

Sand Martins Golf Club Greenkeepers Facility

Noise Impact Assessment Report 1370.NIA.Cond 5.02

For

Sand Martins Golf Club Ltd

Finchampstead Road

Wokingham

Berkshire

RG40 3RQ

18 July 2024

By

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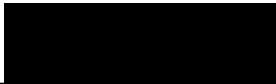
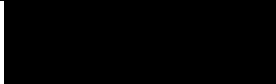
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Table 1. Author Qualifications

Report	Signed	Name and Position	Relevant Qualification
Undertaken and Prepared By		David Fernleigh Principal	MIOA
Checked By		David Fernleigh Principal	MIOA

This report has been prepared with all reasonable skill and care by dBA Acoustics for the Client named. Calculations and estimates made in this report are based on reasonable assumptions and good industry practice that, by their nature, involve uncertainties that could cause future on site results to differ materially from those predicted. dBA Acoustics does not guarantee or warrant any calculation or estimate made. The information contained herein is the property of, and confidential to, the Client. Any third-party information required and/or provided for the completion of this report should not be considered as verified by dBA Acoustics, unless otherwise stated.

1.0 INTRODUCTION

- 1.1 Conditional planning permission (ref:210233) has been granted for a new Green-keepers Facility at Sand Martins Golf Club, Finchampstead.
- 1.2 The condition requires that plant noise emissions and service yard activity noise occurring as a result of the proposed development are suitably controlled in order to protect the occupants of nearby residential properties from noise.
- 1.3 dBA Acoustics have been commissioned to undertake measurements of both the prevailing environmental noise climate at the nearest residential properties and greenkeepers activity noise.
- 1.4 dBA Acoustics have also been commissioned to undertake an assessment of the likely noise impact from the proposed development in order to assist in discharging the condition.
- 1.5 This report concerns the assessment and/or control of atmospheric noise affecting the development site for the purposes of planning and design. Detailed mechanical, structural, H,S&E and conservation considerations are beyond the expertise of this practice and should be dealt with accordingly.

2.0 SUMMARY

- 2.1 An environmental noise survey has been undertaken that includes a weekend period and the prevailing background noise climate has been determined.
- 2.2 Service yard activity and mobile greenkeeping machinery noise surveys have been undertaken and the greenkeepers operational activity noise levels have been quantified.
- 2.3 An assessment of service yard activity and mobile greenkeeping machinery has been undertaken in accordance with BS4142:2014+A1:2019.
- 2.4 It has been agreed to discharge the fixed plant and machinery associated with the greenkeeper's facility separately, prior to occupation.
- 2.5 Mitigation has been proposed comprised of uprated sound insulation of the grinding room, an absorbent acoustic barrier at the perimeter and time limits on jet wash use.
- 2.6 With the proposed mitigation in place the Rating level from service yard and mobile machinery has been predicted to be no higher than the prevailing background sound level and low noise impact.
- 2.7 The proposals are subject to final approval by the Local Authority.

3.0 SITE

- 3.1 The development site lies to the east of Waverley Park and to the west of the A321 Finchampstead Road. Immediate adjacencies are generally residential use with numerous residential roads nearby. The site location and boundary are as shown in the map below: below shows the location of the development site, as indicated:



Figure 1. Site Location - Map Data © OpenStreetMap 2024

- 3.2 The image below shows the approximate location of the acoustic survey monitoring position and nearest adjacent residential receptor:



Figure 2. Noise Monitoring Position – Image Data © Google 2024

4.0 SURVEYS

- 4.1 An automated environmental noise survey was undertaken between approximately 12:00hrs on 17 March 2022 and 12:00hrs on 22 March 2022. The L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} noise levels were measured continuously and logged every 15 minutes. Individual L_{Amax} noise events were measured continuously and logged every 5 seconds. The survey covered a 5day period and included a weekend. The following equipment was used:

Table 2. Automated Noise Monitoring Equipment

	SLM	Preamplifier	Microphone	Calibrator
Manufacturer	Norsonic AS	Norsonic AS	Gras	B&K
Type	140	1209	40AF	4231
Serial No.	1403413	12821	207390	1839133
Latest Calibration	11/02/2021			21/12/2021
Certificate No.	37033			U39794

- 4.2 For the automated measurements a proprietary windshield and extension cable was deployed. The microphone was pole mounted at a height of approximately 2.5m above ground level in freefield conditions.

- 4.3 The entire signal path was checked for calibration at the beginning and end of the survey. No significant fluctuation (greater than 0.1dB) was detected.

The following table details the weather conditions for the survey period:

Table 3. Automated Survey Weather Conditions

Condition	Start	End
Wind Speed ms^{-1}	<0.8	<0.5
Wind Direction (from)	southwest	southeast
Precipitation or Fog	nil	nil
Wet Ground	nil	nil
Frozen Ground or Snow	nil	nil
Temperature $^{\circ}C$	11	16
Cloud Cover %	20	10

- 4.4 It is understood that the weather during the unattended part of the survey was fine with no high winds or significant rainfall. During both attended measurement surveys the weather was dry with little wind.

- 4.5 Attended measurements were undertaken on 22 March 2022 and 3 May 2022. The L_{Aeq} , L_{Amax} , and L_{A90} noise levels of typical activities and machinery at the existing Green-keepers Facility. The following equipment was used:

Table 4. Manned Surveys Noise Monitoring Equipment

Activity Monitoring	SLM	Preamplifier	Microphone	Calibrator
Manufacturer	Norsonic AS	Norsonic AS	Norsonic AS	B&K
Type	140	1209	1227	4231
Serial No.	1406112	20299	151737	1839133
Latest Calibration	18/11/2020			21/12/2021
Certificate No.	U36332			U39794

- 4.6 The calibration of the sound level meter used complies with IEC 61672-1:2003 class 1.
- 4.7 For the attended measurements a proprietary windshield was deployed. The microphone was tripod mounted at a height of approximately 1.5m above ground level at approximately 10m from the activity being measured unless otherwise stated.
- 4.8 The entire signal path was checked for calibration at the beginning and end of the survey. No significant fluctuation (greater than 0.1dB) was detected in any noise monitor.
- 4.9 The monitoring positions and field calibration noted above were deemed suitable for obtaining measurements representative of the prevailing environmental noise levels.
- 4.10 The dominant environmental noise source at the beginning and end of each survey was noted to be greenkeepers activity, distant road traffic and birdsong.

5.0 RESULTS

- 5.1 Time history graphs presenting the automated environmental survey measurements can be found within the appendix. Full raw data is available upon request.
- 5.2 The following table provides a summary of the prevailing sound levels measured over the survey period at the monitoring position.

Table 5. Prevailing Environmental Sound Levels (rounded)

Day	dB LAeq		dB LA10	dB LAmax
	Day 16hr	Night 8hr	18hr	Highest
Thursday	-	46	-	70
Friday	52	44	52	70
Saturday	53	47	51	72
Sunday	50	44	50	70
Monday	51	46	52	76
Tuesday	-	-	-	-

- 5.3 The following table presents the results of the statistical analysis of the prevailing background sound LA90 over the proposed greenkeepers operational hours:

Table 6. Prevailing Background Sound Levels (rounded)

Day	dB LA90	
	07:00-8:00	07:00-18:00
Period	-	40
Thursday	-	40
Friday	45	42
Saturday	43	43
Sunday	41	39
Monday	47	39
Tuesday	47	41
Overall	43	40

- 5.4 The uncorrected LAeq,T results for the attended measurements are given in the table below:

Table 7. Greenkeepers Machinery Measurement Results 22/04/2022

Item	Duration (s)	Sound Level dB at Octave Band Centre Frequency Hz at 10m								
		63	125	250	500	1k	2k	4k	8k	dBA
JD Gator leaving	22	65.8	70.5	63.4	60.3	57.8	56.8	54.1	51.7	64.4
2500E leaving	36	69.4	77.7	68.2	62.0	59.0	59.6	58.7	54.3	67.9
3250D leaving	29	72.4	69.1	63.0	59.8	61.1	60.2	61.3	58.3	67.6
5510 leaving	33	74.6	68.4	64.2	66.9	63.8	63.0	60.4	55.5	69.8
4000 leaving	35	74.0	64.6	65.1	62.7	62.4	62.0	58.3	55.0	68.0
Jet Wash	21	64.4	70.0	64.2	66.4	63.2	62.6	63.3	64.2	70.8
5800 leaving	29	70.1	71.6	66.5	67.3	61.0	60.7	61.2	56.4	69.2
Digger (security)	19	72.3	77.8	64.0	60.0	58.6	57.3	57.2	50.4	66.5
Door shutter closing	24	58.4	60.8	59.1	61.9	56.4	59.7	58.9	64.3	67.5
Door shutter opening	22	57.3	60.8	56.3	62.2	54.2	53.2	55.7	55.2	63.4
JD 4720 (security)	27	73.3	69.6	68.7	67.2	65.7	68.9	63.6	58.4	73.2
Pump (grass filter)	21	67.3	68.7	62.4	54.4	51.8	51.5	52.3	50.6	60.8

- 5.5 During a second site visit of 3 May 2022 the grinding machine and main pump were operational. Measurements undertaken of the operation of these items are detailed below:

Table 8. Workshop Grinding Machinery Measurement Results 03/05/2022

Item measured	Duration (s)	Sound Level dB at Octave Band Centre Frequency Hz at 1m								dBA
		63	125	250	500	1k	2k	4k	8k	
Bernard Anglemaster:										
4000 Express Dual (cylinder)	40	67.1	68.2	68.8	70.6	69.1	70.8	76.8	75.9	80.8
4000 (bottom blade)	40	54.5	62.7	63.1	61.6	64.9	63.2	70.3	71.8	75.1

- 5.6 A further site visit was subsequently arranged of for 4th July 2022 to measure a compressor and air gun. Measurements undertaken of the operation of these items are detailed below:

Table 9. Compressor and Airgun Measurement Results 04/07/2022

Item measured	Duration (s)	Sound Level dB at Octave Band Centre Frequency Hz at 1m								dBA
		63	125	250	500	1k	2k	4k	8k	
Compressor	62	69.8	66.3	73.0	69.9	70.7	67.3	66.7	57.7	75.1
Air gun (at 1.5m)	33	46.5	49.2	52.1	56.7	63.8	71.0	79.4	84.8	85.6
Air gun in use	30	52.3	53.8	63.6	71.6	78.9	82.8	89.8	93.9	95.4

6.0 CRITERIA

6.1 Condition 5 from the approved scheme reads as follows:

"Before the development hereby permitted commences a noise impact assessment shall be submitted to the local planning authority for written approval to address the following: - Noise breakout from the green-keepers building, - Noise from activity in the proposed service yard - Hours of use/operation - Noise from fixed plant and machinery within the compound. The noise impact assessment shall include details of a noise mitigation scheme which will be implemented before the building is occupied. The approved noise mitigation measures will be retained and maintained thereafter.

Reason: To protect the occupants of nearby residential properties from noise".

6.2 Further to the above. The wording of Condition 5 has been amended pursuant to the approval of an application for non-material amendments Ref:240402. Condition 5 now reads as follows:

"Prior to occupation of the development, a noise impact assessment shall be submitted to the local planning authority for written approval to address the following:

- Noise from fixed plant and machinery within the compound

Prior to above ground construction, a noise impact assessment shall be submitted to the local planning authority for written approval to address the following:

- Noise from activity in the proposed service yard

- Noise breakout from the green-keepers building

- Hours of use/operation

The noise impact assessments shall include details of a noise mitigation measures and these must be implemented before the development hereby approved is occupied. The approved noise mitigation measures shall be retained and maintained thereafter.

Reason: To protect the occupants of nearby residential properties from noise."

6.3 This noise impact assessment concerns the second of the above parts "Prior to above ground construction".

6.4 So that noise from the proposed machinery and activities complies with the condition above it is proposed to demonstrate that the rating level of the combined noise level, assessed in accordance with BS41412:2014 +A1:2019, does not exceed the prevailing background sound level at the nearest receptor. The lower background sound measured on Sunday/Monday has been adopted. As such, the applicable noise limits are shown in the table below:

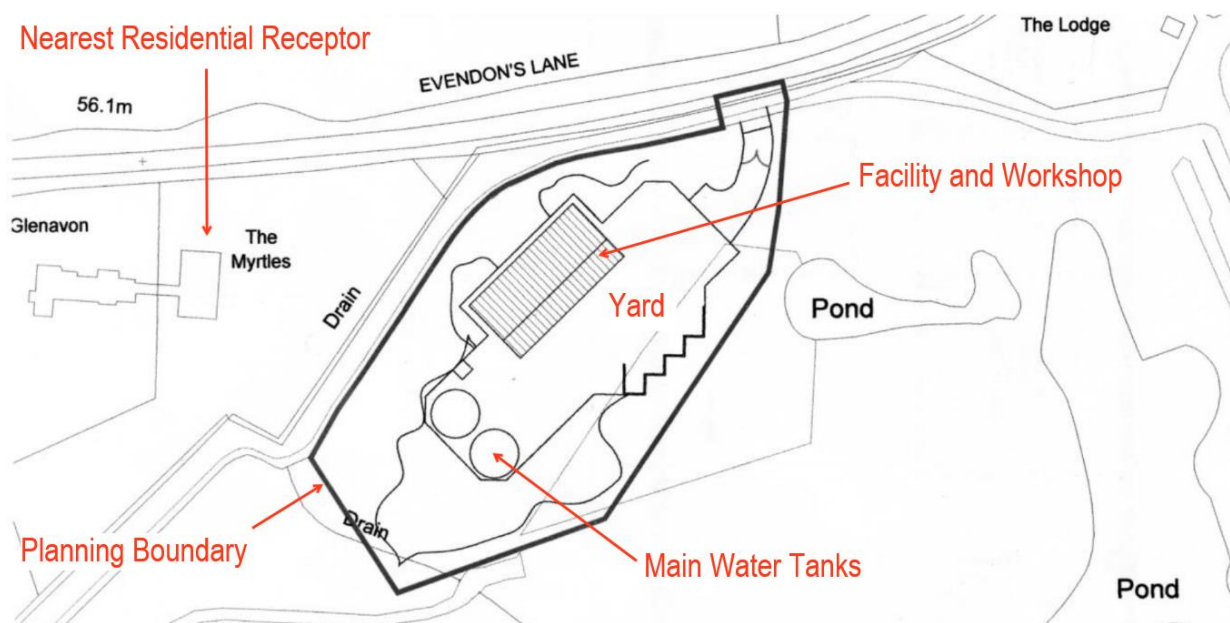
Table 10. Proposed Combined Rating Level Noise Limit

Location	Daytime (07:00 – 18:00) Noise Limits dB (ref: 20μPa)	
	Service Yard Activity and Greenkeepers Building Breakout	Fixed Plant and Machinery
Nearest Residential Receptor	39	29

- 6.5 Some aspects of the service yard activity are particularly difficult to attenuate (e.g. jet wash). It is therefore proposed to subsequently design fixed plant and machinery (part 1 "Prior to occupation" of the above condition) to a level that is at least 10dB below the service yard and greenkeepers activity breakout dealt with in this assessment. This should ensure that it should not be additive.
- 6.6 24hours operational fixed plant items, e.g. water pumps, will need to be assessed against the night-time background sound, which in any event, is more than 10dB below the daytime background.

7.0 ASSESSMENT

- 7.1 The Greenkeepers Compound arrangement relative to the nearest residential receptor is as shown in Block Plan excerpt (Lewandowski Architects drawing 2574.PL.C101.00) below:



- 7.2 The minimum specifications required for the acoustic fence are presented in the tables below:

Table 11. Compound Acoustic Fence SRI Specification

Minimum Sound Reduction Indices (dB) at Octave Band Centre Frequency (Hz)						
Frequency Hz	125	250	500	1k	2k	4k
SRI	13	16	18	29	45	45

Table 12. Compound Acoustic Fence Absorption Coefficient Specification

Minimum Sound Absorption Coefficient*						
Frequency Hz	125	250	500	1k	2k	4k
Absorption coefficient	0.5	0.6	0.8	0.9	0.95	0.95

*The acoustic lining should be inorganic, non-hygroscopic, flame, moisture, vermin proof and suitably stabilized to prevent migration of the acoustic media.

- 7.3 The roller shutters have been placed on the far side of the building from the nearest residential receptor in order to benefit from the additional screening effect from the building mass. The minimum specifications required for the roller shutters is shown in the table below:

Table 13. Roller Shutter Acoustic Specifications

Minimum Sound Reduction Indices (dB) at Octave Band Centre Frequency (Hz)							
Location	125	250	500	1k	2k	4k	Rw
Workshop	22	25	23	32	36	36	30
Equipment Store	8	10	15	20	25	31	20

- 7.4 The worst-case unscreened receptors are considered to be the adjacent property, The Myrtles. The distance from the various activities proposed within the compound and workshop installation to the windows and rear garden of The Myrtles is estimated at approximately 55m to 70m depending on the location of the activity (or plant) within the compound.
- 7.5 It is understood the proposed operational times are 07:00-18:00
- 7.6 In discussion with the greenkeeping operational staff it is understood that the worst-case hour daytime activities are likely to be as follows:
- All mobile greenkeeping machinery starting up and leaving the compound in the morning
 - Noise breakout from grinding machines in grinding room
 - Noise breakout from airgun in equipment store
 - Noise from external jet wash in compound
- 7.7 Where applicable the noise from each activity has been adjusted for distance and duration in accordance with BS4142. Where acoustic screening is present this has been calculated in accordance with the Maekewa Method.
- 7.8 The external walls of the greenkeepers facility are proposed to be a substantial cavity masonry (100mm concrete block/100mm cavity/100mm concrete block). As such, the breakout from internal areas within the building has been estimated via the primary acoustically weak paths of the roof and roller shutters.
- 7.9 The minimum acoustic performance specification for the equipment store roof is shown in the table below:

Table 14. Equipment Store Roof Acoustic Specification

Minimum Sound Reduction Indices (dB) at Octave Band Centre Frequency (Hz)							
Frequency	125	250	500	1k	2k	4k	Rw
SRI	18	34.0	41.0	39.0	38.0	45.0	38

- 7.10 It is considered that the internal activity within the facility with the greatest potential for noise impact due to the typical extended activity duration is the operation of the grinding machinery. Accordingly, these items have been located within an acoustically uprated grinding room within the workshop. Both the grinding room and workshop have an acoustic ceiling.
- 7.11 Grinding Room is proposed to be enhanced as follows:
- Masonry walls lined with 1x15mm dense plasterboard and 1x12mm ply on independent frame with 25mm mineral wool in the cavity.
 - 2 x 15mm dense plasterboard ceiling with 300mm mineral wool in the void above.
 - Rw35dB internal doors between grinding and hydraulic lift room

7.12 The air compressor is also proposed for location within this area in order to benefit from the uprated sound insulation.

7.13 Noise breakout has been calculated using the following formula from SRL publication Noise Control in Building Services:

$$L_{p_{out}} = L_{p_{in}} - SRI + 10\log S(\text{surface area}) - 20\log r(\text{distance}) - 14$$

Calculation summaries follow for the various worst-case activities:

7.14 The process of greenkeeping machinery starting up and leaving the compound has been measured and the noise impact calculated. The assessment incorporates the combined noise from the following equipment, starting up within the equipment store and leaving the compound, all in the same hour:

Greenkeeping machine equipment ID's:

JD Gator, 2500E, 3250D, 5510, 4000, 5800, Digger, Roller Shutter operation, JD 4720

7.15 The operational use of grinding machinery has been measured and the noise impact calculated. The assessment incorporates the combined noise from both grinding machines operating continuously within the grinding room.

7.16 It will be necessary to apply the following activity management protocols in order to keep noise suitably controlled and achieve the proposed limits. The management controls are as follows:

Table 15. Greenkeepers Activity Management Controls

Activity	Control
Jet Wash (external)	No more than 10min use per hour
Airgun (internal)	Use only with roller shutters closed

7.17 Based on the above noise levels arrangement and mitigation the table below presents the summary of the BS4142:2014 assessment undertaken (detailed calculations in Appendix C):

Table 16 BS4142:2014+A1:2019 Summary Calculation

Item	Sound Level dB at Octave Band Centre Frequency Hz at 1m								dBA
	63	125	250	500	1k	2k	4k	8k	
grinding breakout via roof	23.4	17.6	11.1	0.4	-2.9	-5.8	-0.7	-1.3	8.3
grinding breakout via roller shutters	23.3	13.7	12.4	11.4	0.2	-7.4	-5.0	-8.6	10.8
machines start up breakout via roof	34.5	24.5	0.5	-8.0	-10.3	-8.6	-13.8	-23.2	11.7
air gun breakout via roof	13.5	8.2	1.9	1.5	9.8	14.6	14.0	18.0	21.1
airgun breakout via closed front rollers	-1.4	0.7	7.5	7.5	6.7	3.2	0.8	2.0	11.4
machines in compound	43.0	38.6	30.9	28.0	23.4	22.3	16.6	10.7	30.8
jet wash in compound	36.6	39.2	32.2	33.0	27.9	25.6	23.7	22.8	34.7
Total Specific level	44.5	42.0	34.7	34.2	29.3	27.5	24.9	24.3	36.4
Acoustic Character Correction									3
Rating level									39
Background									39

7.18 It is noted that the background sound first thing in the morning and for significant periods during the day was consistently a few dB higher than the overall typical background sound adopted.

7.19 Based on the results presented in the table above it is demonstrated that in a robust worst-case hour of activity the Rating level is predicted to be no higher than the background sound level.

8.0 CONCLUSION

- 8.1 An environmental noise survey has been undertaken that includes a weekend period and the prevailing background noise climate has been determined.
- 8.2 Service yard activity and mobile greenkeeping machinery noise surveys have been undertaken and the greenkeepers operational activity noise levels have been quantified.
- 8.3 An assessment of service yard activity and mobile greenkeeping machinery has been undertaken in accordance with BS4142:2014+A1:2019.
- 8.4 It has been agreed to discharge the fixed plant and machinery associated with the greenkeeper's facility separately, prior to occupation with a further noise impact assessment to be submitted to secure this.
- 8.5 Mitigation has been proposed comprised of an absorbent acoustic barrier at the perimeter and time limits on certain operational activities.
- 8.6 With the proposed mitigation in place the Rating level from service yard and mobile machinery has been predicted to be no higher than the prevailing background sound level and low noise impact.
- 8.7 The proposals are subject to final approval by the Local Authority.

Report end

dBA Acoustics

APPENDIX A – TIME HISTORY GRAPH

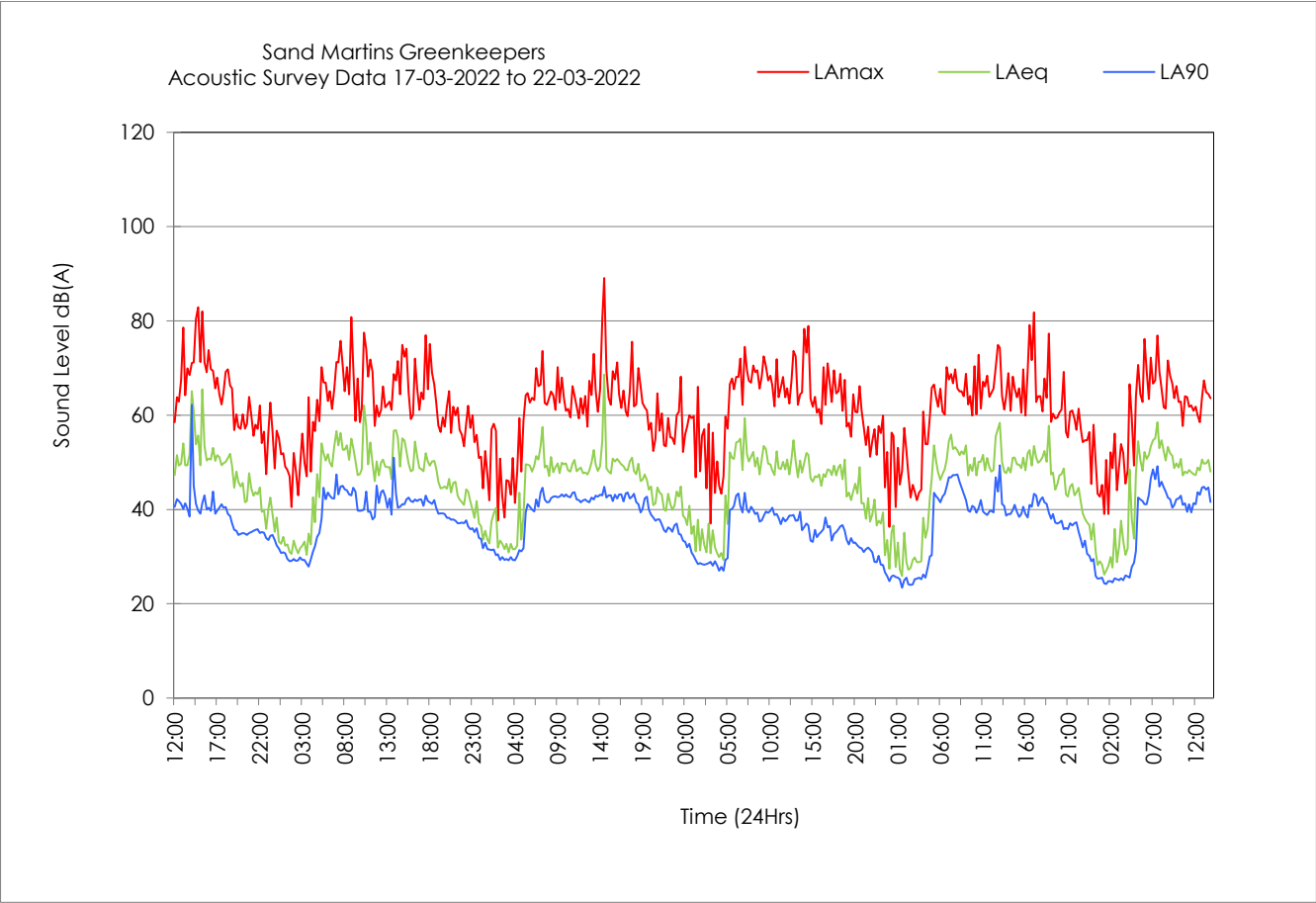


Figure 3. Time History Graph

APPENDIX B – BACKGROUND SOUND ANALYSIS

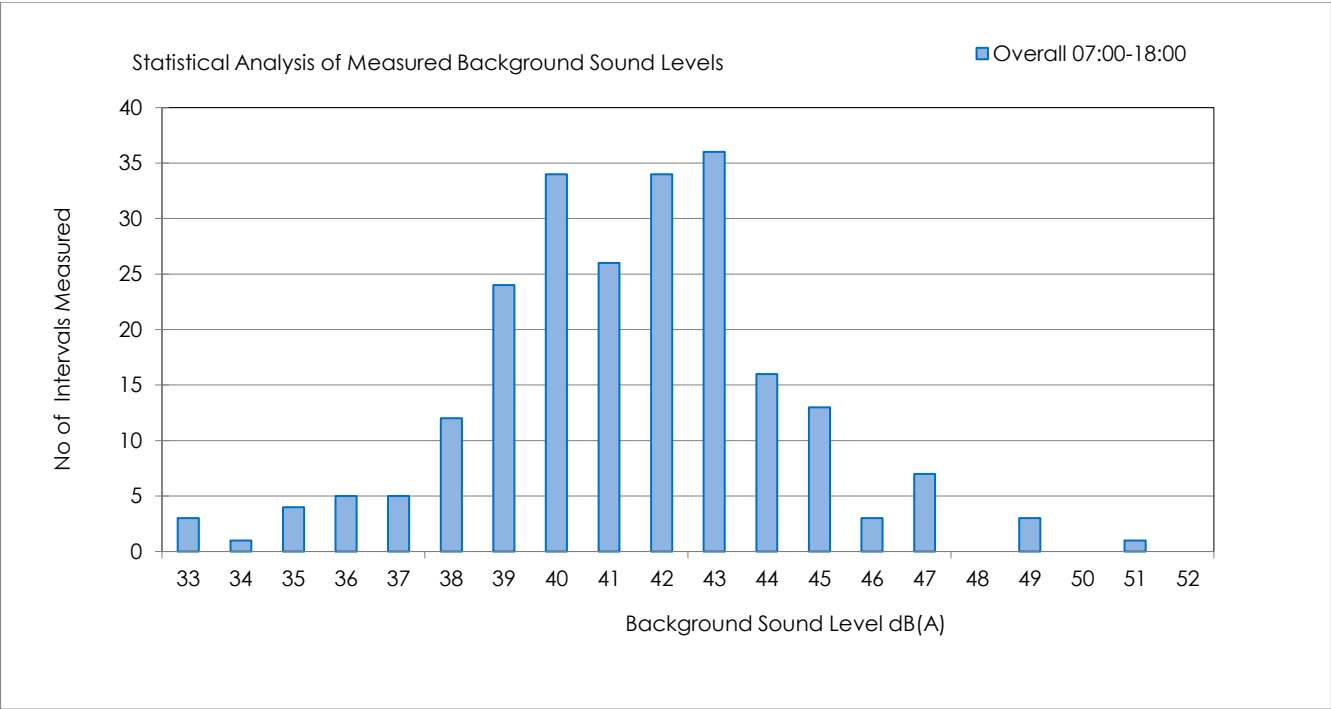


Figure 4. Statistical Analysis of Background Sound – Entire Survey Duration

APPENDIX C – CALCULATIONS

Table 17. BS4142:2014+A1:2019 Service Yard and Breakout Calculation

Duration	Status	63 Hz	125 Hz	250 Hz	500 Hz	1.0 kHz	2.0 kHz	4.0 kHz	8.0 kHz	dB(A)		
(0:0:29.0)	JD Gator + Reverse	74.1	75.8	66.8	64.7	62.6	61.8	59.0	56.3	69.1		
(0:0:22.0)	1 JD Gator leaving	65.8	70.5	63.4	60.3	57.8	56.8	54.1	51.7	64.4		
(0:0:14.0)	1a 2500E in workshop	66.4	60.7	53.0	48.2	43.9	45.7	45.0	40.4	53.4		
(0:0:36.0)	2 2500E leaving	69.4	77.7	68.2	62.0	59.0	59.6	58.7	54.3	67.9		
(0:0:16.0)	2a 3250D in workshop	64.8	62.9	52.4	53.6	47.9	49.1	53.7	43.4	58.3		
(0:0:29.0)	3 3250D leaving	72.4	69.1	63.0	59.8	61.1	60.2	61.3	58.3	67.6		
(0:0:13.0)	3a 5510 in workshop	69.4	61.5	51.9	49.2	49.4	50.8	44.0	37.2	55.9		
(0:0:33.0)	4 5510 leaving	74.6	68.4	64.2	66.9	63.8	63.0	60.4	55.5	69.8		
(0:0:21.0)	4a 4000 in workshop	62.6	60.6	56.3	53.1	49.0	48.1	44.9	37.0	55.9		
(0:0:35.0)	5 4000 leaving	74.0	64.6	65.1	62.7	62.4	62.0	58.3	55.0	68.0		
(0:0:21.0)	Jet Wash	64.4	70.0	64.2	66.4	63.2	62.6	63.3	64.2	70.8		
(0:0:29.0)	6 5800 leaving	70.1	71.6	66.5	67.3	61.0	60.7	61.2	56.4	69.2		
(0:0:19.0)	Digger (security)	72.3	77.8	64.0	60.0	58.6	57.3	57.2	50.4	66.5		
(0:0:24.0)	Door shutter closing	58.4	60.8	59.1	61.9	56.4	59.7	58.9	64.3	67.5		
(0:0:22.0)	7 Door shutter opening	57.3	60.8	56.3	62.2	54.2	53.2	55.7	55.2	63.4		
(0:0:26.0)	Dakota top dresser	74.7	67.2	65.4	61.8	64.3	65.1	60.2	56.1	69.9		
(0:0:27.0)	8 JD 4720 (security)	73.3	69.6	68.7	67.2	65.7	68.9	63.6	58.4	73.2		
(0:0:21.0)	Pump BG	56.8	53.1	49.6	41.0	38.3	36.4	39.2	32.8	46.9		
(0:0:21.0)	Pump side 1	67.3	68.7	62.4	54.4	51.8	51.5	52.3	50.6	60.8		
(0:0:25.0)	Pump side 2	66.6	68.6	62.4	50.7	44.1	44.9	48.7	47.3	58.3		
29	JD Gator + Reverse	74.1	75.8	66.8	64.7	62.6	61.8	59.0	56.3			
14.0	1a 2500E in workshop @10	66.4	60.7	53.0	48.2	43.9	45.7	45.0	40.4			
16.0	2a 3250D in workshop	64.8	62.9	52.4	53.6	47.9	49.1	53.7	43.4			
13.0	3a 5510 in workshop	69.4	61.5	51.9	49.2	49.4	50.8	44.0	37.2			
21.0	4a 4000 in workshop	62.6	60.6	56.3	53.1	49.0	48.1	44.9	37.0			
16.0	5a rep 5800 in workshop	64.8	62.9	52.4	53.6	47.9	49.1	53.7	43.4			
29	on-time correction	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9			
14.0	1a on-time correction	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1	-24.1			
16.0	2a on-time correction	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5			
13.0	3a on-time correction	-24.4	-24.4	-24.4	-24.4	-24.4	-24.4	-24.4	-24.4			
21.0	4a on-time correction	-22.3	-22.3	-22.3	-22.3	-22.3	-22.3	-22.3	-22.3			
16.0	5a rep on-time correction	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5			
	duration corrected start up											
	at 10m											
	JD Gator + Reverse	53.1	54.8	45.9	43.8	41.7	40.9	38.0	35.4			
	2500E in workshop	42.3	36.6	28.9	24.1	19.8	21.6	20.9	16.3			
	3250D in workshop	41.3	39.4	28.9	30.0	24.4	25.6	30.2	19.9			
	5510 in workshop	45.0	37.1	27.5	24.8	24.9	26.3	19.6	12.8			
	4000 in workshop	40.3	38.2	34.0	30.7	26.6	25.7	22.5	14.7			
	5800 in workshop	41.3	39.4	28.9	30.0	24.4	25.6	30.2	19.9			
	duration corrected leaving	54.4	55.2	46.4	44.2	42.0	41.3	38.9	35.6			
22	1 JD Gator leaving	43.6	48.4	41.3	38.2	35.6	34.6	32.0	29.5			
36	2 2500E leaving	49.4	57.7	48.2	42.0	39.0	39.6	38.7	34.3			
29	3 3250D leaving	51.4	48.2	42.1	38.8	40.1	39.3	40.3	37.4			
33	4 5510 leaving	54.2	48.0	43.8	46.6	43.4	42.6	40.0	35.2			
35	5 4000 leaving	53.8	44.4	45.0	42.6	42.3	41.8	38.2	34.9			
29	6 5800 leaving	49.1	50.7	45.6	46.3	40.1	39.8	40.3	35.5			
22	8 Door shutter opening	35.2	38.7	34.1	40.0	32.1	31.1	33.6	33.1			
27	9 JD 4720 (security)	52.1	48.3	47.5	45.9	44.5	47.7	42.3	37.1			
26	Dakota top dresser	53.3	45.8	44.0	40.4	42.9	43.7	38.7	34.7			
	total time corrected unscreened	60.8	60.2	54.3	52.9	50.8	51.7	48.7	44.6	57.7		
	2.5m fence	-5.5	-6.1	-7.2	-8.7	-10.7	-13.1	-15.8	-18.7			
dist.	10 65	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3	-17.3			
	machines leaving with screening	43.0	38.6	30.9	28.0	23.4	22.3	16.6	10.7	30.8		
	machines start up inside at 10m	42.4	38.3	30.3	28.8	24.5	25.2	27.0	17.6	33.2		
rev lp	10 1 at store perimeter	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0			
	150 10log5	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8			
	SRI roof	12.0	18.0	34.0	41.0	39.0	38.0	45.0	45.0			
distance	60	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6			
	machines start up breakout via roof	34.5	24.5	0.5	-8.0	-10.3	-8.6	-13.8	-23.2	11.7		
600 sec												
	Jet wash boundary screen only	36.6	39.2	32.2	33.0	27.9	25.6	23.7	22.8	34.7	3	37.7
	Machines startup plus breakout plus leaving	43.6	38.8	30.9	28.0	23.4	22.3	16.6	10.7	30.8	3	33.8
3600	(adjust duration) airgun breakout via closed front rollers	-1.4	0.7	7.5	7.5	6.7	3.2	0.8	2.0	11.4		
	(adjust duration) air gun breakout roof breakout	13.5	8.2	1.9	1.5	9.8	14.6	14.0	18.0	21.1		
	Sub total Machines plus airgun	43.6	38.8	31.0	28.0	23.6	23.0	18.6	18.8	31.3	3	34.3
	Grand total Machines plus air hose plus jet wash:											39.35
	07:00-08:00 Lowest background											39

Table 18. Airgun Breakout via Roof:

INSIDE TO OUTSIDE									Element		Direct	
Source Room Length:	24		Width	6		Height	4.5		Area	150	Distance	3
S		63	125	250	500	1k	2k	4k	8k			
558		558	558	558	558	558	558	558	558		Lw loss	-17.52
		0.08	0.1	0.1	0.15	0.2	0.2	0.25	0.25	4		
		44.64	55.8	55.8	83.7	111.6	111.6	139.5	139.5			
		48.5	62.0	62.0	98.5	139.5	139.5	186.0	186.0			
		-10.8	-11.9	-11.9	-13.9	-15.4	-15.4	-16.7	-16.7			
Q	2	2	2	2	2	2	2	2	2			
		2.8	3.1	3.1	4.0	4.7	4.7	5.4	5.4			
		-10.8	-11.9	-11.9	-13.9	-15.4	-15.4	-16.7	-16.7			
		63	125	250	500	1k	2k	4k	8k			
on-time corrected Lw		63.254	64.83	74.59	82.63	89.913	93.77	100.84	104.88	106.4		
Direct Lp		45.7	47.3	57.1	65.1	72.4	76.2	83.3	87.4	88.9		
Rev Lp		52.4	52.9	62.7	68.7	74.5	78.3	84.2	88.2	89.9		
Total Lp		53.3	54.0	63.7	70.3	76.6	80.4	86.8	90.8	92.4		
											Distance	60
Lp (out,close) = Lp (in) - SRI comp - 6 or Lp (out, far *) = Lp (in) - SRI comp + 10Log (S2) - 20Log (r) - 14												
Direct+Rev Lp		53.3	54.0	63.7	70.3	76.6	80.4	86.8	90.8	92.42		
SRI roof		12.0	18.0	34.0	41.0	39.0	38.0	45.0	45.0	Insul standing seam 24mm p		
see shutters below											dBa	
Close to partition		35.3	30.0	23.7	23.3	31.6	36.4	35.8	39.8		42.9	
Far* from partition		13.5	8.2	1.9	1.5	9.8	14.6	14.0	18.0		21.1	

Table 19. Airgun Breakout via Roller Shutters:

INSIDE TO OUTSIDE									Element		Direct	
Source Room Length:	24		Width	6		Height	4.5		Area	14	Distance	3
S		63	125	250	500	1k	2k	4k	8k			
558		558	558	558	558	558	558	558	558		Loss	-17.5
		0.08	0.1	0.1	0.15	0.2	0.2	0.25	0.25	4	Lp loss	-9.54
		44.64	55.8	55.8	83.7	111.6	111.6	139.5	139.5			
		48.5	62.0	62.0	98.5	139.5	139.5	186.0	186.0			
		-10.8	-11.9	-11.9	-13.9	-15.4	-15.4	-16.7	-16.7			
Q	2	2	2	2	2	2	2	2	2			
		2.8	3.1	3.1	4.0	4.7	4.7	5.4	5.4			
		-10.8	-11.9	-11.9	-13.9	-15.4	-15.4	-16.7	-16.7			
		63	125	250	500	1k	2k	4k	8k			
on-time corrected Lw		63.254	64.83	74.59	82.63	89.913	93.77	100.84	104.88	106.4		
Direct Lp		45.7	47.3	57.1	65.1	72.4	76.2	83.3	87.4	88.9		
Rev Lp		52.4	52.9	62.7	68.7	74.5	78.3	84.2	88.2	89.9		
Total		53.3	54.0	63.7	70.3	76.6	80.4	86.8	90.8	92.4	Receptor	
											Distance	60
Lp (out,close) = Lp (in) - SRI comp - 6 or Lp (out, far *) = Lp (in) - SRI comp + 10Log (S2) - 20Log (r) - 14												
Direct+Rev Lp		53.3	54.0	63.7	70.3	76.6	80.4	86.8	90.8	92.42		
Building edge Screening		-11.6	-6.1	-7.2	-8.7	-10.7	-13.1	-15.8	-18.7			
Basic shutter		4	8	10	15	20	25	31	31		dBa	
Close to partition		31.7	33.8	40.6	40.6	39.8	36.3	33.9	35.1		44.5	
Far* from partition		-1.4	0.7	7.5	7.5	6.7	3.2	0.8	2.0		11.4	shutte

Table 20. Grinding Room Breakout -Grinders plus Compressor:

INSIDE TO OUTSIDE										Reverberant			
Source Room Length:	7	Width			6	Height		5	Area		45	Distance	1
		63	125	250	500	1k	2k	4k	8k				
	214	214	214	214	214	214	214	214	214	220.96	Lw Loss	-1.961	
		0.05	0.05	0.08	0.08	0.08	0.1	0.1	0.1	7			
	Sxa	10.7	10.7	17.12	17.12	17.12	21.4	21.4	21.4				
	1-a	11.3	11.3	18.6	18.6	18.6	23.8	23.8	23.8				
	R	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2				
Q	8	8	8	8	8	8	8	8	8				
		0.7	0.7	0.9	0.9	0.9	1.0	1.0	1.0				
spherical	1	-4.5	-4.5	-6.7	-6.7	-6.7	-7.7	-7.7	-7.7				
hemi	2												
quarter	4	63	125	250	500	1k	2k	4k	8k				
eighth	8	82.75	82.05	85.71	84.56	84.62	83.9	89.02	88.37	93.7			
	Direct	80.8	80.1	83.7	82.6	82.7	81.9	87.1	86.4	91.7			
	Rev	78.3	77.6	79.0	77.9	77.9	76.2	81.3	80.6	86.2	Distance	65	
	Total	82.7	82.0	85.0	83.9	83.9	83.0	88.1	87.4	92.8	20Log	36.3	
Lp (out,close) = Lp (in) - SRI comp - 6 or Lp (out, far *) = Lp (in) - SRI comp + 10Log (S2) - 20Log (r) - 14													
		63	125	250	500	1k	2k	4k	8k				
	Rev+Direct Lp	82.7	82.0	85.0	83.9	83.9	83.0	88.1	87.4	92.808			
	Partition Comp SRI	26	31	40	50	53	55	55	55		dBa		
	Close to partition	51.1	45.3	38.9	28.1	24.9	22.0	27.1	26.4		36.0		
	Via Walls and Roof	23.4	17.6	11.1	0.4	-2.9	-5.8	-0.7	-1.3		8.3		
	Via Roller Shutter	23.3	13.7	12.4	11.4	0.2	-7.4	-5.0	-8.6		10.8		
	Total	26.3	19.1	14.8	11.7	1.9	-3.5	0.7	-0.6		12.7		

APPENDIX D – DEFINITION OF TERMS

$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level defined IN BS4142:2014 as the value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time.

L_{A90} is the background sound level as defined in BS4142:2014 as the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T , measured using time weighting F and quoted to the nearest whole number of decibels.

L_{Amax} Defined in WHO as the maximum outdoor sound pressure level associated with an individual noise event.

Background Sound Level is the L_{A90} , see above.

BB93 is Building Bulletin 93 "Acoustic Design of Schools: Performance standards" and sets out the minimum performance standards for the acoustics of school buildings.

IANL as defined in BB93 is the indoor ambient noise level within teaching accommodation and is comprised of a 30minute L_{Aeq} .

Ambient Sound as defined by BS4142:2014 is the totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.

Specific Sound as defined by BS4142:2014 is the sound source being assessed.

Residual Sound as defined by BS4142:2014 is the ambient sound remaining at the assessment location when the specific sound is suppressed to such a degree that it does not contribute to the ambient sound.

Rating Level as defined by BS4142:2014 is the specific sound level plus any adjustment for the characteristic features of the sound.

Tonal Characteristic as defined by BS4142:2014 Annex C: For a prominent, discrete tone to be identified as present, the time-averaged $L_{Zeq,T}$ sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged $L_{Zeq,T}$ sound pressure levels of both adjacent one-third-octave bands by some constant level difference.

The level differences between adjacent one-third-octave bands that identify a tone are:

- 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
- 8 dB in the middle-frequency one-third-octave bands (160 Hz to 400 Hz); and
- 5 dB in the high-frequency one-third-octave bands (500 Hz to 10 000 Hz).

WHO refers to the World Health Organisation.