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Caulfield Grammar School
26 November 2025

New Senior School, TLI Wheelers Hill Campus

Noise Impact Assessment

www.octaveacoustics.com.au

Project New Senior School, TL1 Wheelers Hill Campus
Client Caulfield Grammar School
Document Number AD025MB-01E05 Noise Impact Assessment (r0)

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1. Introduction

Octave Acoustics was engaged by Caulfield Grammar School to conduct a noise impact assessment of mechanical services (in particular the proposed substation) associated with the Senior School building to be constructed at the Wheelers Hill Campus (Subject Site/Subject Development).

The project will involve the construction of a new three storey teaching building near the southern boundary of the campus, which will provide:

- General learning areas.
- Staff lounge.
- Offices.
- Science labs.
- Group meeting rooms.
- Co-lab common space.
- Art rooms.
- Multi-purpose function/gallery spaces.
- Associated storage and amenities.

In addition to noise from mechanical services, it is understood that Council have expressed concern regarding noise from the PA system and sirens at the existing adjacent sports oval and pavilion, in particular after 7pm. These sports facilities are existing and are not directly associated with the Subject Development. Nevertheless, this assessment discusses relevant criteria and proposed mitigation of noise from these sources.

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2. Site Assessment

The Subject Site is zoned Neighbourhood Residential Zone 4 (NRZ4) abutted:

- To the north and east by Caulfield Grammar grounds and facilities, including a sports field and sports pavilion (all zoned NRZ4) and beyond that by Jells Park (zoned PPRZ).
- To the south by the Caulfield Grammar driveway and beyond that by single and double storey residential dwellings on Mary Avenue (all zoned NRZ4).
- To the west by a Caulfield Grammar carpark and school buildings (zoned NRZ4) and beyond that by Jells Park Primary School (zoned PUZ2).

As part of the Subject Development, a substation is planned to be constructed adjacent to the fence of the residential dwelling located at 108 Mary Avenue.

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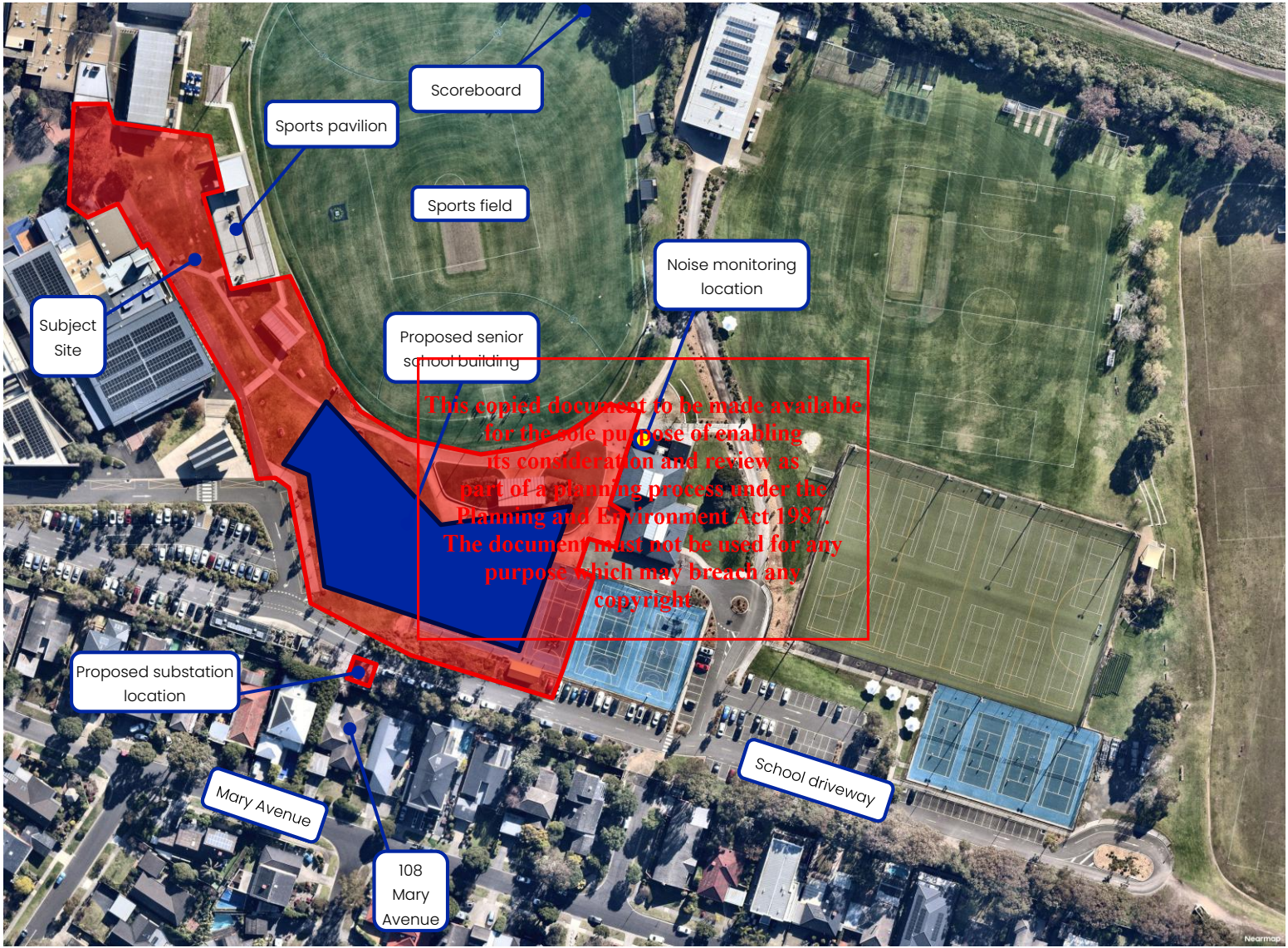


Figure 1 - Site Context

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2.1. Noise Measurements

Octave Acoustics attended the Subject Site to install a noise monitor on an existing on-site building, as shown in Figure 1. Noise monitoring was carried out between Monday 17th November and Monday 24th November 2025. The noise monitor was installed in free field conditions approximately 1.2m above the roof level.

Measurements were carried out using an NTi XL2 sound level meter which was calibrated before and the assessment using a Brüel & Kjær 4231 calibrator. No drift in calibration was detected. The NTi XL2 complies with the requirements of IEC 61672-1:2013 Sound Level Meters and is classified as a Class 1 instrument. The calibrator complies with the requirements of IEC 60942:2004 Sound Calibrators. The XL2 and calibrator carry current NATA certification.



Figure 2 – Noise Monitor Location

The lowest period average hourly background noise levels, for the EPA noise limit calculation, are presented below in Table 1.

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Table 1 – Background Measurement Summary

EPR Period	Lowest Period Average Hourly Background Noise Level, L_{A90} dB
Day	44
Evening	40
Night	36

2.2. Sports Speakers

While onsite on Monday 17th November 2025, Octave Acoustics identified speakers at the sports pavilion to the west of the sports field and speakers on the scoreboard to the north of the sports field. The horn speaker on the scoreboard is to be understood to be used for game sirens and the pavilion speakers are understood to be only used for activities associated with the sports pavilion.



Figure 3 – Sports Pavilion Speakers

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Figure 4 – Scoreboard Speaker

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3. Project Acoustic Criteria

3.1. Environment Protection Regulations

3.1.1. Plant Noise Emissions

Noise associated with building plant and equipment is required to comply with Part 5.3 of the *Environment Protection Regulations 2021* (EPR 2021). *EPA Victoria Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises, and Entertainment Venues Publication 1826.5* (Publication 1826.5) provides a protocol for determining EPR 2021 noise limits and carrying out subsequent assessment of noise impacts.

EPR 2021 is a regulation under the *Environment Protection Act 2017* (EP Act) and compliance is mandatory when noise levels are assessed at noise sensitive areas which includes residential properties. The applicable EPR 2021 noise limits for plant and services noise emissions are presented in Table 1 below.

Table 2 – EPR 2021 Noise Emission Criteria for Mechanical Plant

Period	Zoning Level	Measured Background Level, L_{A90} dB	Background Condition	Applicable Noise Limit, L_{Aeq} dB
Day	50	44	Neutral	50
Evening	45	40	Neutral	45
Night	39	36	Neutral	39

- Notes:
- Day period is:
 - 07:00 – 18:00 Monday – Saturday (except public holidays)
 - Evening period is:
 - 18:00 – 22:00 Monday – Saturday
 - 07:00 – 22:00 Sunday and public holidays
 - Night period is:
 - 22:00 – 07:00 Monday – Sunday
 - Where the noise source under consideration is equipment used solely in relation to emergencies (such as fire pumps, standby generators, stair pressurisation and smoke spill fans), the relevant noise limit applying to the testing or maintenance of such equipment is increased by 10dB for the day period and 5dB for the evening and night periods.

Environment Protection Regulations 2021 states in Part 5.3 – Noise that:

In this Division, when the level of noise emitted from commercial, industrial and trade premises is assessed, the following sources of noise must not be taken into account-

...

(c) noise from-

(i) crowds;

...

(v) sporting events;

(vi) intruder, emergency or safety alarms or sirens;

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As such, EPR 2021 does not apply to the assessment of sports-related noise (including sirens).

3.1.2. General Environmental Duty

Under Part 3.2 of the EP Act, a person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste [including noise] must minimise those risks, so far as reasonably practicable.

With respect to noise, to determine what is (or was at a particular time) reasonably practicable in relation to the minimisation of risks of harm to human health and the environment, regard must be given to:

- The likelihood of those risks eventuating,
- The degree of harm that would result if those risks eventuated,
- What the concerned person knows, or ought reasonably to know, about the harm or risks of harm and any ways of eliminating or reducing those risks,
- The availability and suitability of ways to eliminate or reduce those risks,
- The cost of eliminating or reducing those risks.

It should be noted that the General Environmental Duty requirement applies irrespective of whether compliance with EPR 2021 noise limits is achieved. Compliance with EPR noise limits does not necessarily infer adequate conduct under General Environmental Duty.

3.1.3. Public Address Systems

It is understood that Council have requested that noise from Public Address systems are inaudible at nearby residential dwellings after 7pm. Octave Acoustics were informed by a representative of Caulfield Grammar that public address systems will not be required to be used after 7pm and that this condition is therefore acceptable.

3.1.4. Sirens

There are currently no regulatory criteria or guidelines that specifically address siren noise associated with sporting events. As noted in Section 3.1.1, the Environment Protection Regulations 2021 (EPR 2021) explicitly state that they must not be used for the assessment of sports noise or sirens. EPA Publication Noise Control Guidelines 1254.2 provides noise objectives for public address systems which are “commonly used in conjunction with outdoor entertainment and sporting activities”. Publication 1254.2 provides noise objectives for both:

- “Small systems such as are used for controlling competitors in events like BMX bike races and go-kart races.”
- “High-power systems for commentaries and announcements”

However, neither of these categories are considered to be directly applicable to the operation of sports sirens.

If sirens were to be operated during the night period, it would be appropriate to assess them against recognised sleep disturbance criteria. However, it is understood that sirens will not be used after 9:30 pm, therefore a sleep disturbance assessment is not considered to be necessary.

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4. Assessment

4.1. Mechanical Services

At this early stage of the project, only preliminary mechanical services details are available. Octave Acoustics have conducted a preliminary assessment of mechanical services noise emissions on the understanding that plant equivalent to the following items are expected to be installed on the rooftop of the Senior School building. In addition to the units listed below, it is anticipated that additional plant items, such as exhaust fans may be required. However, noise emissions from fans can typically be controlled with the installation of acoustically lined ductwork or attenuators.

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Table 3 – Indicative Equipment Noise Levels

Equipment Description	Quantity	Condition	SWL ₁ , dB(A)	Octave Band Centre Frequency, (Hz)							
				63	125	250	500	1k	2k	4k	8k
2000 kVA Transformer ₂	1	Radiated	62	65	67	62	62	56	51	46	39
ERV Units	4	Outlet	98	82	85	89	91	92	92	88	90
Condensing Units – West Plant Area	1	Radiated	83	87	87	84	81	77	74	71	63
	3	Radiated	83	87	87	84	81	77	74	71	63
	2	Radiated	88	93	93	90	87	83	80	77	69
	2	Radiated	86	90	90	87	84	80	77	74	66
	1	Radiated	87	91	91	88	85	81	78	75	67
	8	Radiated	70	74	74	71	68	64	61	58	50
	2	Radiated	83	87	87	84	81	77	74	71	63
	6	Radiated	83	87	87	84	81	77	74	71	63
Condensing Units – East Plant Area	6	Radiated	89	93	93	90	87	83	80	77	69
	1	Radiated	90	94	94	91	88	84	81	78	70
	8	Radiated	70	74	74	71	68	64	61	58	50

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Note 1. SWL re 10⁻¹² W.
 2. Wilson 876-7008 sound power level has been used for this assessment, with a standard transformer spectrum from Engineering Noise Control, 6th Edition.

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4.2. Mechanical Services Emissions to Residential Receivers

To calculate noise impacts from mechanical services, a 3D computer noise model of the Subject Site and surrounds was built within CadnaA software. Calculations were run implementing the ISO9613 algorithms to calculate the propagation of noise between source and receivers. This algorithm takes into account propagation effects associated with:

- Source sound power;
- Geometrical spreading;
- Atmospheric conditions causing enhanced noise propagation;
- Air absorption;
- Ground absorption ($G=0$ for a conservative assessment, $G=0.3$ on the sports ovals);
- Reflections from buildings and environment; and
- Barrier effects due to obstructions between noise sources and residential receivers;
- 5dB tonality penalty for the transformer.

From this assessment, noise levels are calculated to comply with the EPR 2021 noise limits that are stated in Table 2 assuming that the following indicative treatment is implemented. The exact details of the treatment required shall be determined during the detailed design phase of the project.

- Acoustic fence/screening is required around each of the rooftop plant areas and around the substation to reduce noise emissions to residential dwellings.
- All acoustic plant fencing/screening shall extend a minimum of 500mm above the top of the tallest item of plant and is to be installed to at least the extent marked up in Appendix B;
- The acoustic plant screening shall be constructed of any solid (non-perforated) cladding such as timber palings, fibre cement sheeting, lightweight concrete panels or perforated metal cladding as long the selected material (or combined skins) has a surface mass of at least 25 kg/m^2 ;
- The acoustic plant fencing/screening shall have no gaps or holes in it, thus preventing noise passing through. Any gaps or penetrations shall be fully sealed with a flexible acoustic sealant;
- The acoustic plant fencing/screening shall extend hard down to the top of the ground or rooftop so that noise will not pass underneath it;
- Where required for airflow, the rooftop plant screen may be replaced with acoustic louvres. The insertion loss of the acoustic louvres is to be determined during detailed design when the mechanical services design is sufficiently progressed.
- Condensing units must operate on a low noise mode during the evening and night periods.
- Noise emissions from fans and ERV ductwork is to be treated with acoustically lined ductwork and attenuators as required.

4.3. Noise Emissions from Sports Speakers

4.3.1. Sports Sirens

The sports siren shown in Figure 2 is existing and is not part of the Subject Development and there are no mandatory criteria or guidelines which directly apply to sports sirens. In addition, the Subject Development is expected to provide a measure of screening from noise from the siren to affected dwellings.

Nevertheless it is recommended that, if the siren is used after 7pm, that the volume is set such that it is minimised as far as practical, while still being clearly audible for people using the oval.

4.3.2. Public Address Systems

As stated in Section 3.1.3, public address systems will not be used after 7pm. As such, further assessment is not required.

5. Conclusion

Octave Acoustics have conducted an assessment of expected mechanical services noise emissions from the Senior School Building to be constructed at Caulfield Grammar, Wheelers Hill Campus.

At this stage, only preliminary mechanical services design information is available. Nevertheless, noise levels are calculated to comply with EPR 2021 noise limits at the nearest affected residential dwellings if plant screening/fencing is installed around rooftop plant areas and the substation as shown in Section 4.2 and Appendix B. Noise from any additional rooftop fans can typically be sufficiently mitigated by installing acoustically lined duct or attenuators. A full assessment will be conducted during the design phase of the project to calculate the detailed mitigation measures which are required to achieve compliance with EPR 2021 noise limits.

It is understood that public address systems will not be used by the school after 7pm.

While there are no mandatory criteria or guidelines that are applicable to the assessment of sports siren noise, it is recommended that sirens are operated at the lowest practicable volume when used after 7 pm. Furthermore, the construction of the proposed Senior School building is expected to provide additional acoustic screening, thereby reducing siren noise impacts on nearby residential dwellings.

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Appendix A: Glossary of Terms

'A' Frequency Weighting

The 'A' frequency weighting roughly approximates to the Fletcher–Munson 40 phon equal loudness contour. The human loudness perception at various frequencies and sound pressure levels is equated to the level of 40 dB at 1 kHz. The human ear is less sensitive to low frequency sound and very high frequency sound than midrange frequency sound (i.e. 500 Hz to 6 kHz). Humans are most sensitive to midrange frequency sounds, such as a child's scream. Sound level meters have inbuilt frequency weighting networks that very roughly approximates the human loudness response at low sound levels. It should be noted that the human loudness response is not the same as the human annoyance response to sound. Here low frequency sounds can be more annoying than midrange frequency sounds even at very low loudness levels. The 'A' weighting is the most commonly used frequency weighting for occupational and environmental noise assessments. However, for environmental noise assessments, adjustments for the sound level of the sound will often be required.

AMBIENT NOISE

The ambient noise level at a particular location is the overall environmental noise level from all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (LAeq,T).

AUDIBLE

Audible refers to a sound that can be heard. There are a range of audibility grades, varying from "barely audible", "just audible" to "clearly audible" and "prominent".

BACKGROUND NOISE LEVEL

Total silence does not exist in the natural or built-environments, only varying degrees of noise. The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90 % of the measurement period 'T' (LA90,T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15

minute) measurements over multiple days (often 7 days). For a 15-minute measurement period the Background Noise Level is set at the quietest level that occurs at 1.5 minutes.

'C' FREQUENCY WEIGHTING

The 'C' frequency weighting approximates the 100 phon equal loudness contour. The human ear frequency response is more linear at high sound levels and the 100 phon equal loudness contour attempts to represent this at various frequencies at sound levels of approximately 100 dB.

DECIBEL

The decibel (dB) is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. The decibel is ten times the logarithm of the ratio of any two quantities that relate to the flow of energy (i.e. power). When used in acoustics it is the ratio of the square of the sound pressure level to a reference sound pressure level, the ratio of the sound power level to a reference sound power level, or the ratio of the sound intensity level to a reference sound intensity level. See also Sound Pressure Level and Sound Power Level. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB (from $10 \log_{10}(10^{(50/10)} + 10^{(50/10)})$) and not 100 dB. In theory, ten similar machines placed side by side will increase the sound level by 10 dB, and one hundred machines increase the sound level by 20 dB. The human ear has a vast sound-sensitivity range of over a thousand billion to one, so the logarithmic decibel scale is useful for acoustical assessments.

dBA – See 'A' frequency weighting

dBC – See 'C' frequency weighting

EQUIVALENT CONTINUOUS SOUND LEVEL, LAeq

Many sounds, such as road traffic noise or construction noise, vary repeatedly in level over a period of time. More sophisticated sound level meters have an integrating/averaging electronic device inbuilt, which will display the energy time-average (equivalent continuous sound level - LAeq) of the 'A' frequency weighted sound pressure level. Because the decibel scale is a logarithmic ratio, the higher noise levels have far more sound energy, and therefore the LAeq level tends to indicate an average which is strongly influenced by short-term,

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high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closer to the LAeq noise level than any other descriptor.

'F' (FAST) TIME WEIGHTING

Sound level meter design-goal time constant which is 0.125 seconds.

FREE FIELD

In acoustics a free field is a measurement area not subject to significant reflection of acoustical energy. A free field measurement is typically not closer than 3.5 metres to any large flat object (other than the ground) such as a fence or wall or inside an anechoic chamber.

FREQUENCY

The number of oscillations or cycles of a wave motion per unit time, the SI unit is the hertz (Hz). 1 Hz is equivalent to one cycle per second. 1000 Hz is 1 kHz.

LOUDNESS

The volume to which a sound is audible to a listener is a subjective term referred to as loudness. Humans generally perceive an approximate doubling of loudness when the sound level increases by about 10 dB and an approximate halving of loudness when the sound level decreases by about 10 dB.

MAXIMUM NOISE LEVEL, LA_{Fmax}

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'F' (Fast) time weighting. Often used for noise assessments other than aircraft.

MAXIMUM NOISE LEVEL, LA_{Smax}

The root-mean-square (rms) maximum sound pressure level measured with sound level meter using the 'A' frequency weighting and the 'S' (Slow) time weighting. Often used for aircraft noise assessments.

NOISE

Noise is unwanted, harmful or inharmonious (discordant) sound. Sound is wave motion within matter, be it gaseous, liquid or solid. Noise usually includes vibration as well as sound.

OFFENSIVE NOISE

Reference: Dictionary of the NSW Protection of the Environment Operations Act 1997).

"Offensive Noise means noise:

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

(i) is harmful to (or likely to be harmful to) a person who is outside the premise 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."

'S' (SLOW) TIME WEIGHTING

Sound level meter design-goal time constant which is 1 second.

SOUND ATTENUATION

A reduction of sound due to distance, enclosure or some other device. If an enclosure is placed around a machine, or an attenuator (muffler or silencer) is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 20 dB reduces the sound energy by one hundred times.

SOUND EXPOSURE LEVEL (LAE)

Integration (summation) rather than an average of the sound energy over a set time period. Use to assess single noise events such as truck or train pass by or aircraft flyovers. The sound exposure level is related to the energy average (LAeq,T) by the formula $LA_{eq,T} = LAE - 10 \log_{10} T$. The abbreviation (SEL) is sometimes inconsistently used in place of the symbol (LAE).

SOUND PRESSURE

The rms sound pressure measured in pascals (Pa). A pascal is a unit equivalent to a newton per square metre (N/m²).

SOUND PRESSURE LEVEL, L_p

The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (Pa/Po)^2$ dB (or $20 \log_{10} (Pa/Po)$ dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 μPa (20 x 10⁻⁶ Pa) for airborne sound. Lp varies with distance from a noise source.

SOUND POWER

The rms sound power measured in watts (W). The watt is a unit defined as one joule per second. A

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measures the rate of energy flow, conversion or transfer.

SOUND POWER LEVEL, L_w

The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB,

re: $1pW$, (10^{-12} watts) where 'a' is the measurement noise-emission area (m^2) in a free field.

SOUND TRANSMISSION LOSS

The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL NOISE LEVELS, L_n

Noise which varies in level over a specific period of time 'T' (standard measurement times are often 15-minute periods) may be quantified in terms of various statistical descriptors with some common examples:

The noise level, in decibels, exceeded for 1% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF1,T}$. This may be used for describing short-term noise levels such as could cause sleep arousal during the night.

The noise level, in decibels, exceeded for 10% of the measurement time period, when 'A' frequency

weighted and 'F' time weighted is reference to as $L_{AF10,T}$. In most countries the $L_{AF10,T}$ is measured over periods of 15 minutes, and is used to describe the average maximum noise level.

The noise level, in decibels, exceeded for 90% of the measurement time period, when 'A' frequency weighted and 'F' time weighted is reference to as $L_{AF90,T}$. In most countries the $L_{AF90,T}$ is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

WEIGHTED SOUND REDUCTION INDEX, R_w

This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 Hz to 3.150 kHz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999). Internal partition wall R_w+C ratings are frequency weighted to simulate insulation from human voice noise. The R_w+C is similar in value to the STC rating value. External walls, doors and windows may be R_w+C_{tr} rated to simulate insulation from road traffic noise. The spectrum adaptation term C_{tr} adjustment factor takes account of low frequency noise. The weighted sound reduction index is normally similar or slightly lower number than the STC rating value.

'Z' FREQUENCY WEIGHTING

The 'Z' (Zero) frequency weighting is 0 dB within the nominal 1/3 octave band frequency range centred on 10 Hz to 20 kHz. This is within the tolerance limits given in AS IEC 61672.1-2004: 'Electroacoustics - Sound level meters - Specifications'.

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Appendix B: Preliminary Mechanical Services Mark-up

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Appendix C: Hourly Measured Noise Levels

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