 below.

TABLE 11 – NORTHERN FACADE ACOUSTIC LOUVRE

	System	Depth	Octave Band Centre Frequencies - Hz							
			63	125	250	500	1K	2K	4K	8K
STL	Acoustic Louvre	300	4	7	9	13	14	12	12	8
NR	Acoustic Louvre	300	10	13	15	19	20	18	18	14

NR – Noise Reduction STL – Sound Transmission Loss

By implementing the above recommendations the $L_{Aeq,\ 15\ minute}$ noise level at the nearest residential boundary is predicted to be 34 dBA which complies with the day and evening noise goals.

7.2 Doors on Northern Facade

Doors located on the northern facade should only be used in emergency situations and provide a sound transmission loss of not less than R_w 30 dB. Complying constructions would be not less than 40 to 43 mm solid hardwood timber and be installed with close fitting edges to the frame. Alternative constructions may be required to comply with fire and safety standards but should also achieve the sound transmission loss performance of R_w 30 dB.

7.3 Mechanical Services

Outdoor air conditioning units will be located over the shallow roof between the new sports hall and the existing sports hall approximately 52 metres from the eastern residential boundaries. Noise emissions from building services should not

exceed 35 dBA ($L_{Aeq,\ 15\ minute}$) to comply with the day, evening and night noise criterion at the nearest residential boundaries.

The number and size of noise sources is not known at this time. However the combined sound power level (re 10^{-12} watts) of all equipment should not exceed 73 dBA. The combined sound power is calculated by the logarithmic addition of the sound power level for each noise source or equipment. Noise control equipment such as acoustic louvres, duct attenuators and noise barriers may be required to achieve the stated noise goals. A detailed assessment should be carried out during the construction certificate stage.

7.4 Car Park Noise Emissions

Informal car parking currently exists along the access road to the sports fields. The future car parking arrangements will formalise parking on the access road and extend parking further west. Car parking activities will occur between 40 and 117 metres from the residential facades and 28 to 105 metres from the residential boundaries.

Friday afternoon is considered to be one of the peak periods for car park activity as people attend outdoor sports fields and the indoor sporting activities. During the afternoon of Friday 15th March 2013 the highest rate of cars entering the car park was counted at 25 during one 15 minute period. The $L_{Aeq,\ 15\ minute}$ noise level as a result of car park activities is calculated by applying the car park noise levels, as stated in section 4.3 and the variable distance of 28 to 105 metres to the residential boundaries. The calculations demonstrate a variable $L_{Aeq,\ 15\ minute}$ noise level of 36 to 48 dBA at the residential boundaries with a potential average of 41 dBA. The calculation is based on peak traffic flows into and out of the car park which would typically occur during the day time period. The average level of 41 dBA complies with the noise goal of 45 dBA for the day time period.

7.5 Road Traffic Noise

Existing and future traffic flows for peak periods have been provided by *'RoadNet Pty Ltd'* within their draft report 13029P dated 14 June 2013.

Surveys undertaken by *'RoadNet'* during the peak hour period of Friday afternoon between 5.00pm and 6.00pm indicate that existing traffic flows along Hibbard Drive to the south of the entrance to the sports centre are in the order of 342 vehicles per hour with 113 vehicles travelling south and 229 vehicles travelling north. The predicted increase of traffic during the peak period is 90 vehicles per hour to the north and 42 vehicles per hour to the south.

Existing and future traffic flows to the north of the proposed sports centre entrance are of negligible significance and do not require further study.

The predicted increase of traffic noise emissions during peak periods south of the entrance on Hibbard Drive is less than 2 dB which complies with the noise goal of existing traffic noise plus 2 dB (see section 3.4). Traffic flows and the predicted increase of noise emissions are summarised below in Table 12.

TABLE 12 – PREDICTED INCREASE OF TRAFFIC NOISE LEVELS FOR THE PEAK PERIOD

Traffic Direction	Existing Traffic Flows	Predicted Additional Traffic	Predicted Increase In Traffic Noise
Hibbard Drive south of sports centre entrance	342	132	<2dB

8. CONCLUSIONS

Noise goals for the extension of the existing sports centre have been derived according to the procedures provided by the NSW Industrial Noise Policy (2000). Recommendations for the roof structure and ventilation louvre have been provided in section 7.1 above which, if implemented, will ensure noise goals related to noise transmission through the structure are achieved during peak periods of operation.

Outdoor air conditioning units, located over the shallow roof between the new sports hall and the existing sports hall, should be designed to not exceed 35 dBA ($L_{Aeq,\ 15\ minute}$) at the nearest residential boundaries. To comply, the combined sound power level (re 10^{-12} watts) of all equipment should not exceed 73 dBA.

Potential noise emissions from the relocated and extended car park have been calculated and are predicted to comply with the day and evening noise goals.

The predicted increase of traffic noise emissions during peak periods south of the entrance is less than 2 dB which complies with the noise goal of existing traffic noise plus 2 dB.

The recommendations provided within this report will ensure noise emissions from the development comply with the NSW Government guidelines and the acoustic amenity of nearby residential properties will not be adversely affected.

Date	Prepared by:	Status
31 May 2013	Paul Thomas MAAS	Draft
11 July 2013	Paul Thomas MAAS	Draft Rev 1
	Checked by:	**Status**
12 July 2013	Ken Scannell MSc MAAS MIOA	Final

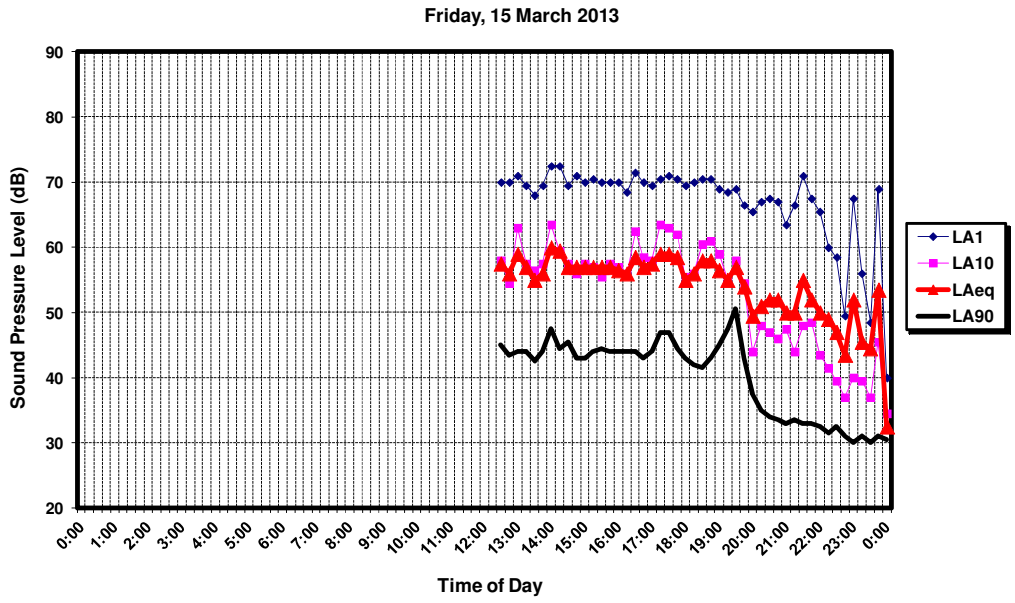
Important Notes. *All products and materials suggested by 'Noise and Sound Services' are selected for their acoustical properties only. All other properties such as air flows, aesthetics, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, grout or tile cracking, loading, shrinkage, smoke, ventilation etc are outside of 'Noise and Sound Services' field of expertise and* ***must be*** *checked with the supplier or suitably qualified specialist before purchase.*

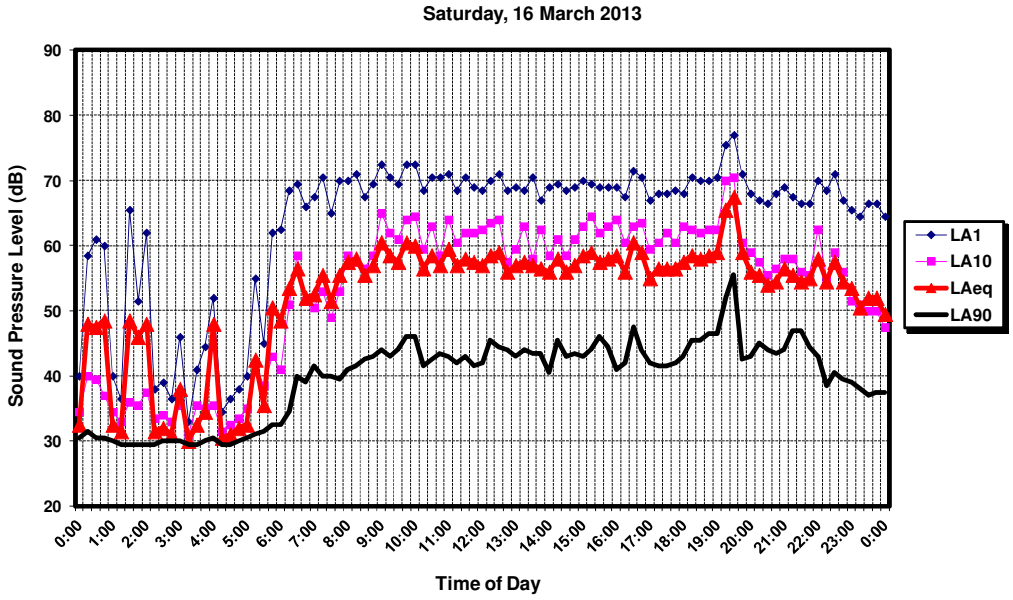
APPENDIX A – MEASURED SOUND PRESSURE LEVELS

Environmental noise levels can vary considerably with time; therefore it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the L_{A10} noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The L_{A90} level is the noise level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the "background" noise level. The L_{Aeq} level represents the average noise energy during the measurement period. This level is often referred to as the 'ambient' noise level.

The measurements results from ambient noise monitoring are shown below.

Logged Ambient Noise Levels
18 Hibbard Drive, Port Macquarie




Saturday, 16 March 2013
Sound Pressure Level (dB)
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30
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3:00
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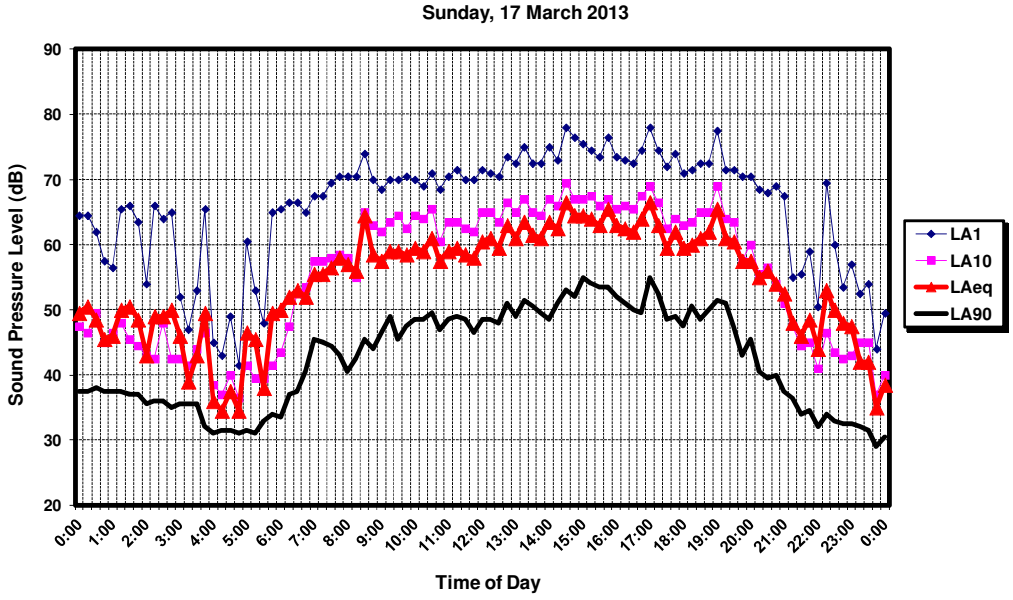
0:00
Time of Day
LA1
LA10
LAeq
LA90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Sound Pressure Level (dB)
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2:00
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13:00
14:00
15:00
16:00
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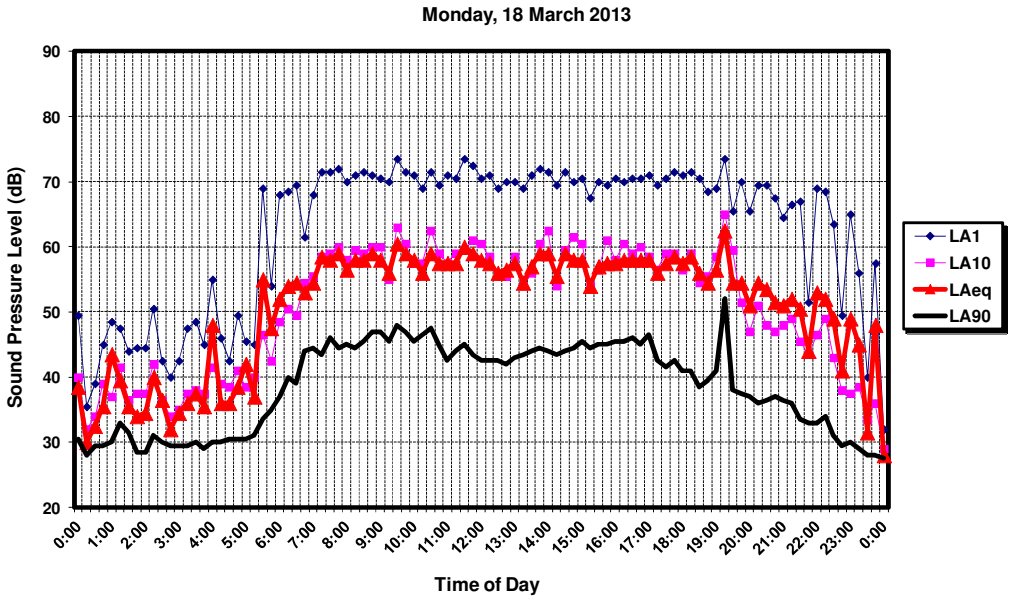
0:00
Time of Day
LA1
LA10
LAeq
LA90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16:00
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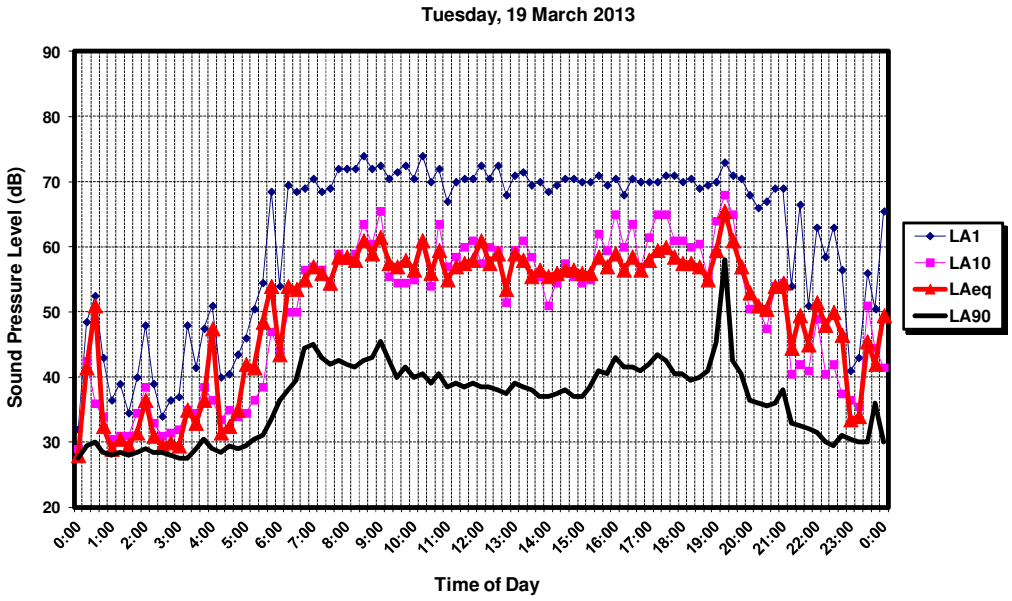
0:00
Time of Day
LA1
LA10
LAeq
LA90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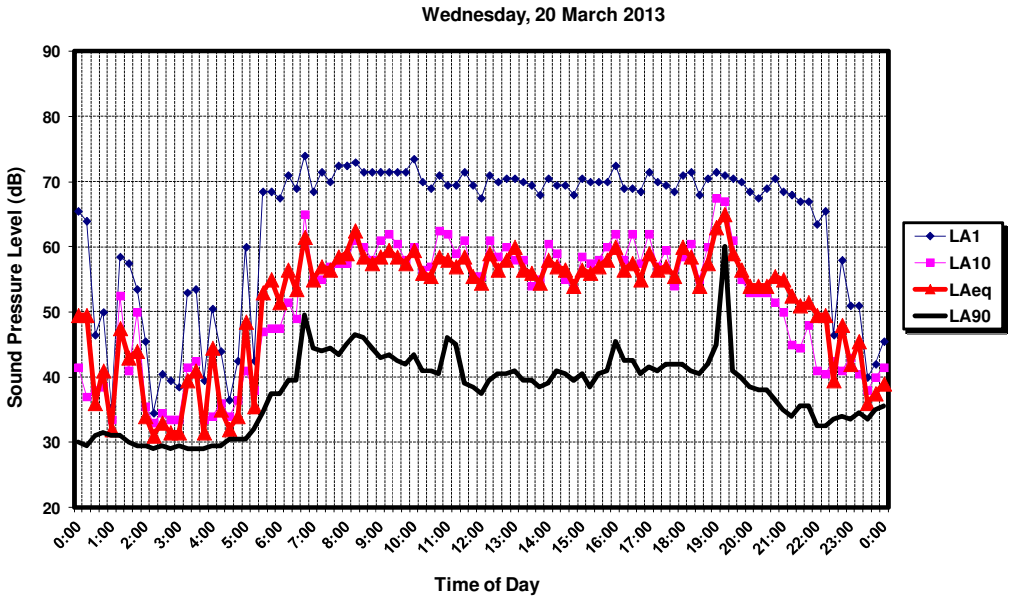
Time of Day
LA1
LA10
LAeq
LA90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Sound Pressure Level (dB)
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Time of Day
LA1
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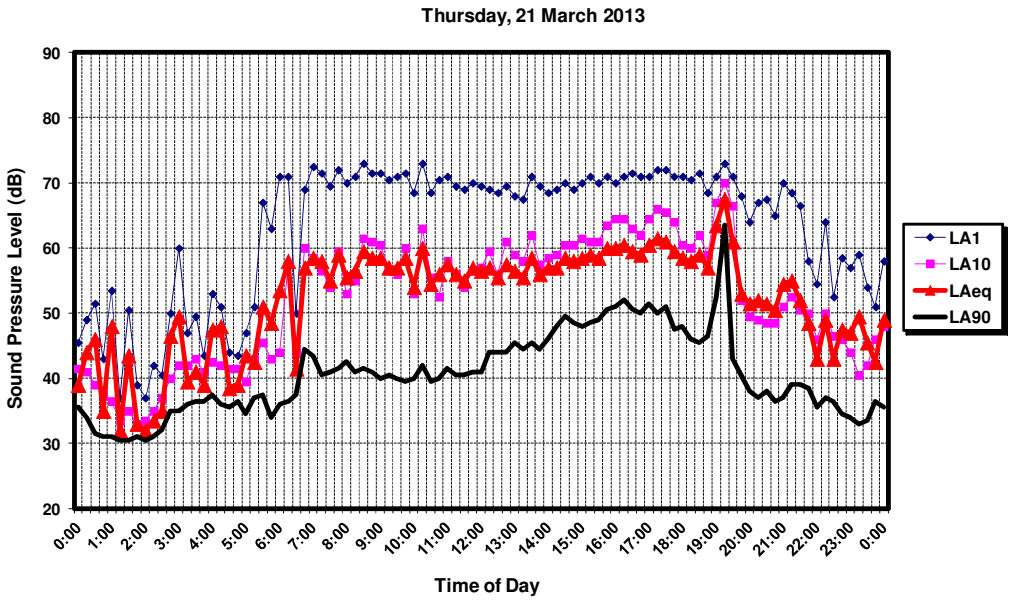
LAeq
LA90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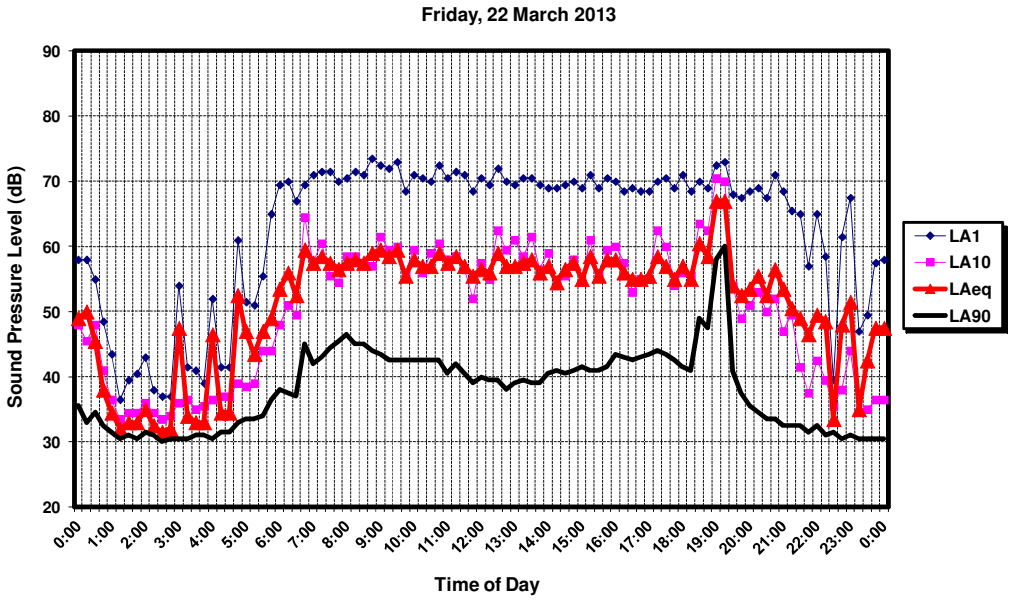
Time of Day
LA1
LA10
LAeq
LA90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Sound Pressure Level (dB)
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Time of Day
LA1
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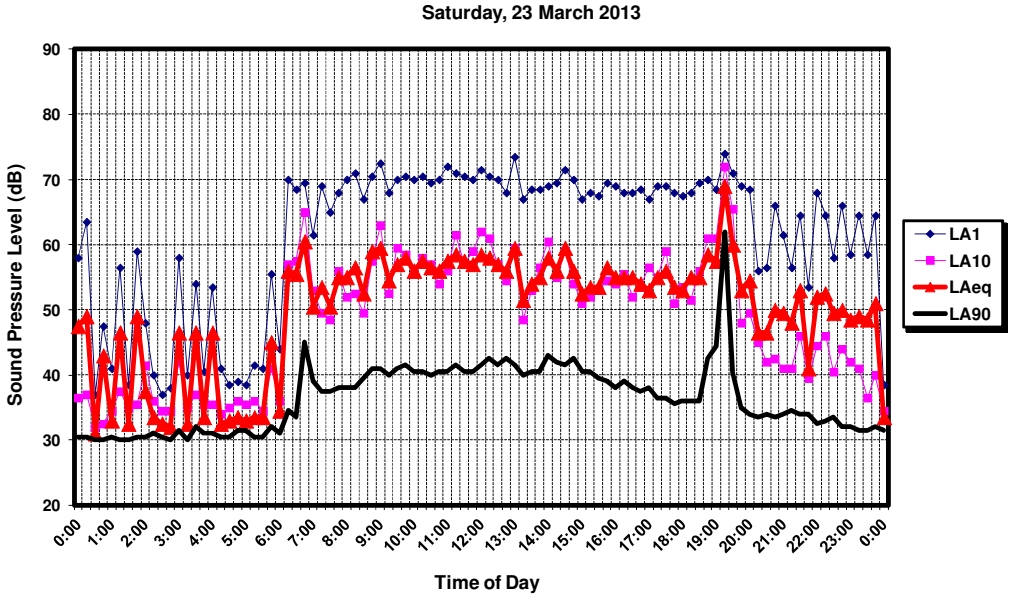
LAeq
LA90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Time of Day
LA1
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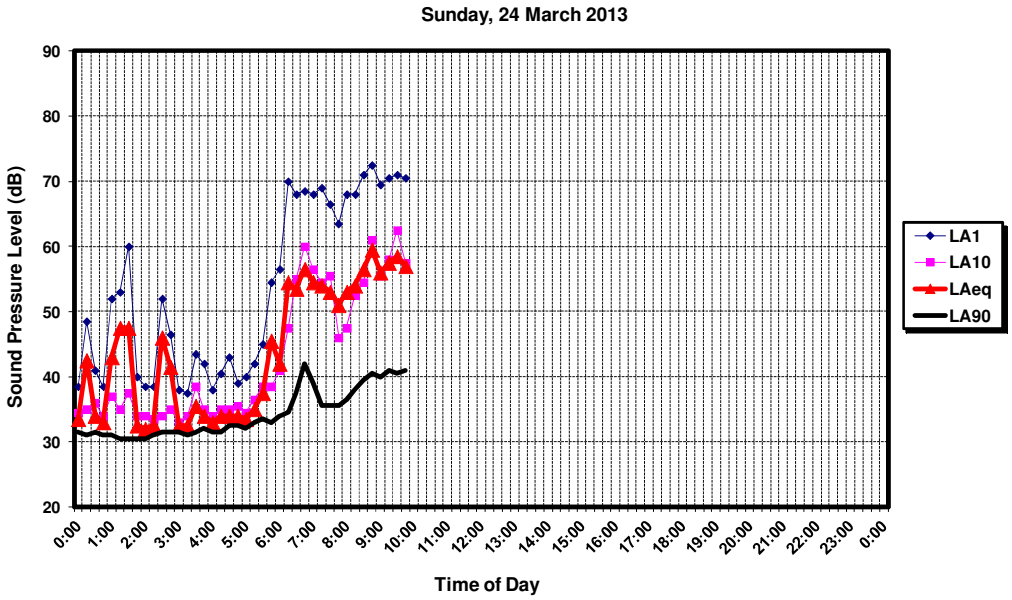
LAeq
LA90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0:00
Time of Day
LA1
LA10
LAeq
LA90

APPENDIX B – GLOSSARY OF TECHNICAL TERMS

'A' Frequency Weighting – The most widely used sound level frequency filter is the A scale, which roughly corresponds to the inverse of the 40 dB (at 1 kHz) equal-loudness curve. Using this filter, the sound level meter is less sensitive to very high and, in particular, very low frequencies. Sound pressure level measurements made with this filter are commonly expressed as **dBA.**

Percentile Levels (L_{AF10}, L_{Aeq}, L_{AF90}) - Environmental noise levels can vary considerably with time; therefore it is not adequate to use a single number to fully describe the acoustic environment. The preferred, and now generally accepted, method of recording and presenting noise measurements is based upon a statistical approach. For example, the L_{AF10} noise level is the level exceeded for 10% of the time, and is approximately the average maximum noise level. The L_{AF90} level is the level that is exceeded for 90% of the time, and is considered to be approximately the average of the minimum noise level recorded. This level is often referred to as the 'background' noise level. The L_{Aeq} level represents the average noise energy during the measurement period. This level is often referred to as the 'ambient' noise level.

Decibel (dB) – The logarithmic ratio of any two quantities and relates to the flow of energy (power). Unit of acoustic measurement related to power, pressure and intensity. Expressed in dB, relative to standard reference levels.

Sound Pressure Level (SPL) – 20 times the logarithm to the base 10 of the ratio of the r.m.s. sound pressure of 20 micro Pascals.

Ambient Sound – The all-encompassing sound associated with that environment being a composite of sounds from many sources, near and far.

Rating Background Level (RBL) – The median value of the tenth percentile value (ABL) for the recorded L_{A90} levels for each day, evening and night period over the complete 7 days or more of noise monitoring. The tenth percentile is also referred to as the Assessment Background Level (ABL).

Assessment Background Level (ABL) – The tenth percentile value of the recorded L_{A90} level for each day, evening and night period.