NOISE AND VIBRATION ASSESSMENT

FOR PROPOSED TYRE RECYCLING OPERATIONS AT 68-70 VICTORIA STREET, SMITHFIELD

Prepared for: Tyrex Australia Pty Ltd

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Association of Australian Acoustical Consultants

Acoustic Directions is a member of the Association of Australian Acoustical Consultants and our work is conducted in accordance with the Association's code of conduct.

1. INTRODUCTION

Acoustic Directions has been retained by Tyrex Australia Pty Ltd (c/o- Mod Urban) to undertake an acoustic assessment of their proposed tyre recycling operations at 68-70 Victoria Street, Smithfield (Lot 9 & 10 in DP 239868). We understand that Tyrex has been requested by the Department of Planning, Industry and Environment (DPIE) to prepare an Environmental Impact Statement (EIS) in accordance with the Planning Secretary's Environmental Assessment Requirements (SEARs).

This assessment forms part of the requirements for submission of the required EIS.

We understand that The SEARs requires an acoustic assessment addressing all potential noise-generating activities on site, including mechanical plant or equipment, tyre recycling machinery, air-conditioning units and vehicle movements to and from site.

Based on discussions with Equilibrium who are assisting Tyrex with their application to Council, the following specific items were also identified as pertinent to the assessment:

- large trucks accessing site for delivery and pick up
- ducted rooftop extraction fans for the existing machinery
- new rubber shredding machine (Genox XENO X1600 twin shaft shredder with 2 x 45 kW motors)
- 1.1kw and 1.5kw motors used for packing
- consideration of the passive recreational area to the north of the site
- use of 70 Victoria St as an outdoor tyre overflow storage

As required, this assessment has been made in accordance with the NSW EPA Noise Policy for Industry (2017).

1.1. About Acoustic Directions

Acoustic Directions is an active member of the Association of Australasian Acoustical Consultants (AAAC) which is the peak body of acoustic consultants in the Australasian region. The reviewer of this report, Glenn Leembruggen, is the Principal of the company and is a Fellow of the Institute of Acoustics (UK). Our staff are members of the Australian Acoustical Society and the Acoustical Society of America. Membership of these societies requires our engineering staff to undertake continual professional development. Glenn has provided many expert witness services in relation to environmental noise emissions to the City of Sydney and other corporate clients in the NSW Land and Environment Court.

2. PERTINENT DETAILS FOR OUR ASSESSMENT

Based on the information provided by Tyrex Australia (Tyrex from here on), the following details are pertinent to our assessment of the proposed operation of the new premises.

2.1. Proposed Operation for Tyrex Australia

a) Tyrex Australia Pty Ltd is a rubber tyre recycling facility, which is proposing to relocate their existing operations at 66 Victoria Street, Smithfield to the adjacent two premises at 68-70 Victoria Street.

b) As per correspondence with MOD Urban, we understand that the main operations include receiving, consolidating and onforwarding of approximately 30,000 tons of waste tyres (rubber) per annum. As part of the 30,000 tonnes, there will be approximately 5-10 tonnes per week of thin steel wire which will be collected via magnets during processing and taken to steel mills for further processing.

c) The site proposes to operate 24-hours a day, seven days a week, adhering to the following schedule:
   - 6:00 am to 3:00 pm – Shift 1 (full operation)
   - 3:00 pm to 12:00 am – Shift 2 (full operation)
   - 12:00 am to 6:00 am – Shift 3 (only for cleaning, preparation, and maintenance)

d) There will be a maximum of eight employees on site at any one time.

e) Product is received by utility vehicles and trucks at the facility. Regular delivery activities will be via 12.5 m long Heavy Rigid Vehicles (HRVs). The largest vehicle to access the site will be a 13.9 m long semi-trailer.

f) Tyre processing-machinery and air-conditioning equipment are identified as the major noise-generating items on site. Given that there is a high level of vehicular traffic along Victoria Street, the relatively small number of truck movements onto site (compared to the volume of traffic) would not cause significant disturbances to surrounding adjacent receivers.

g) The breakdown of the maximum site storage of 186 tonnes of rubber material at any one time is as follows:

In 68 Victoria St, up to 186 tonnes tyres and rubber products, involving:

- Six storage piles, 12.5 tonne each
  25 tonnes in the shredding area
- 66 tons of crumb rubber on shelving in bulk bags

In 70 Victoria St, involving:

- 20 ton and steel wires in bulk bags under the awning.

A plan view showing the proposed site use from architectural drawings prepared by *Planzone* is provided below:

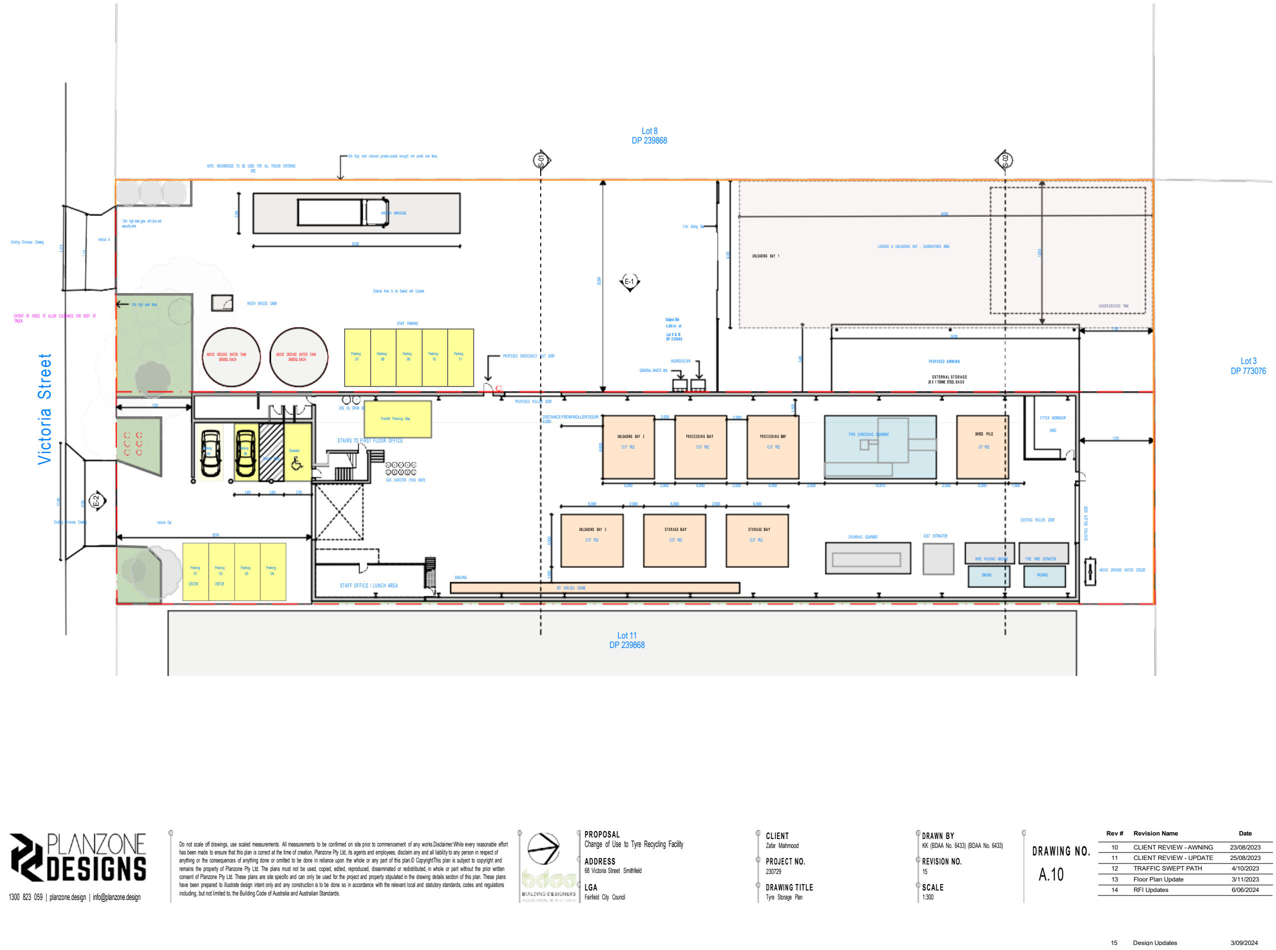


Figure 1. Plan view of proposed site at 68-70 Victoria St, Smithfield, showing proposed use.

h) Given the above, and based on discussions with Tyrex, we understand that operations proposed for 68 Victoria St will be essentially identical to the existing operation at 66 Victoria St, but with the addition of an additional rubber-granule processing machine (this unit is smaller than the existing rubber-granule processing machine). 70 Victoria St will be used as an outdoor loading, unloading quarantined area and for weighbridge to record the data of tyre and tyre materials entering and exiting the site along with the use of forklifts to move materials in to the undercover awning area, with some staff parking.

i) As such, our assessment is based on the current noise emissions from the existing site at 66 Victoria St (refer to Acoustic Direction's DA report dated, 23 February 2018), with consideration of the noise contribution from the proposed additions (further detail is provided in Section 5.1 below).

2.2. Most-Affected Receivers

a) The most-affected noise receivers in the vicinity of the site have been identified to be industrial premises adjoining and directly across Victoria Street from site.

b) However, due to the greater noise sensitivity of residential premises, we have also identified the closest residences between 714-734 The Horsley Drive, approximately 250 metres away, as being potentially noise-affected.

c) To the north of the site is a passive recreation area, Chifley St Reserve, which is accessible to the general public.

d) Figure 1 below presents an aerial view of the site with the location of the site, nearby noise receivers, roads, and noise measurement locations identified.

Figure 2. Aerial view of site showing site location, nearby noise receivers, roads, and noise measurement locations.

3. EXISTING NOISE LEVELS AT SITE

3.1. Background Noise Levels

a) To determine the potential operational noise emissions from the project site and understand the noise impact on the most-affected receivers identified in Section 2.2 above, it was necessary to establish the long-term background noise levels.

b) Due to access and equipment-security issues, it was not possible to installing a long-term noise logger at the most-affected residential receivers. Accordingly, an unattended noise logger was installed in the front of the existing property at 66 Victoria Steet for a net twelve-day period between 15 February and 3 March 2023. This location enabled us to capture the existing ambient noise at the site to represent ambient noise and understand the existing truck movements at the adjoining industrial receivers. Adjustments were made to account for the positional differences between the affected receivers and the logger as described below.

c) Using the logged data, the background noise levels were determined from the L_{A90} parameter and were used to represent the rating background level (RBL) at the nearest residential receivers. RBLs are commonly described for three time-periods, which are daytime, evening and night. These periods are defined as follows:

- Daytime – 7:00 am - 6:00 pm Monday to Saturday and 8:00 am - 6:00 pm for Sundays and Public Holidays.
- Evening – 6:00 pm to 10:00 pm everyday
- Night – remaining periods

d) Using historical weather data from Weatherzone (www.weatherzone.com.au), all instances of inclement weather were removed from the logged data. In accordance with Section B1.3 of the NPI, additional logging days were implemented to ensure that a complete and accurate assessment of the background noise levels were obtained.

e) Refer to Appendix A for noise and weather data recorded by the logger installed on site.

f) To establish background noise levels at the nearest parkland and residential receivers relative to the logger position, 15-minute operator-attended measurements were undertaken simultaneously with the noise logger at various times of the day, evening and night.

These measurements enabled the relationships between noise levels at the site and at the nearest receivers to be determined, which were used to calculate the long-term rating background levels (RBLs) for the assessment at these receivers.

g) All measurements were made using NTI-Audio XL2 with Class 1 measurement microphones. Calibration checks were made prior to and after the logging to ensure the validity of data.

h) Measurements were conducted in accordance with the method outlined in the Noise Policy for Industry.

i) The location and attended-measurement times at the most-affected residential and parkland receivers are listed in **Table 1** below. All measurement locations have been identified in **Figure 2** above.

Table 1. Details of the operator-attended 15-minute background noise measurements.

Date	Location	Measurement Period
15/02/2023	720 The Horsley Drive	Night (10:40 pm - 10:55 pm)
	Chifley Street	Night (9:55 pm - 10:20 pm)
16/02/2023	720 The Horsley Drive	Evening (6:35 pm - 7:05 pm)
	Chifley Street Reserve	Evening (7:20 pm - 7:35 pm)
27/02/2023	720 The Horsley Drive	Evening (6:00 pm - 6:20 pm)
	Chifley Street Reserve	Evening (5:25 pm - 5:45 pm)
03/03/2023	720 The Horsley Drive	Daytime (9:35 am - 9:50 am)
	Chifley Street Reserve	Daytime (10:15 am - 10:35 am)

j) **Table 2** below shows the RBL for each period calculated from the logger data located at 66 Victoria St (representing the most-affected industrial receivers) and the calculated RBLs for the residential and parkland receivers.

Table 2: Existing RBLs noise levels for the most-affected receivers.

Receiver Location	Receiver Type	Time Period	Rating Background Noise Levels (RBL)
R2, R3, R4 60 – 75 Victoria St	Industrial	Daytime	56 dB
		Evening	47 dB
		Night	42 dB
R1 714-734 The Horsley Dr	Residential	Daytime	59 dB
		Evening	50 dB
		Night	45 dB
R5 Chifley St Reserve	Recreational	Daytime	53 dB
		Evening	45 dB
		Night	40 dB

4. NOISE EMISSION CRITERIA

4.1. Secretary's Environmental Assessment Requirements (SEARS)

The NSW Department of Planning and Environment letter dated 27 April 2023 (EF23/4571, SEAR 1774) includes the following relevant noise and vibration criteria for the site.

Key issues raised in this letter include:

- **noise and vibration** – including:
  - a description of all potential noise and vibration sources during construction and operation, including road traffic noise
  - a noise and vibration assessment in accordance with the relevant Environment Protection Authority guidelines
  - a description and appraisal of noise and vibration mitigation and monitoring measures.

Additionally, Attachment A of the SEARS states that the EIS must address the following conditions relating to noise impacts:

Noise Impacts

The EPA expects that potential noise sources are assessed in accordance with the *Noise Policy for Industry* (EPA 2017) and, where required, that mitigation measures are proposed (e.g. appropriate equipment chosen to minimise noise levels). All residential or noise sensitive premises likely to be impacted by the development must be identified and the design, construction, operation, and maintenance of the facility should aim to minimise potential noise impacts. The times of operation for all aspects of the development and for all noise producing activities should be specified.

The proposed development is likely to result in an increase in traffic movements. The number of traffic movements associated with the proposal should be quantified and the potential noise impacts associated with these traffic movements need to be assessed in accordance with the *NSW Road Noise Policy* (DECCW, 2011).

Given the above requirement for assessment in accordance with the *Noise Policy for Industry* (NPI), we provide the following relevant criteria from the NPI and the *NSW Road Noise Policy (DECCW, 2011)* for completeness.

4.2. NSW EPA Noise Policy for Industry (2017)

a) The NSW EPA Noise Policy for Industry (2017) provides a clear framework for assessing noise impacts from noise-emitting premises. To support the goal of minimizing noise impacts to surrounding noise-sensitive receivers through available feasible and reasonable noise mitigation measures, the policy sets out a procedure to determine a benchmark noise level, called the "project noise trigger level", above which noise management measures are required to be considered.

b) The project noise trigger level is specific to each noise-receiver, and considers the background noise environment, the time of day of the activity, the character of the noise and the type of receiver (e.g. residential or commercial). The project noise trigger level has been adopted in this assessment as the noise threshold of which operational noise on site should remain below.

c) The project noise trigger level is an $L_{Aeq,15min}$ level that is determined as the lower of the "project intrusiveness noise level" and "project amenity noise level". These levels are calculated as follows:

- The project intrusiveness noise level is determined by adding 5 dB to the RBL and is represented as an $L_{Aeq,15min}$ level. We note that the intrusive noise level only applies to residential receivers.
- The project amenity noise level is determined by subtracting 5 dB from the recommended $L_{Aeq,period}$ amenity noise levels in Table 2.2 of the policy. (The 5 dB factor is to limit noise-creep in the area). This project amenity noise level is then converted to an $L_{Aeq,15min}$ level by adding 3 db.

d) We note that, while there is no specific criterion for noise levels reaching people who are in parklands for recreation, for completeness, we have included Chifley St Reserve in our assessment. The closest relevant noise criterion is from Table 2.2 of the NPI which states only an amenity level of 50 dBA for passive recreation, and 55 dBA for active recreation. However, given the Council's concern with the amenity of people in the parklands we have assessed the operational noise emissions from the subject site to the lowest of the amenity and intrusiveness criterion for each period as per the NPI. Table 1 presents the adopted project noise criteria.

With the RBLs presented in **Table 2**, the project noise trigger levels for the most-affected noise receivers were calculated and are presented in **Table 3** below.

Table 3: Project noise trigger level at receiver locations most affected by site operations.

Receiver Location	Receiver Type	Time Period	Project intrusiveness noise level ($L_{Aeq,15min}$)	Project amenity noise level ($L_{Aeq,15min}$)	Adopted project noise trigger level ($L_{Aeq,15min}$)
R2, R3, R4 60 – 75 Victoria St	Industrial	When in Use	n/a	68 dB	68 dB
R1 714-734 The Horsley Dr	Residential (Suburban)	Daytime	64 dB	53 dB	53 dB
		Evening	55 dB	43 dB	43 dB
		Night	50 dB	38 dB	38 dB
R5 Chifley St Reserve	Passive Recreation	Daytime	58 dB	50 dB	50 dB*
		Evening	50 dB		50 dB*
		Night	45 dB		45 dB*

* see note in Section 4.1d) above.

4.3. NSW Road Noise Policy (RNP), Department of Environment, Climate Change and Water (DECCW) 2011

Victoria Rd is classified as a *State* road as per the Transport for NSW *Road Network Classifications* website (https://roads-waterways.transport.nsw.gov.au/classification/map/).

Based on this classification, the criteria from the NSW Road Noise Policy, Department Of Environment And Climate Change (DECCW, 2011) has been considered in relation to the following noise criteria. Of relevance is Item 3 from the table below (see **Table 4**) relating to "existing residences affected by additional traffic on existing freeways/arterial/sub—arterial roads generated by land use developments".

Table 4. Noise assessment criteria from Table 3 of the NSW Road Noise Policy.

Table 3 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/land use	Assessment criteria – dB(A) Day (7 a.m.–10 p.m.)	Assessment criteria – dB(A) Night (10 p.m.–7 a.m.)
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq,\,(15\,hour)}$ 55 (external)	$L_{Aeq,\,(9\,hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,\,(15\,hour)}$ 60 (external)	$L_{Aeq,\,(9\,hour)}$ 55 (external)

In relation to commercial receivers we note that the NSW RNP states in Section 2.5.6, that "for commercial and industrial premises, information on desirable internal noise levels is contained in Australian Standard 2107:2000 (Standards Australia 2000)." This standard only presents recommended design sound levels.

5. OPERATIONAL FACTORY NOISE EMISSIONS ASSESSMENT

5.1. Measured Equipment Noise Levels

a) Acoustic Directions previously undertook an acoustic DA assessment of the existing rubber recycling operations at 66 Victoria Street (*180223 Acoustic Report for DA 66 Victoria Street Smithfield v1.0* dated, 23 February 2018). The following aspects of this assessment have been based on that previous assessment of operational noise:

- As the new premises are directly adjacent, the distances to the most affected commercial and residential receivers can be considered identical.
- As existing operational equipment will be moved from the existing premise to the new site , the

previous measured noise emissions from this existing equipment have been used for this assessment.

- Equipment inside 68 Victoria St will be located in approximately the same configuration as existing premise at 66 Victoria St.
- The building construction of the factory (metal) and openings at the north and south facades are essentially the same dimensions.

b) Given the above information, the proposed changes to the operation of 68-70 Victoria St that have potential noise implications and have been assessed separately are:

- The addition of a rubber shredding machine.
- Trucks passing through 70 Victoria St to enter 68 Victoria St.

c) To understand the contribution of the above changes and established measured levels for previously-assumed operational noise from the rubber recycling facility, two engineers attended site between 11:00 am and 12:30 pm on 24 February 2023. Measurements of the noise emissions from the following equipment and operations were undertaken:

- Operation of the new rubber shredding machine with 2 x 45 kW motors.
- The existing roof exhausts at 66 Victoria St, which will be installed in the roof at 68 Victoria St.
- Delivery and unloading of tyres: this process consists of a truck reversing into the premises, followed by manual unloading of around fifty tyres of between approximately 40 cm to 80 cm in diameter from the back of the truck.

d) Although the facilities are not currently in operation, the proposed tyre-rubber processing machines and air conditioning system already exist on site. Noise levels produced by these existing machines was measured for the DA for 66 Victoria St to enable noise breakout calculations based on their emitted sound power levels.

e) The equipment measured on site in 2018 and 2023 by Acoustic Directions includes the following items, which are located internally unless stated otherwise:

Internal

- Rubber-granule processing machine rated at 132 kW
- Rubber shredding machine with 2 x 45kW motors
- Rubber chipper machine
- Tyre cutter
- Bead wire separator
- Press machine
- Small 1.1kw and 1.5kw motors for packing
- Overhead crane rated at 10 t

External

- Water chiller for rubber-granule processing machines
- Forklift
- Air-conditioning condenser unit
- Exhaust fans (roof)
- Truck movements in No. 70

f) We have employed the following method to determine the sound power levels produced by machinery:

- Noise measurements were made at a known distance from each machine with all other machines switched off.
- The reverberation times of the workshop were measured in octave frequency bands to determine the contribution of reverberant sound energy to the measured noise levels.
- Using the known measurement distance and reverberation time, the sound power of each machine was calculated using sound propagation and reverberation theory.
- Measurements were made using an NTI-Audio XL2 with a Class 1 measurement microphone. Calibration checks were done prior and after the logging to ensure the validity of data.
- We note that the 132-kW rubber-granule processing machine and the roof exhaust fans were the

loudest measured machinery/plant, both with a calculated sound power of 100 dBA.

- Previous measurements of rubber-granule machine rated at 110 kW and our assumption that the second machine of the same power rating would produce the same sound power output.
- The calculated sound power levels and reverberation times are presented in **Table 5** and **Table 6** below.

Table 5: Computed sound power level of measured equipment on site.

Equipment	Sound Power Level, L_{Aw}
Rubber-granule processing machine rated at 132 kW	100 dB
Rubber shredding machine rated (2 x 45 kW motors)	93 dB
Rubber chipper machine	97 dB
Tyre cutter	85 dB
Bead wire separator	81 dB
Overhead crane rated at 10 T	88 dB
External water cooler for rubber-granule processing machine	89 dB
Forklift (petrol)	81 dB
Air-conditioning condenser unit	68 dB
Unloading of tyres from truck	84 dB
Exhaust fan (roof)	100 dB

Table 6: Measured reverberation time (T30) in seconds of the workshop at 66 Victoria St.

Octave-band Centre Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Reverberation Time (T30), in seconds	1.5	3.6	3.6	2.5	2.4	2.1	1.6	0.9

5.2. Predicted Noise Impacts To Surrounding Receivers

Using the sound power levels shown in **Table 5**, a noise model was constructed to predict the noise impacts from operational equipment and machinery on each of the most-affected noise receivers.

Our noise model considers:

a) The levels associated with the sound power data listed in **Table 5**.

b) The direct-sound level incident on the internal walls and roof of the workshop, based on the distance from each machine to these surfaces.

c) The reverberant sound level within the workshop caused by the reverberance of the space.

d) The total amount of sound energy radiating from the building shell, considering the combined direct and reverberant internal sound levels, transmission loss characteristic of the external construction and total radiating surface area.

e) The transmission path from the building shell to the noise receiver, considering the direct path and any significant reflected paths or acoustic shielding.

Our model includes the following assumptions:

- The roller doors on the south and north walls are closed while the machines are continuously operating.
- The externally-located motors for the chillers within the north area of site are shielded from direct line-of-sight to the industrial premises to the west either by constructing a small partial enclosure near the equipment or by having a 1.8 metre solid fence along the western boundary at the rear of the factory.
- The existing solid masonry fence approximately 2 m high on the northern boundary (at the rear of the factory) remains in place.

Table 7, **Table 8,** and **Table 9** present the predicted noise impacts on the surrounding most-affected residential, industrial, and parkland noise receivers respectively, for the three proposed operational shifts.

Table 7: Comparison of predicted noise impacts at most-affected **residential** receivers with the project noise goals.

Scenario	Representative time of day	Noise level predicted at closest residential receivers ($L_{Aeq,15min}$)	Noise goal ($L_{Aeq,15min}$)	Compliance
Shift 1 and 2: Factory fully operational with all equipment operating.	6 am to 7 am	32 dB	38 dB	Yes
	7 am to 6 pm		53 dB	Yes
	6 pm to 10 pm		43 dB	Yes
	10 pm to midnight		38 dB	Yes
Shift 3: Factory partially operational for cleaning, preparation and maintenance. No tyre-processing machines operating. Only forklift and air-conditioning operational.	midnight to 6 am	10 dB	38 dB	Yes

Table 8. Comparison of predicted noise impacts at most-affected **industrial** receivers with the project noise goal.

Scenario	Representative time of day	Noise level predicted at closest industrial receivers ($L_{Aeq,15min}$)	Noise goal ($L_{Aeq,15min}$)	Compliance
Shift 1 and 2: Factory fully operational with all equipment operating.	When in use	66 dB	68 dB	Yes
Shift 3: Factory partially operational for cleaning, preparation and maintenance. No tyre-processing machines operating. Only forklift and air-conditioning operational.	When in use	34 dB	68 dB	Yes

Table 9: Comparison of predicted noise impacts at **parkland** receivers with the project noise goal.

Scenario	Representative time of day	Noise level predicted at parkland ($L_{Aeq,15min}$)	Noise goal ($L_{Aeq,15min}$)	Compliance
Shift 1 and 2: Factory fully operational with all equipment operating.	6 am to 7 am	45 dB	45 dB	Yes
	7 am to 6 pm		50 dB	Yes
	6 pm to 10 pm		50 dB	Yes
	10 pm to midnight		45 dB	Yes
Shift 3: Factory partially operational for cleaning, preparation and maintenance. No tyre-processing machines operating. Only forklift and air-conditioning operational.	midnight to 6 am	13 dB	45 dB	Yes

6. TRAFFIC AND TRUCK DELIVERY NOISE ASSESSMENT

6.1. Commercial Receivers Near Site

a) To address concerns relating to increased traffic noise from truck movements on site, our assessment considered i) site observations by Acoustic Directions' engineers during attended nose measurements, ii) careful listening to the recorded audio from the noise logger installed at 66 Victoria St for twelve days, and ii) the traffic impact assessment prepared by APEX Engineers (dated October 2023).

b) APEX Engineers' traffic report states the following:

"The proposal involves the use of the subject site at 68-70 Victoria Street as a tyre recycling facility. The site at 70 Victoria Street will provide an entry-only driveway, a weighbridge, areas and 5 car parking spaces. The site at 68 Victoria Street will be used as an open warehouse and provide 7 car spaces (including a single disability-accessible car space) and an exit-only driveway.

Internal vehicle access between lots 70 and 68 will be provided through a new roller door to the building in lot 68. Figure 2 shows the proposed site layout plan.

As a result of the proposed operations, the number of truck movements will be between 5-6 deliveries per day. Regular delivery activities will be via 12.5m long Heavy Rigid Vehicles (HRVs). The largest vehicle to access the site will be a 13.9m semi-trailer. The proposed development will be serviced by 8 staff members (maximum on-site, at any one time) and will likely attract at most 2 visitors per day."

It concludes the following:

"As per the above, the peak hour traffic generation of this proposal will likely be in the order of approximately 8 trips, which reflects the vehicle movements generated by staff (8 trips entering the site in the AM peak hour and 8 trips exiting the site in the PM peak hour). Throughout the day, the site will generate vehicle movements related to visitors and deliveries. However, these activities will at most generate 4 trips in a given hour.

As per the above, the anticipated peak hour and daily traffic generation potential of the proposed development is considered minimal and is therefore unlikely to eventuate into any material impacts on the existing local traffic conditions."

c) Accordingly, we conclude that the increase in overall long-term noise levels at surrounding commercial noise-receivers from trucks making deliveries to the proposed rubber recycling 68 and 70 Victoria St will be insignificant. For instance, if the number of vehicle movements were doubled, the noise would increase only by 3 dB. As such, the increased traffic noise from delivery trucks is not addressed in this report. In any event, there is no requirement in the NSW Road Noise Policy to assess the impact of road-traffic noise at commercial/industrial receivers.

d) As per the traffic assessment, we understand that trucks will be entering the site at 70 Victoria St and proceed to the side door on the west façade of 68 Victoria St . Once inside No 68, the tyres are unloaded. As such, we have assessed the possible impact these trucks will have on the adjoining most- affected commercial/industrial receiver directly adjacent at 72 and 74 Victoria St.

e) Our model considers the following:

- estimated truck speed 5 km/hr
- length of traverse 30 m
- a truck producing a sound pressure level of 103 dBA equivalent at 1 m.

f) With the above calculation parameters, the L_{Aeq} as measured over 15-minutes is 68 dB. We note however, that this would occur only up to six times (i.e. the number of truck deliveries) a day for approximately 11 seconds. This noise level should also be seen in context that the typical $L_{Aeq,15\text{-minute}}$ sound level at the logger position was 72 dBA.

g) As truck deliveries will not be permitted between 12:00 am to 6:00 am (Shift 3), there will not be vehicle noise during the periods of lowest background noise in the night period.

Given the high ambient noise environment of the street and open-area of No. 70, we consider that the noise from trucks will have little overall noise impacts on nearby receivers.

6.2. Residential Receivers

To determine the possible impact that truck delivery movements to the site may have on residential receivers we adopted the following rational and calculation method.

a) There are no nearby residents on Victoria St; the closest are located on the Smithfield Rd to the south-east of the site.

b) Based on the surrounding roads to the site, we have assumed that trucks delivering to Tyrex will be travelling on Smithfield Rd and turn onto Victoria St.

c) As we do not have measured ambient noise data for Smithfield Rd, we have adopted a conservative approach and assumed that the levels for Victoria St represent those on Smithfield Rd (however, in reality the ambient noise levels on Smithfield Rd will be higher).

d) To calculate the change in noise levels at the most-affected residential receivers on Smithfield Rd from Tyrex truck movements, we adopted the method from equation F.6 from British Standard BS5228-1: 2009 Method for mobile plant using regular well-defined route (e.g. haul roads) which is shown in Figure 4 below.

e) For the calculation we adopted the following:

- Ambient noise level minimum one-hour L_{Aeq} level of 70 dBA between 6:00 am and 5:00 pm, and 65 dBA between 5:00 pm and 12 midnight.
- A sound power of 111 dBA for the truck (based on a sound pressure of 103 dBA at 1 m).
- A speed of 40 km/hr for a truck approaching the corner of Victoria Rd from Smithfield Rd in a 60 km/hr zone.
- A distance of 10 m to the receiver from the centre of the haul road (as per BS5228).
- A worst-case total of 2 truck delivery per hour (based on a maximum of six deliveries between 6:00 am and 12 midnight with two arriving within the hour).

$$L_{Aeq} = L_{WA} - 33 + 10\log_{10}Q - 10\log_{10}V - 10\log_{10}d \qquad \text{(F.6)}$$

where:

L_{WA} is the sound power level of the plant, in decibels (dB);

Q is the number of vehicles per hour;

V is the average vehicle speed, in kilometres per hour (km/h);

d is the distance of receiving position from the centre of haul road, in metres (m).

Figure 4. Equation F.6 from British Standard BS5228-1: 2009.

f) The calculated $L_{Aeq\ 1\ hr}$ level is 55 dBA.

g) A level of 55 dB is 10 dB below the 5:00 pm to 12 midnight ambient noise level of 65 dBA, and 15 dB below the 6:00 am to 5:00 pm ambient noise level.

h) Accordingly, the impact of truck noise from trucks delivering to Tyrex will have no effect on the existing most-affected residents.

7. DISCUSSION AND RECOMMENDATIONS

7.1. Operational Factory Noise

Results from **Table 7**, **Table 8**, and **Table 9** show that the predicted noise levels emitted from the factory at the most-affected noise receivers comply with the established noise goals derived from the EPA Noise Policy for Industry.

To ensure that noise emissions from the industrial operations at Tyrex Australia continue to meet the required levels, we recommend that Tyrex adopt the following items:

a) Machinery should remain in their existing locations. However, if relocation of equipment is required, equipment should only be moved towards the centre of the factory.

b) Workers within the facility should undertake their work using the quietest reasonable processes and method.

c) All roller doors to the factory should be shut when processing tyres.

d) Delivery trucks shall drive into the factory prior to offloading and loading goods from the vehicle.

e) Trucks shall turn off their engines while unloading (i.e. do not leave trucks idling).

f) Forklifts shall not be used in outdoor areas, such as behind 68 Victoria St and at 70 Victoria St between 10 pm and 8:00 am each day.

g) The exhaust fans installed in the roof of 68 Victoria St shall be equivalent in noise output to those installed in the existing premise at 66 Victoria St.

h) All external noise-generating machines/equipment (including chillers) shall be located at least four metres from the nearest boundary and shall be shielded from direct line-of-sight to the closest two boundaries. This can be achieved by constructing an open-topped enclosure that surrounds the external equipment. The height of the enclosure should be at least 500 mm above the highest machine and lined with 100 mm thick insulation such as Megasorber P100. Once the location of the equipment is confirmed, we can provide additional advice as needed for each item of major plant such as the chillers.

7.2. Truck Noise

To comply with the adopted noise goal of 68 dB at the most-affected receiver directly adjacent at 72 Victoria St, the following operational conditions shall be implemented:

a) Maximum of 6 trucks per day as per APEX Engineer's traffic report.

b) Time-spacing of no more than one truck delivery per 15-minute period approximately.

c) As soon as the truck arrives the access door between 68 and 70 Victoria St shall be opened.

d) Trucks shall not idle in 70 Victoria St for more than the time taken to open the access door.

e) Trucks in 70 Victoria St must not idle.

f) Truck deliveries will only be allowed outside the hours of 12:00 am to 6:00 am (Shift 3).

g) The truck access door between the 68 and 70 Victoria St shall remain closed except to allow truck to pass through when required.

8. CONCLUSIONS

This Environmental Impact Statement presents an acoustic assessment of the proposed Tyrex Australia facility at 68-70 Victoria Street, Smithfield. This assessment was undertaken to satisfy the requirements from the Department of Planning, Industry and Environment (DPIE) through their recent issue of formal Planning Secretary's Environmental Assessment Requirements (SEARs). The assessment has considered noise emitted from the machines and activities associated with operation of the rubber recycling facility.

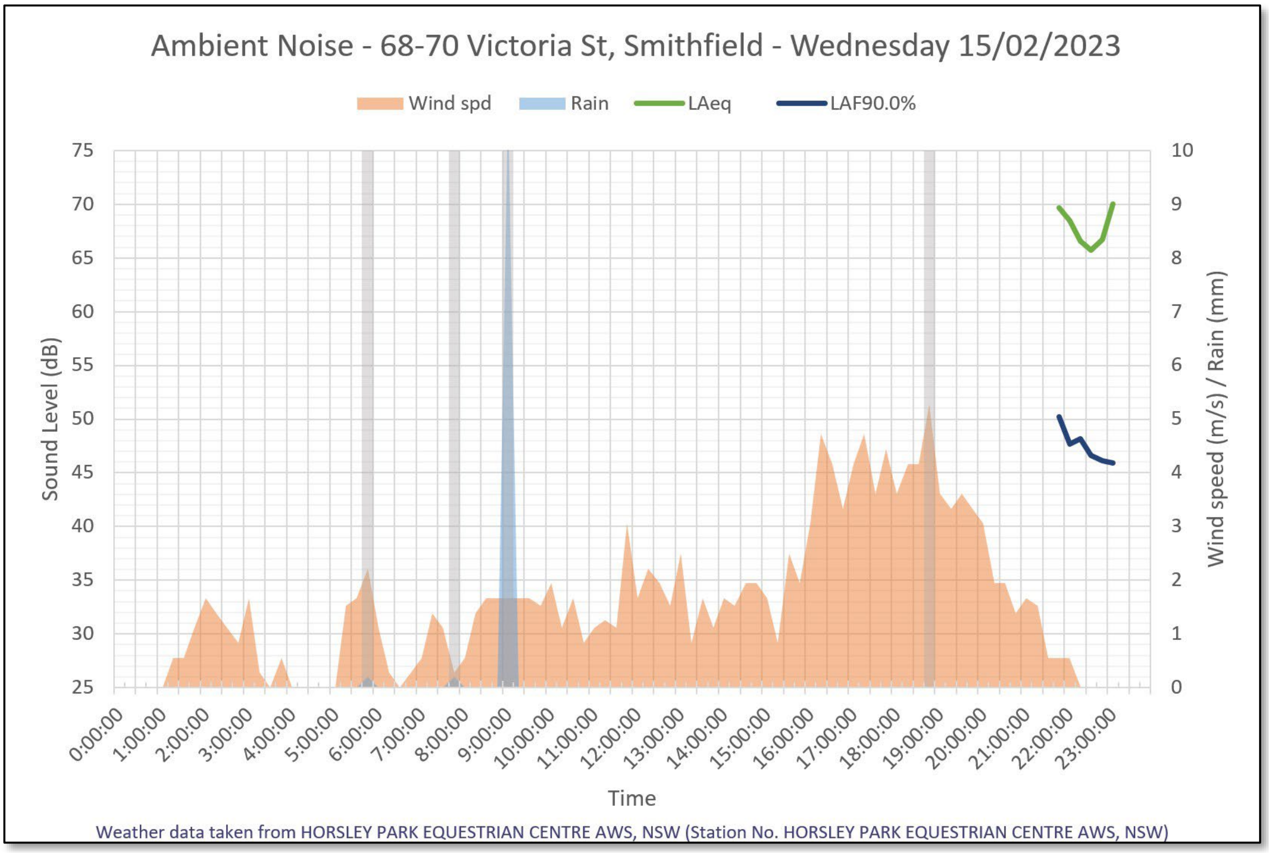
Based on i) the background noise measurements made at the most-affected receivers, and ii) our noise model of the existing operations at 66 Victoria St, in conjunction with the noise measurements of the additional new machines, we conclude the following:

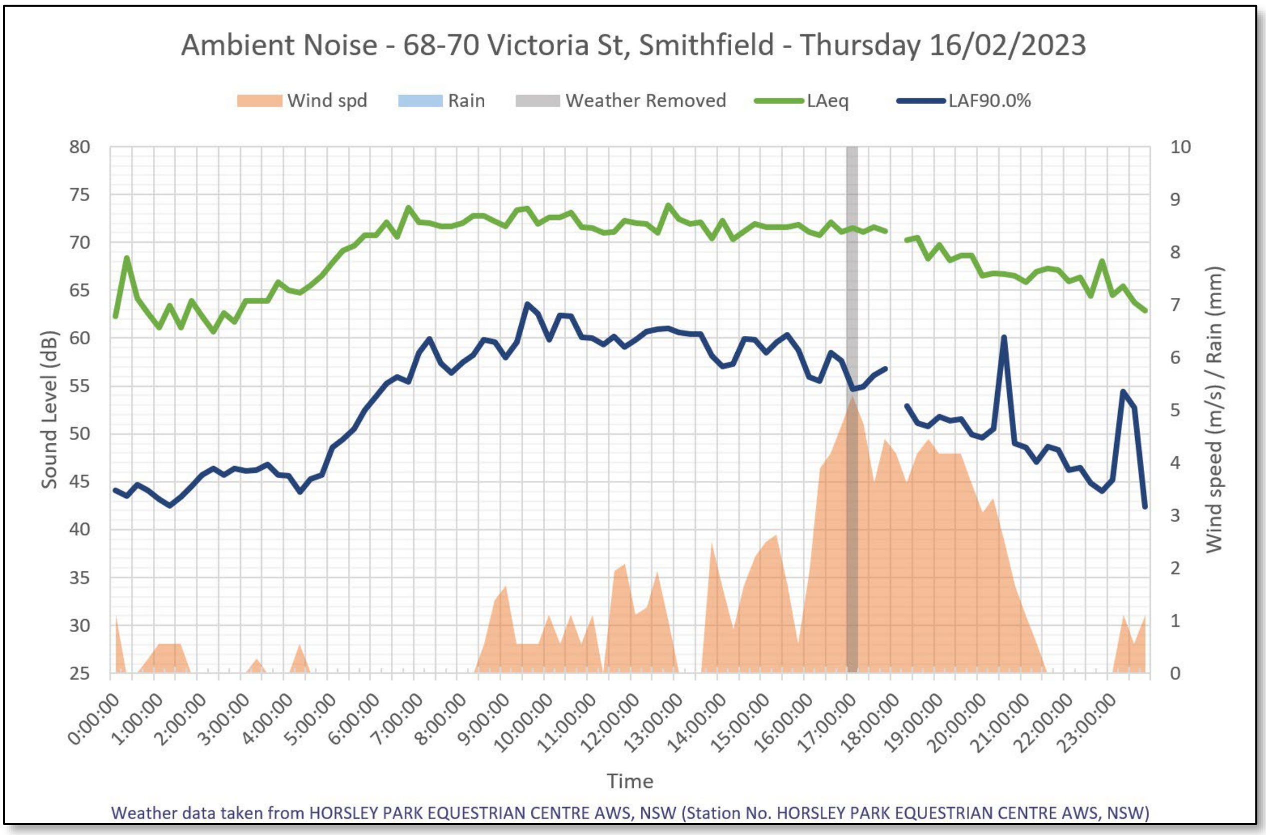
a) Noise levels emitted to surrounding noise receivers will be below the project noise trigger levels as defined by the EPA Noise Policy for Industry.

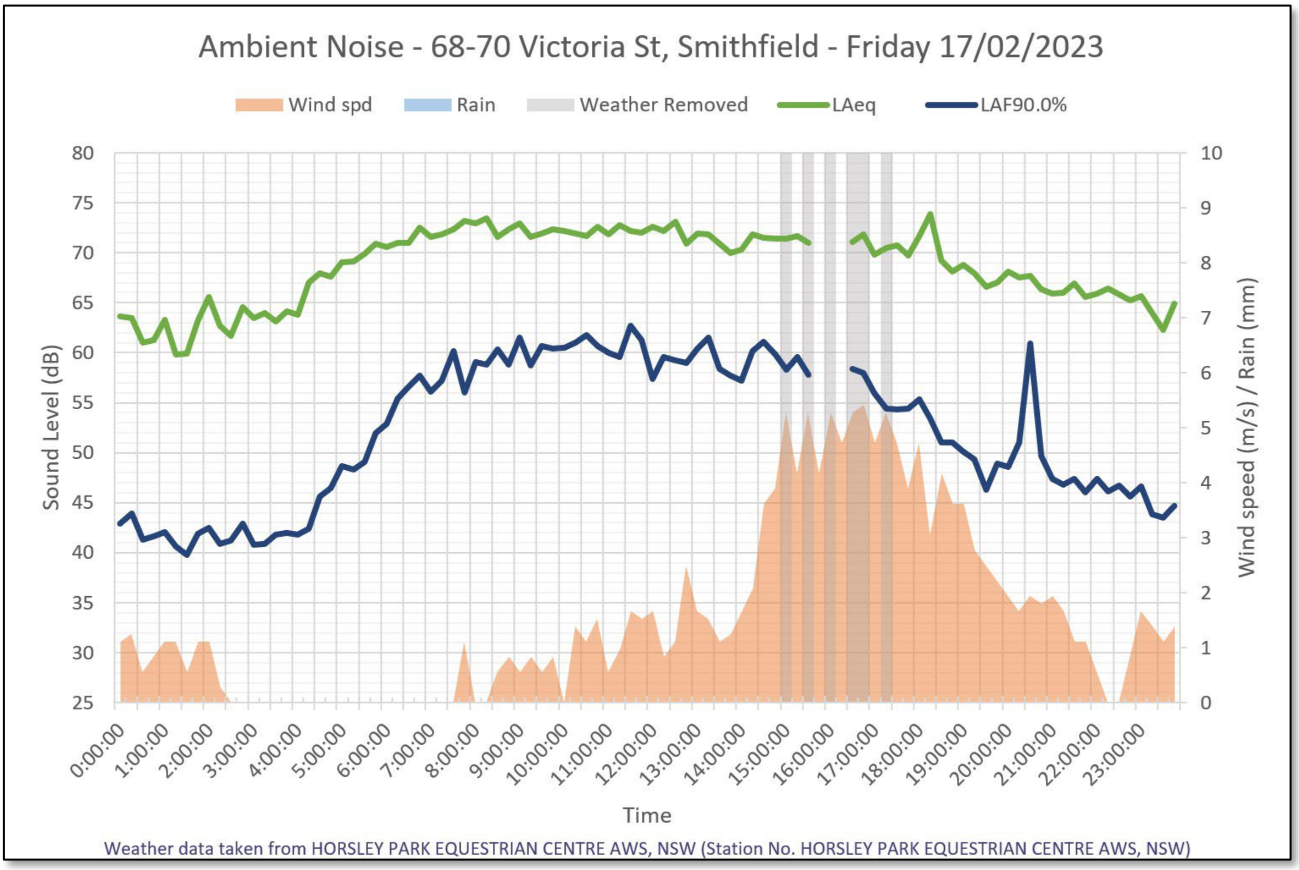
b) However, the predicted noise levels are based on operational assumptions such as good noise management practices on site, suitable placement of noise-generating equipment and a specified operational schedule.

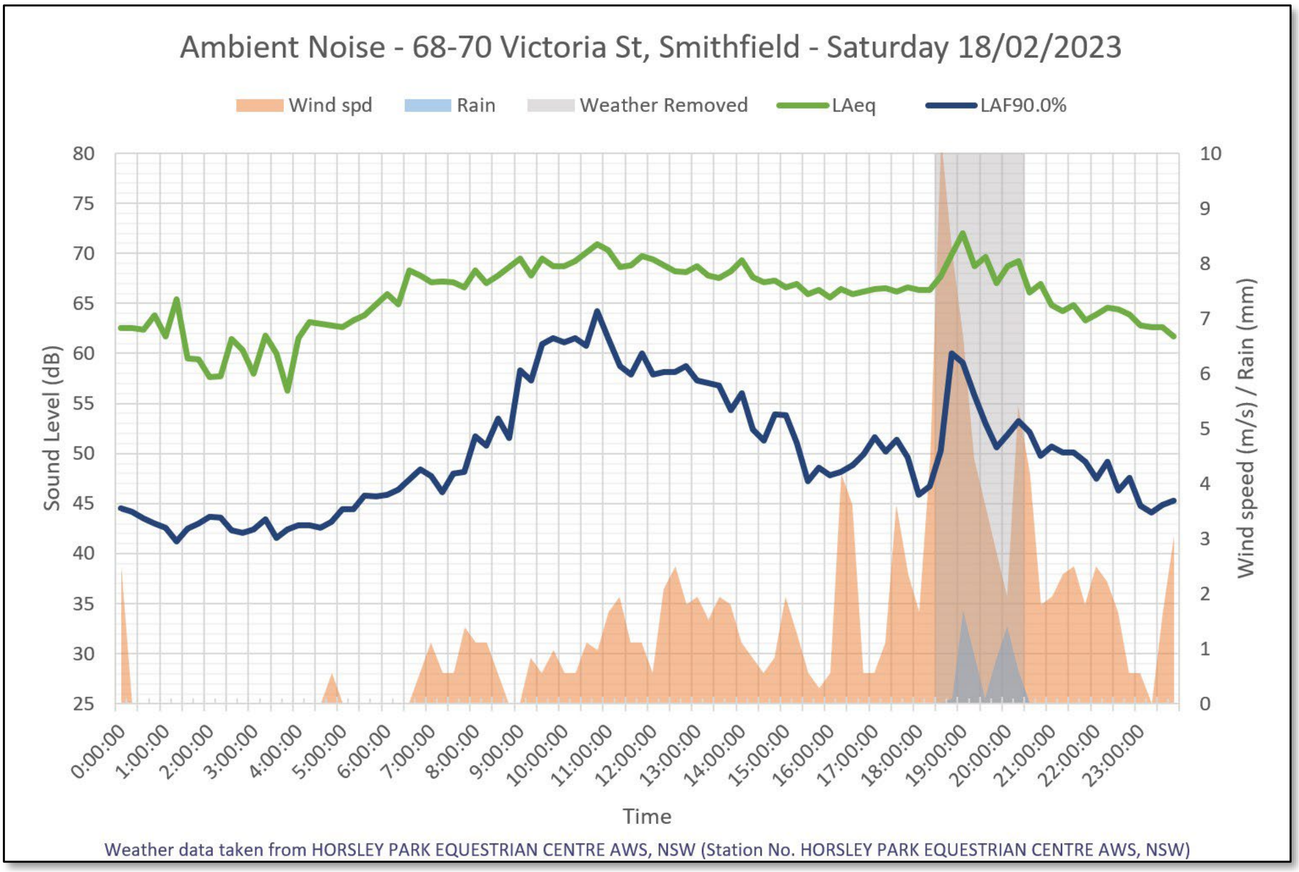
c) To ensure that ongoing noise emissions remain acceptable, we recommend that recommendations provided in Section 6.2 are followed.

9. APPENDIX A – NOISE LOGGER DATA






Ambient Noise - 68-70 Victoria St, Smithfield - Friday 17/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)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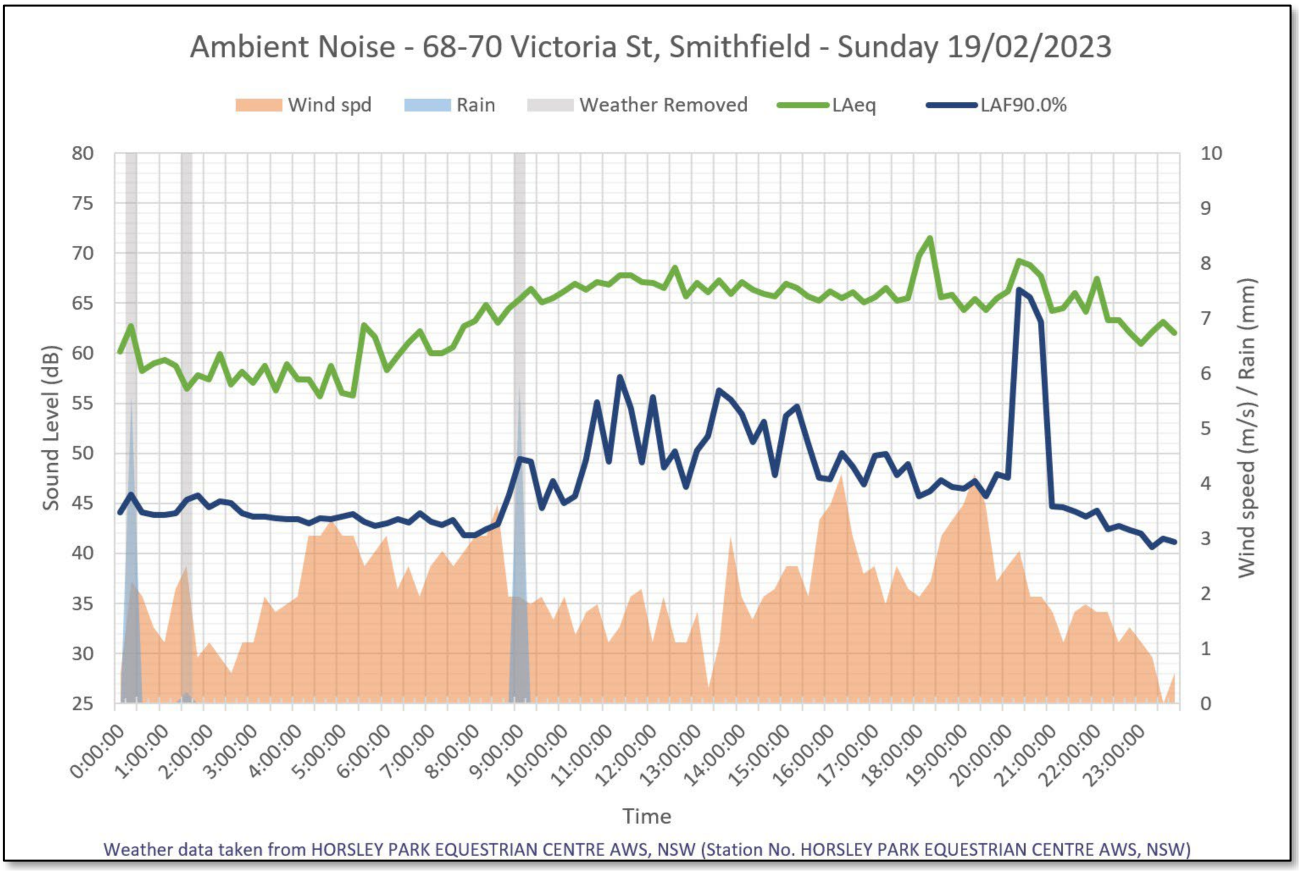
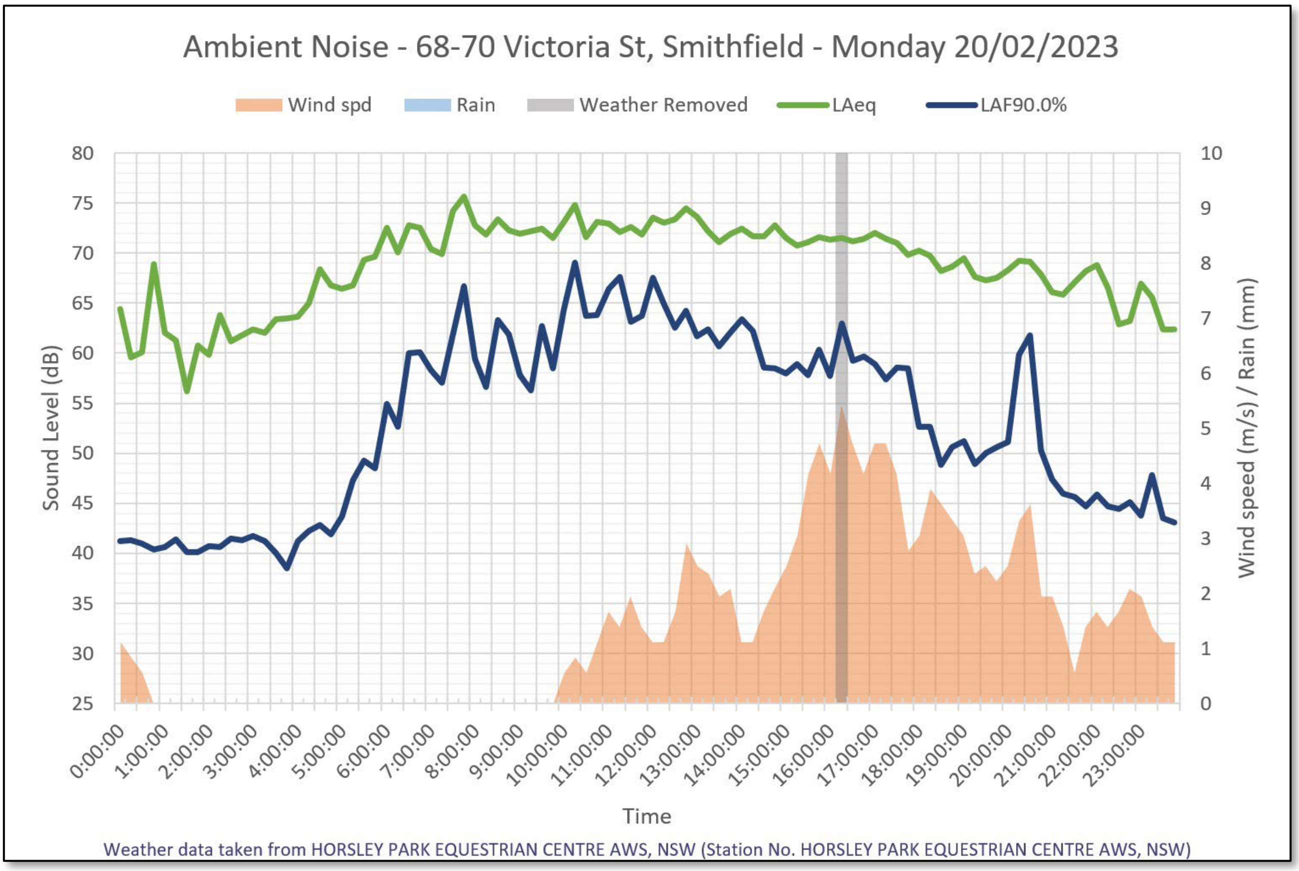
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Sunday 19/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Monday 20/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
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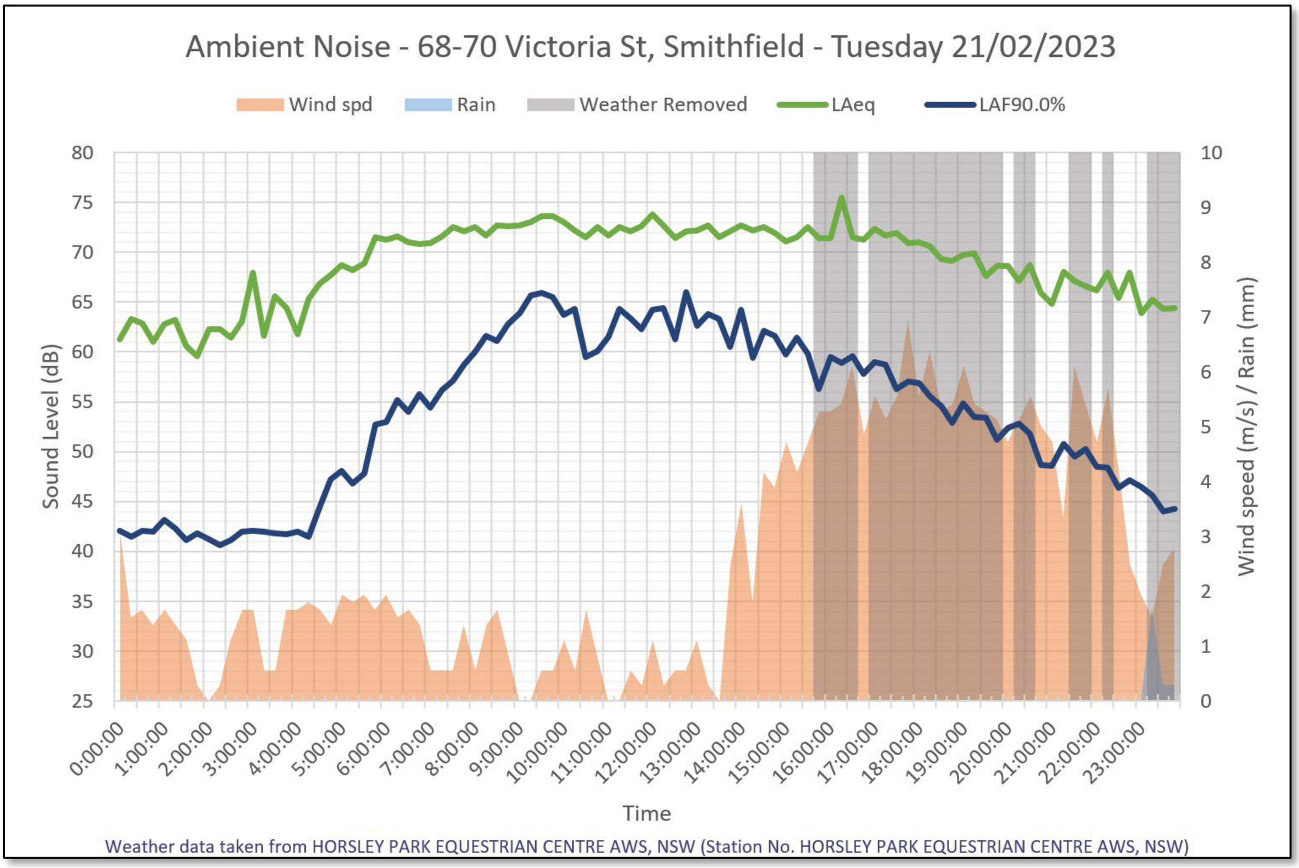
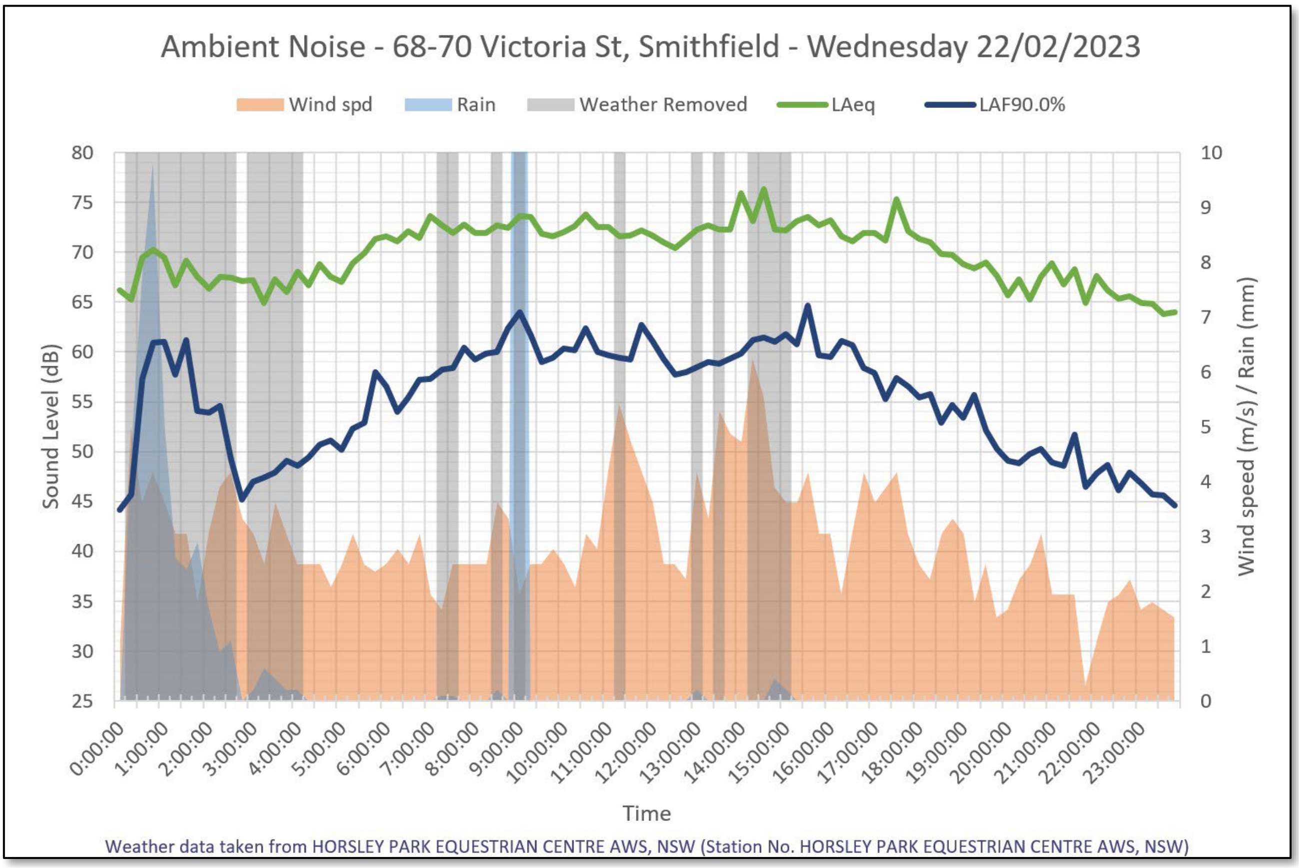
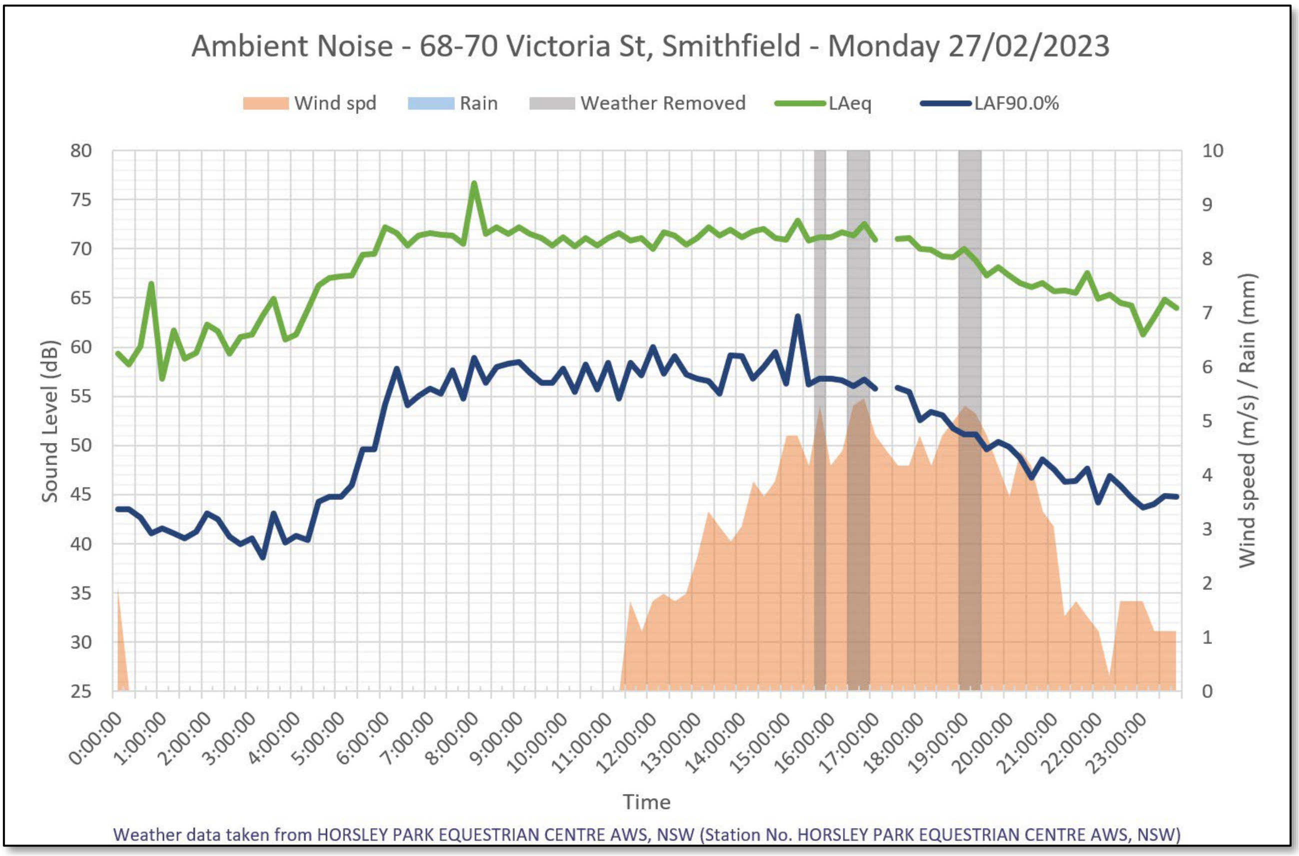
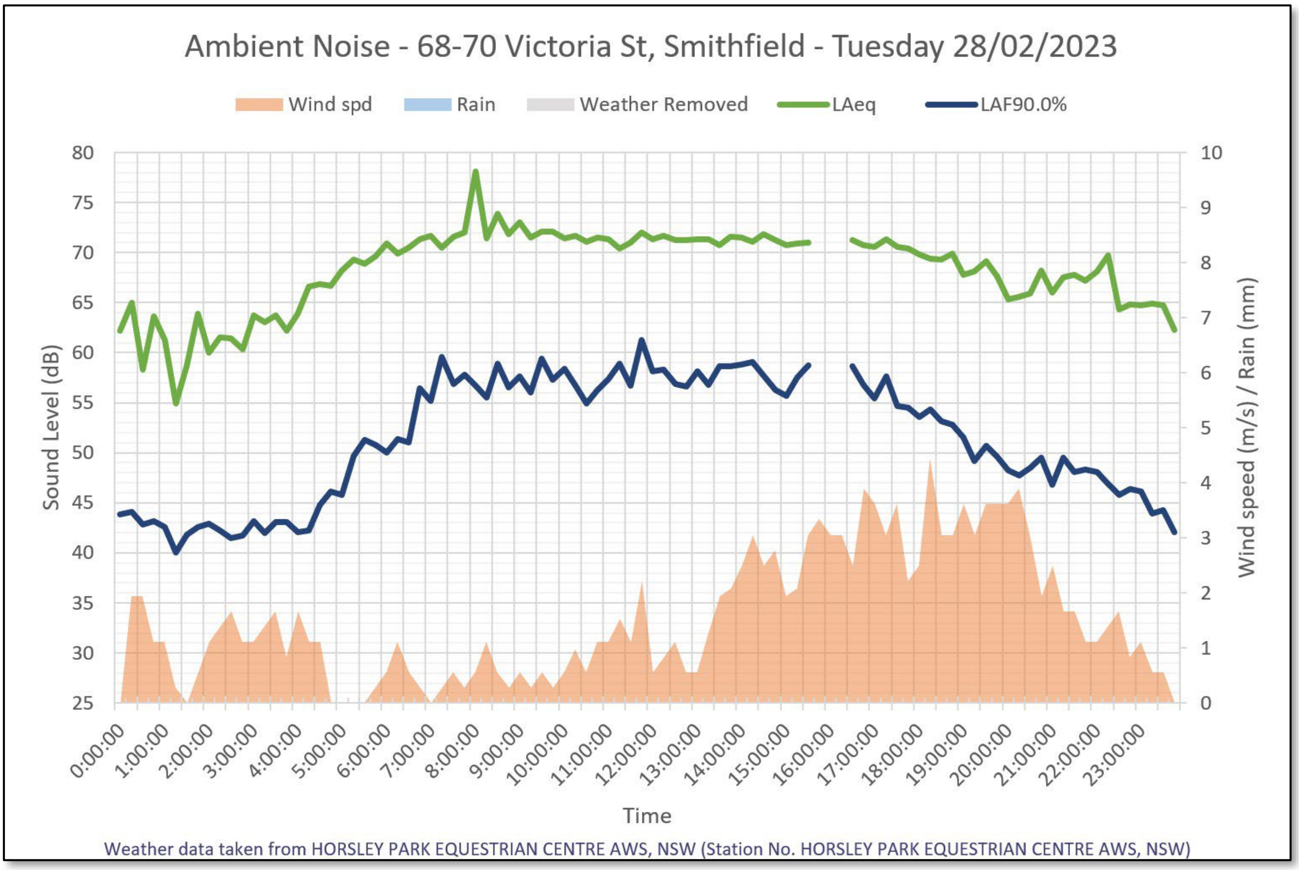
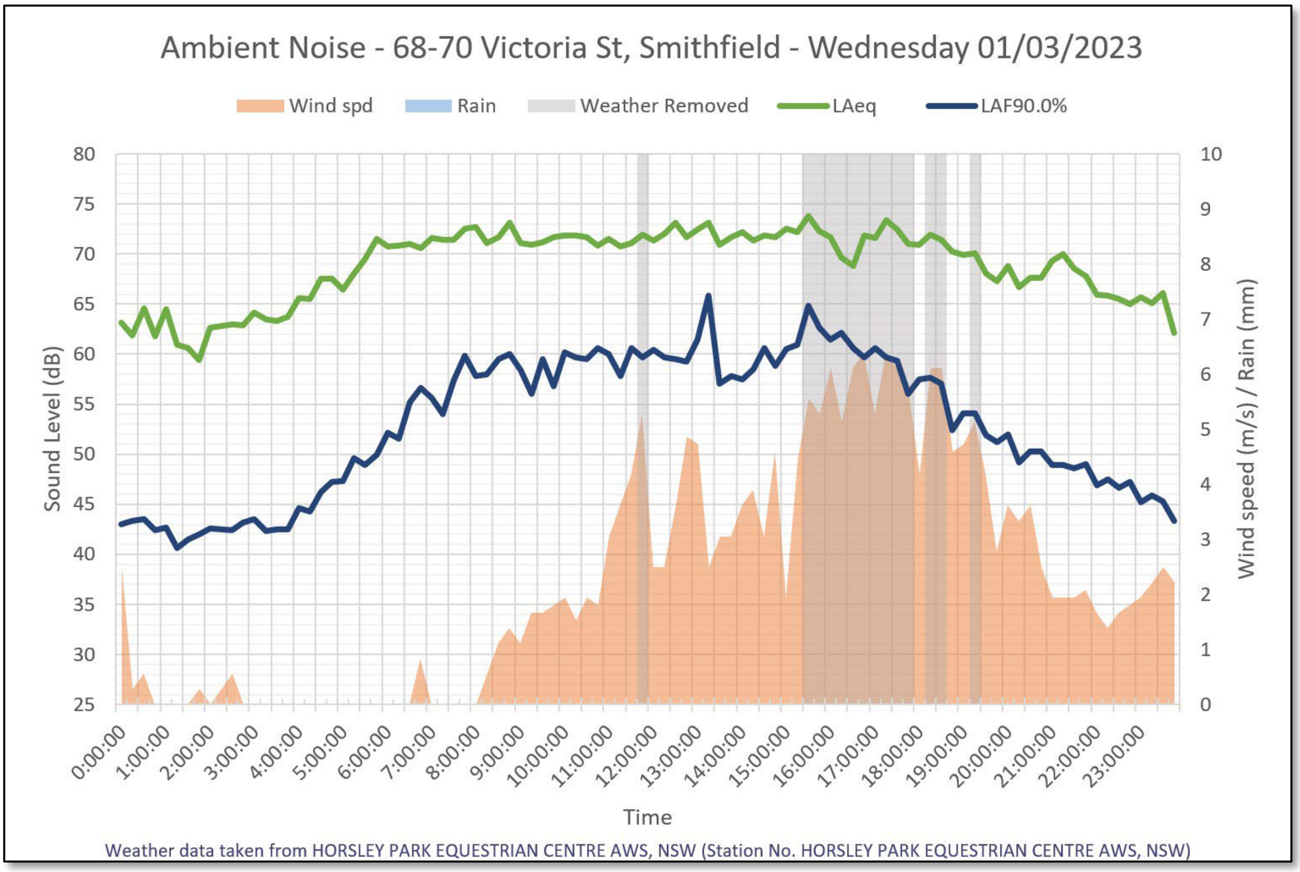
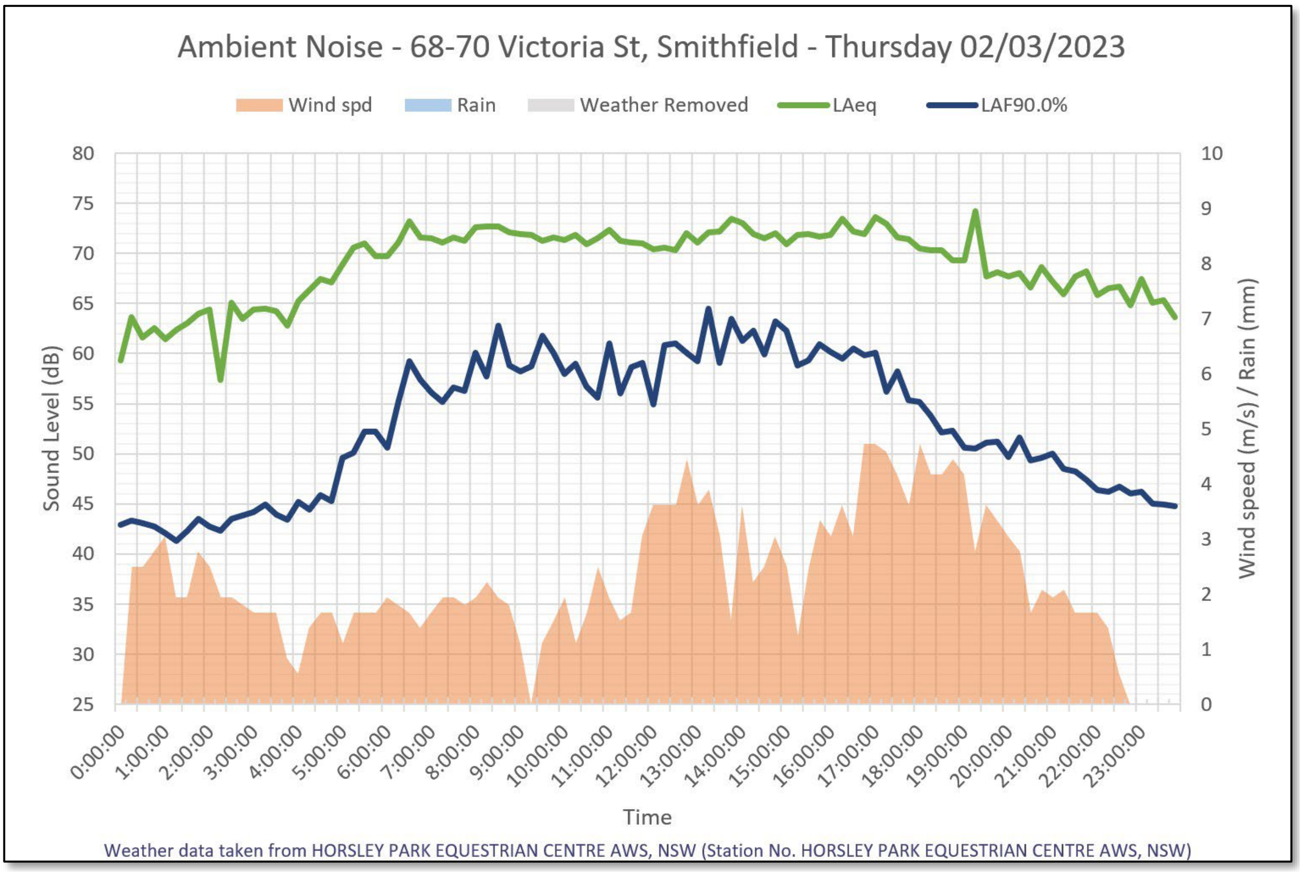

Ambient Noise - 68-70 Victoria St, Smithfield - Tuesday 21/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)

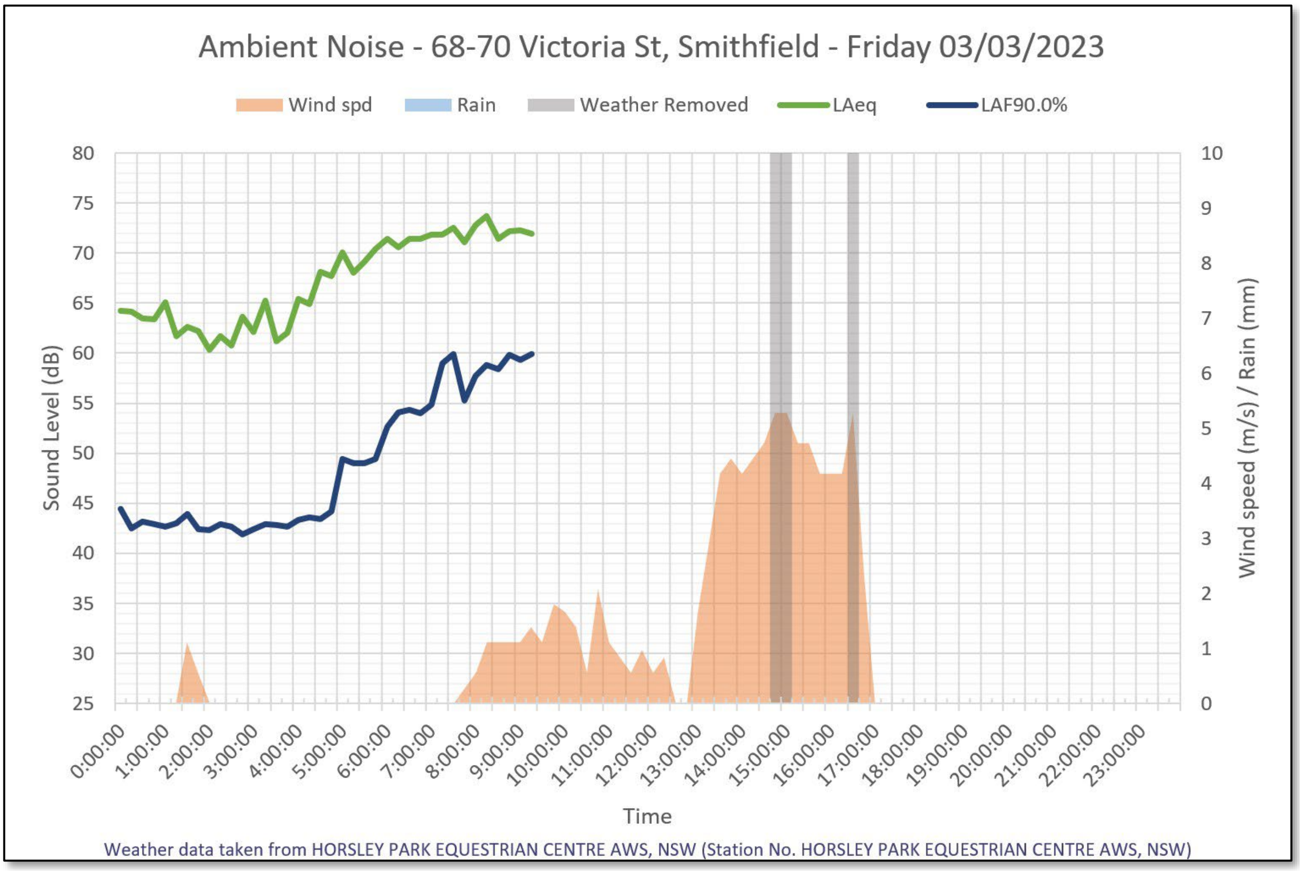

Ambient Noise - 68-70 Victoria St, Smithfield - Wednesday 22/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Monday 27/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Tuesday 28/02/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Wednesday 01/03/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Thursday 02/03/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)


Ambient Noise - 68-70 Victoria St, Smithfield - Friday 03/03/2023
Wind spd
Rain
Weather Removed
LAeq
LAF90.0%
Sound Level (dB)
Wind speed (m/s) / Rain (mm)
Time
Weather data taken from HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW (Station No. HORSLEY PARK EQUESTRIAN CENTRE AWS, NSW)

10. APPENDIX B - GLOSSARY OF ACOUSTIC TERMS

10.1. Index to Terms

The glossary is arranged alphabetically to assist readers to find the required information by clicking on the link.

10.2. Glossary

SOUND

Sound is an instantaneous fluctuation in air pressure over the static ambient pressure and is transmitted as a wave through air or solid structures.

SOUND PRESSURE LEVEL

Commonly known as "sound level", the sound pressure level in air is the sound pressure relative to a standard reference pressure of 20µPa (20x10-6 Pascals) when converted to a decibel scale.

DECIBEL (dB)

A scale for comparing the ratios of two quantities, including sound pressure and sound power.

The ratio of sound pressures which we can hear is a ratio of 106:1 (one million to one). To measure this huge range in pressure, a logarithmic measurement scale is used with the associated unit being the decibel (dB).

An increase or decrease of approximately 10 dB corresponds to an approximate subjective doubling or halving of the loudness of a sound. A change of 2 to 3 dB is subjectively a small change and may sometimes be difficult to perceive.

As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply to dB values.

The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.

SOUND POWER

The sound power level (Lw) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (Lp) varies as a function of distance from a source or other factors such as shielding. However, the sound power level is an intrinsic characteristic of a source.

FREQUENCY

Frequency is the rate of repetition of a sound wave. The subjective equivalent of frequency in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to the number of cycles per second. A thousand hertz is often denoted kiloHertz (kHz), e.g. 2 kHz = 2000 Hz.

Human hearing ranges from approximately 20 Hz to 20 kHz.

OCTAVE BAND

The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the octave band below it. In subjective terms, it corresponds to a doubling of pitch.

For design purposes, the octave bands ranging from 31.5 Hz to 8 kHz are generally used. For more detailed analysis, each octave band may be split into three one-third octave bands or, in some cases, narrow frequency bands.

A-WEIGHTED SOUND LEVEL dBA

The unit of sound level, weighted according to the A scale, which takes into account the increased sensitivity of the human ear at some frequencies. The unit is generally used for measuring environmental, traffic or industrial noise is the A weighted sound pressure level in decibels, denoted dBA.

A weighting is based on the frequency response of the human ear at moderate and low sound levels and has been found to correlate well with human subjective reactions to various sounds.

Sound level meters usually have an A-weighting filter network to allow direct measurement of A-weighted levels.

C-WEIGHTED SOUND LEVEL dBC

As the sound level increases, the ear is better able to hear low frequency sounds, The C-weighting filter allow low frequencies to contribute to the measurement much more than the A weighting filter.

Z-WEIGHTING dBZ

The Zero-weighting is equivalent of non-frequency shaping or weighting the measured sound level, and as no filter is applied to the sound before measurement, it is sometimes referred to as "linear" weighting.

SOUND LEVEL INDICES

Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so several different noise indices have been defined, according to how the averaging or statistics are carried out.

Examples of sound level indices are L_{eq},T Lmax, L_{90}, L_{10} and L_1, which are described below. The reference time period (T) is normally included, e.g. $dBL_{A10,\ 5min}$ or $dBLA_{90,8hr}$.

EQUIVALENT CONTINUOUS SOUND LEVEL (L_{eq})

Another index for assessment for overall noise level is the equivalent continuous sound level, L_{eq}. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. This allows fluctuating sound levels to be described as a single figure level, which assists description, design and analysis.

The L_{eq} is often A-weighted to remove the contribution of low frequencies, which may be less audible and is written as L_{Aeq}. It can also have no weighting as L_{Zeq} or C-weighting as L_{Ceq}.

L_{max},T - MAXIMUM SOUND LEVEL

A noise level index defined as the maximum noise level during the measurement period duration T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

L_{90}(T)

A noise level index. The L_{A90} is the sound pressure level measured in dBA that is exceeded for 90% of the time over the measurement period T. In other words, the measured noise levels during the period were greater than this value for 90% of the measurement period.

L_{90} can be considered to be the "average minimum" noise level and in its A weighted form is often used to describe the background noise a L_{A90}.

L_{A10}(T)

A noise level index. The L_{A10} is the sound pressure level measured in dBA that is exceeded for 10% of the time interval (T). In other words, the measured noise levels during the period were only greater than this value for 10% of the measurement period.

This is often referred to as the average maximum noise level.

L_{A1}(T)

Refers to the sound pressure level measured in dBA, exceeded for 1% of the time interval (T). This is often used to represent the maximum noise level from a period of measurement but is not the same as L_{Amax}.

RATING BACKGROUND LEVEL (RBL)

A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.

ASSESSMENT BACKGROUND LEVEL (ABL)

A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time.

Reverberation Time

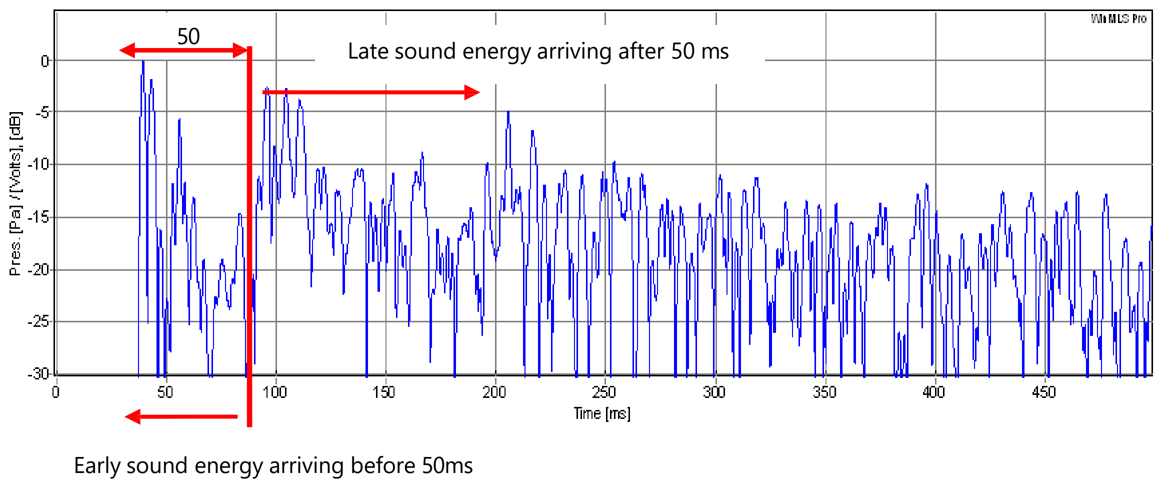
The time in seconds required for the sound at a given frequency to decay away (or reduce to) to one-thousandth of its initial steady-state value after the sound source has been stopped. This degree of reduction is equivalent to 60 decibels.

CLARITY RATIO

The clarity ratio is a metric that is used to assess the degradation in speech intelligibility due to the temporal effects of reverberation and echo. It is defined as the ratio of the sound energy of early-arriving sound that is useful for intelligibility to the energy of late-arriving sound which is not useful. Early-arriving sound consists of the direct sound and some reflections, while late arriving sound consists of reverberation and echoes.

Early-arriving sound consists of sound that arrives between the start of an extremely short pulse (an impulse) up to 50 ms after the start of the pulse, while late arriving sound is the total sound energy arriving later than 50 ms after the start of the pulse.

The following figure shows a typical impulse response and illustrates the dividing period of 50 ms between early and late arriving sound, which is used to compute the C_{50} clarity ratio.



Typical impulse response illustrating how the clarity ratio C_{50} is computed.

As the ear and therefore subjective intelligibility is sensitive to the amount of reverberation and echo at different frequencies, the C_{50} ratios must be as high as possible at all frequencies to maximise intelligibility.

STI - SPEECH TRANSMISSION INDEX

The Speech Transmission Index (STI) is one of the better available metrics to assess the capability of a transmission system to transmit intelligible speech. STI is a single number that ranges between 0 and 1. It attempts to assess the degradation in intelligibility caused by reverberation/echoes and background noise by measuring the reduction in modulation of the speech-like waveform. Phonemes in speech are produced by modulating vocal sounds in a specific pattern, and when perfect transmission of the modulation pattern is present at a listening location, the clarity is perfect. When modulations are corrupted by reverberation or noise, the time pattern of the phonemes is changed, and the clarity is degraded.

However, STI has three fundamental weaknesses:

i) It is almost blind to the effects of tonal balance on intelligibility.

ii) It is partially blind to the effects of echo on intelligibility.

iii) It reduces many complex factors (frequency/level/time) into to a single number, thereby concealing important and audible components that contribute to the degradation of speech intelligibility.

To accommodate these weaknesses in STI, Acoustic Directions uses two other metrics (clarity ratios and frequency response) in conjunction with STI to assess speech intelligibility produced by a sound system.

The STI value is computed from weighted MTI values, which represent the loss of modulation in each octave-wide frequency range. When assessing STI performance, it is instructive to assess the loss of modulation in each frequency range by inspecting the associated MTI values.

Given that the majority of speech sounds occur in the 250 Hz and 500 Hz frequency ranges, the MTI values in these frequency ranges are a direct indicator of the smearing or degradation in vowel sounds. In turn, this indicates the extent to which long vowel sounds will subjectively mask sounds with higher frequency content such as consonants.

FREQUENCY RESPONSE

Subjective tonal balance is measured as a system's frequency response at each location. As the ear is very sensitive to the direct sound field (the first-arriving part of the sound before reflections arrive), the response of the direct field with speech must be as consistent as possible over the listening area in the frequency range of 100 Hz to 12 kHz.

EQUIVALENT ACOUSTIC DISTANCE

By amplifying a talker's speech, a sound system reduces the apparent acoustic distance between a talker and distant listener. The equivalent acoustic distance defines the resulting acoustic distance between the talker and listener and is a direct measure of the amount of voice amplification that the system can provide before the onset of acoustic feedback. Feedback is often heard as a strong colouration to the voice or howling sound.

We are accustomed to holding conversations in relatively close proximity, and to produce similar conditions in a courtroom and allow soft talkers to be heard, the EAD should be less than 2.2 m and typically 1.8 m without any trace of feedback or tonal ringing in the sound.

EAD is associated with speech intelligibility as it directly relates to the amount of speech amplification that the system can provide in order to deliver a satisfactory level of speech signal above the noise to each listener.

Factors affecting the EAD include:

- The number of microphones switched on at any time.
- The relationships between the directional response characteristics of the microphone and loudspeaker.
- The sound level reaching the audience at the critical mid and mid-high frequencies.
- Room acoustic behaviour.

VIBRATION

Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing structure-borne noise or human comfort issues respectively. Vibration amplitude may be quantified as a peak value, or as a root mean squared (rms) value.

Vibration amplitude can be expressed as an engineering unit value e.g. 1mms-1 or as a ratio on a logarithmic scale in decibels:

Vibration velocity level, LV (dB) = 20 log (V/Vref),

(where the preferred reference level, Vref, for vibration velocity = 10-9 m/s).

The decibel approach has advantages for manipulation and comparison of data.

SOUND ABSORPTION

This is the removal of sound energy from a room or area by conversion into heat.

SOUND ABSORPTION CO-EFFICIENT

Sound absorption co-efficient indicate the extent to which a material absorbs sound power at a specific frequency and is expressed on a scale of 0 to 1, with a value of 1 representing the maximum possible absorption.

SOUND INSULATION

The sound insulation is the capacity of a structure such as a wall or floor to prevent sound from reaching a receiving location.

SOUND REDUCTION INDEX

This parameter is used to describe the sound insulation properties of a partition and is the decibel ratio of the airborne sound power incident on the partition to the sound power transmitted by the partition and radiated on the other side. It is usually measured in specific frequency bands, such as octave or one-third octave.

$D_{nT,w}$

The single number quantity that characterises sound insulation between rooms over a range of frequencies with airborne sound.

R_w

Single number quantity that characterises the sound-insulating properties of a material or construction element over a range of frequencies with airborne sound.