NoiseAssess

Acoustics, Noise and Vibration Consultants

Project:	**Proposed business park** **Plot 3, 4 & 5, South Lincs Food Enterprise Zone, Holbeach**
Scope of Report	**Assessment of potential noise due to noise breakout, deliveries/dispatch & unloading/loading and external plant**
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1.0 INTRODUCTION

1.1 NoiseAssess Ltd has been appointed by Stirlin Developments Ltd to carry out an outline noise assessment for a proposed business park on Plots 3, 4 & 5, South Lincs Food Enterprise Zone (FEZ), Holbeach. The site location is shown in Figure 1 and the proposed site plan as prepared John Roberts Partnership in Figure 2.

1.2 The site is to the northwest of Holbeach, to the southwest of the junction of the A17 and A151 and immediately to the north of the Rose View Drive Travellers site. The Travellers site is the closest residential area to the proposed business units on Plots 3, 4 and 5 of the FEZ.

1.3 The site is currently open ground laid to grass and small shrubs. At the time of this assessment the access road to the north of the proposed site had been installed but not finished and industrial premises to the northwest were under construction.

1.4 The site plan shows 12 business units arranged in 3 blocks consisting of:

- Eastern Block: Units 1-4, two storey, hybrid units, 6.5m to eaves and 8.1m to ridge.
- Central Block: Units 5-9, single storey, workshop units, 5.0m to eaves and 9.6m to ridge.
- Western Block: Units 10-12, single storey, workshop units, 5.0m to eaves and 7.5m to ridge.
- Vehicle access off site road to the north of the site.
- Each unit has a service yard to the front with additional car parking along the north and south boundaries of the site.

1.5 It is understood that the units are to operate during the following periods:

- 07:00-18:00 hrs Monday-Friday
- 07:00-14:00 hrs Saturdays

1.6 A noise assessment was carried out for the proposed FEZ by Bluetree Acoustics and the findings and recommendations presented in report reference 02859-130101 dated 14/10/2016. The noise assessment was carried out for South Holland District Council. The recommendations in the report were based on the criterion that the rating level of noise from the FEZ should not exceed the existing

background noise levels at the closest residential properties. This noise assessment has been carried out for the proposed development on Plots 3, 4 and 5 of the FEZ because the Bluetree report was an outline assessment and a detailed assessment is considered necessary due to the close proximity of the Travellers site.

1.7 This report considers the potential impact of noise break out and dispatch/delivery movements and loading/unloading on the closest residential properties in accordance with BS4142[1]. A design target has been provided for cumulative noise from external plant.

2.0 CRITERIA

BS4142

2.1 The noise impact of commercial/industrial noise sources on existing residential properties is normally assessed in accordance with BS4142[1].

2.2 The scope of BS4142 is given in the extract below.

"1.1 This standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) Sound from industrial and manufacturing processes;

b) Sound from fixed installations which comprise mechanical and electrical plant and equipment;

c) Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and

d) Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and / or commercial site.

The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident."

2.3 The standard compares sound from industrial / commercial sources with the background sound level. The standard states in Clause 9.1 that "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level". Such features are taken into account by adding a correction to the specific sound level depending on the extent to which the distinguishing acoustic characteristics will attract attention. The standard states the following in Clause 9.2:

"Tonality: For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone that is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible".

"Impulsivity: A correction of up to 9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

"Other sound characteristics: Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied."

"Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it may be appropriate to apply a single correction. Where both features are likely to affect perception of response, the correction ought normally to be applied in a linear fashion."

"Intermittency: When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied".

Note: Although not clear in the standard it appears from the examples given that the intermittency penalty is for use when the specific sound source is intermittent but not particularly impulsive. Therefore, it has been assumed that impulsive and intermittency penalties would not generally be both applied in a linear fashion.

2.4 BS4142 provides guidance on the assessment of impacts in Clause 11.

"11 Assessment of the impacts

COMMENTARY ON CLAUSE 11.

The significance of sound of an industrial / commercial nature depends upon both the margin by which the rating of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs / will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context".

2.5 BS4142 recommends that the specific sound level during daytime periods 07:00 - 23:00 hrs should be determined over a reference time interval of 1 hour and during night-time periods 23:00 - 07:00 hrs over a reference time interval of 15 minutes.

Assessment in Context

2.6 BS4142 recommends that the industrial sound should also be assessed in context. Therefore, the sound levels have been assessed in the context of the character of the area; the derived ambient noise levels and the criteria given in BS8233[2].

2.7 The BS8233 recommendations for indoor ambient noise levels are given below.

Table 1: BS8233 recommendations for indoor ambient noise levels

Activity	Location	07:00 to 23:00 hrs	23:00 to 07:00 hrs
Resting	Living room	35 $dBL_{Aeq,16hour}$	-
Dining	Dining room/area	40 $dBL_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 $dBL_{Aeq,16hour}$	30 $dBL_{Aeq,8hour}$

2.8 Paragraph 7.7.3.2 of BS8233 recommends that for traditional external amenity areas such as gardens and patios, it is desirable that during the daytime the external noise level does not exceed 50 $dBL_{Aeq,T}$ with an upper guideline value of 55 $dBL_{Aeq,T}$ which would be acceptable in noisier environments. The time period is not stated but is assumed to be 16 hours (07:00 hours to 23:00 hrs) as in the previous version of BS8233.

3.0 BASELINE NOISE SURVEY

3.1 A survey of the current noise levels at the site was carried out from 12:00 hrs on Friday 10/02/2023 to 10:00 hrs on Tuesday 14/02/2023.

3.2 Noise levels were measured at a survey location approximately 70m to the northwest of the northwest corner of the Travellers Site and approximately 290m to the west of the A151 and 450m southwest of the A17. The microphone was in freefield conditions at a height of approximately 2.2m above ground level. The microphone was mounted on fencing around the compound of the construction site for a new business unit being built close to Bush Meadow Lane to the west of the proposed development. The survey location is marked A on Figure 3. The noise levels at the survey location are considered to be representative of the noise levels at the Travellers site. This location was used because it was secure enough for an extended unattended noise survey.

3.3 Noise levels were measured using an unattended auto-logging Rion NL-31 sound level meter (s/n 00583274). The sound level meter was calibrated using a portable Norsonic 1251 calibrator (s/n 30901) at the start and finish of the survey with no variation in the calibration level. Broadband noise levels were measured using 5-minute sample periods.

3.4 Weather reports indicate that conditions during the noise survey were dry with low windspeeds (<5m/s) and temperatures of -2 to 10 °C.

3.5 The results of the noise survey are presented in full in Appendix A2 and summarised below. The $dBL_{Aeq,5min}$ ambient noise levels have been logarithmically averaged and the $dBL_{A90,5min}$ background values have been arithmetically averaged. The mode of the 1-hour daytime and 15-minute night-time dBL_{A90} values has also been given. Construction activities close to the survey location affected the survey measurements during the periods: 12:00-17:00 hrs Friday 10/02/2023, 07:00-14:00 hrs Saturday 11/02/2023, 07:00-17:00 hrs Monday 13/02/2023 & 07:00-10:00 hrs Tuesday 14/02/2023. Daytime noise levels for the periods when there was no construction activity are also given, these values are conservative because they are based on relatively quiet periods including Sunday daytime, the Saturday afternoon / evening and Friday and Monday evenings.

Table 2. Location A: Summary of daytime freefield noise levels

Day	Period	Ambient noise level dBL_{Aeq}		Background noise level dBL_{A90}	
		Average	Range	Average	Mode
10/02/2023	12:00 - 23:00	61	43 - 68	44	45
11/02/2023	07:00 - 23:00	61	42 - 69	43	37
12/02/2023	07:00 - 23:00	48	46 - 50	44	43
13/02/2023	07:00 - 23:00	65	48 - 76	49	46
14/02/2023	07:00 - 10:00	63	61 - 65	48	†

† Insufficient data to determine mode

Table 3. Summary of daytime freefield noise levels without construction noise

Day	Period	Ambient noise level dBL_{Aeq}		Background noise level dBL_{A90}	
		Average	Range	Average	Mode
10/02/2023	17:00 - 18:00	49	-	46	-
	18:00 - 19:00	48	-	44	-
11/02/2023	14:00 - 15:00	44	-	39	-
12/02/2023	07:00 - 18:00	48	47 - 50	44	43
	07:00 - 13:00	48	47 - 49	43	43
13/02/2023	17:00 - 18:00	55	-	52	-
	18:00 - 19:00	53	-	51	-

- Noise levels on Friday 10/02/2023, Saturday 11/02/2023 & Monday 13/02/2023 are the noise levels measured during the 1 or 2 hours after construction work stopped. The second hour shown is outside the proposed operating hours but is used as indicative which is likely to be conservative.
- Noise levels reported for Sunday 12/02/2023 are for the proposed operating times of 07:00-18:00 hrs Monday to Friday and 07:00-13:00 hrs on Saturdays. Sunday operation is not proposed but the Sunday noise levels have been used as indicative which is likely to be conservative.

Table 4. Summary of night-time freefield noise levels

Night of	Period	Ambient noise level dBL_{Aeq}		Background noise level dBL_{A90}	
		Average	Range	Average	Mode
10/02/2023	23:00 - 07:00	41	34 - 46	34	32
11/02/2023	23:00 - 07:00	41	35 - 48	31	30
12/02/2023	23:00 - 07:00	44	36 - 51	34	30
13/02/2023	23:00 - 07:00	44	36 - 49	36	33

3.6 During the two site visits to install and retrieve the auto-logging sound level meter road traffic was the main noise source when there were no construction activities.

4.0 RECOMMENDATIONS FOR THE CONTROL OF NOISE

4.1 Initial calculations have indicated that the following measures will be necessary to control the impact of noise from the proposed business units on the closest noise sensitive properties.

Building envelope

4.2 The external walls of the units will need to provide the following minimum levels of sound insulation.

Table 5. Minimum sound insulation for external walls of units.

Walls	Octave band sound reduction indices, dB R								dB R_w
	63	125	250	500	1000	2000	4000	8000	
Side & rear walls (except to south)	7	14	18	23	29	34	33	33	28[a]
South walls	14	19	30	35	40	46	46	46	39[b]
Front walls	7	14	20	26	29	35	34	34	30[c]

[a] Based 80mm TATA Trisomet wall cladding panels.

[b] Based 80mm TATA Trisomet wall cladding panels with internal lining consisting of 15mm dense plasterboard or 18mm dense particle board with mineral wool insulation in the cavity.

[c] Based on 80 TATA Trimpanel wall cladding panels.

4.3 The roofs of the units should provide the following minimum level of sound insulation.

Table 6. Minimum sound insulation the roofs.

Roof	Octave band sound reduction indices, dB R								dB R_w
	63	125	250	500	1000	2000	4000	8000	
All roofs	10	17	22	27	32	38	37	37	31[d]

[d] Based on 120mm TATA Trisomet roof cladding panels.

4.4 The sound insulation specification of the roof of hybrid Units 1-4 to the east is not critical because the upper floors of these units will be offices and therefore low noise environments.

4.5 The roller shutter doors should be well sealed to the walls. The assessment is based on roller shutter doors providing the following minimum sound insulation when closed.

Table 7. Minimum sound insulation for the roller shutter doors of all units

Block	Octave band sound reduction indices, dB R								dB R_w
	63	125	250	500	1000	2000	4000	8000	
All	6	12	13	15	16	17	17	19	17

4.6 The assessment is based on personnel doors to the front of the units and fire escape doors to the rear / sides of the units providing a minimum sound insulation of 30 dB R_w. All external doors should be fitted with seals which are fully compressed when the doors are closed leaving no gaps. The doors should be fitted in good quality frames which provide a good seal when closed. The door frames should be well sealed to the surrounding walls.

4.7 All personnel doors should be kept closed apart from during emergencies.

Use of roller shutter doors

4.8 All units in the should operate with their roller shutter doors closed unless the noise levels inside the roller shutter door are low, i.e. no greater than 70 dBL_{Aeq}.

Dispatch/delivery movements and loading/unloading

4.9 HGV and forklift movements should permitted during the proposed operating times of 07:00-18:00 rs Monday - Friday but not on Saturdays.

4.10 Only electric forklifts should be used on the site and the yards where they are used should be smoothly surfaced.

4.11 There may be dispatch / delivery by vans Monday - Friday 07:00 - 18:00 hrs and Saturdays 07:00 - 13:00 hrs.

Acoustic barriers

4.12 It is recommended that 5m high acoustic barriers should be installed along the south boundary of the site between the three blocks of units as shown on Figure 4.

4.13 The ends of the acoustic barriers should be sealed to the buildings.

4.14 The acoustic barriers should be imperforate and have a minimum mass of 12 kg/m^2. The acoustic barriers should be fully sealed to the ground at the base and should be designed so that gaps do not open between panels or at the base due to weathering over the lifespan of the barrier. This will normally mean that panels are interlocking or have cover strips and that gravel boards at the base are designed to limit deterioration due to contact with the ground. The barrier should also be well sealed at the corners. Consideration should be given to the procedures for maintenance or replacement of the barriers as necessary to ensure their continued effectiveness. The acoustic barrier may consist of one of the following:

- An acoustic fence meeting the above specification. Acoustic fences are available in various materials with varying lifespans as can be seen from the examples of proprietary acoustic fences below.
- A masonry wall with no gaps.

4.15 Examples of suppliers of proprietary acoustics fences are as follows:

Gramm Barriers:	http://www.grammbarriers.com/our-products/acoustic-barriers/
Jacksons Fencing:	https://www.jacksons-fencing.co.uk/acoustic-fencing
Premier Acoustic Fencing:	http://www.premieracousticfencing.co.uk/

5.0 PREDICTION OF NOISE FROM THE PROPOSED DEVELOPMENT

Noise modelling

5.1 Noise at the nearest noise sensitive premises due to the proposed development has been modelled using CadnaA noise modelling software, produced by DataKustick GmbH.

5.2 The noise model has been used to calculate the noise propagation in accordance with ISO 9613-1996: Acoustics[3]. The model takes into account distance attenuation; screening attenuation; ground absorption; atmospheric absorption and reflections. The modelling has been based on hard ground (G=0) and a maximum order of reflection of 1 with a search radius of 100m. The atmospheric conditions used in the model input were a temperature of 10℃ and a relative humidity of 70%. The modelling calculations have been carried out on the basis of the receptors being downwind of all sources simultaneously and no allowance has been made for directivity. This assumption is conservative.

Closest noise sensitive premises

5.3 Noise from the proposed development has been predicted for the following receptor positions on the Rose View Drive, Travellers Site.

R1: A position 10m south of the centre of the south boundary of the proposed business park.

R2: A position 30m south of the south boundary of the proposed business park.

R3: A position in the centre of the north elevation of the house in the northwest corner of the Travellers site.

R4: A position on the Travellers' site 15m to the east of the proposed business park and 10m south of the north boundary of the Travellers' site.

The receptor locations properties are shown on Figure 3.

5.4 Daytime noise has been predicted for a height of 1.5m above ground level representative of external amenity areas, ground floor windows and caravans.

Noise break-out from proposed industrial units

Dimensions of industrial units and internal noise levels

5.5 Based on the site plans provided and discussion with the client the predicted noise levels are based on the following:

- Eastern Block: Units 1-4, two storey, hybrid units, 6.5m to eaves and 8.1m to ridge with 1 roller shutter open in the west elevation of each unit.
- Central Block: Units 5-9, single storey, workshop units, 5.0m to eaves and 9.6m to ridge with 1 open roller shutter in the east elevation of units 5 and 6 and 1 open roller shutter door in the west elevation of units 7-9.
- Western Block: Units 10-12, single storey, workshop units, 5.0m to eaves and 7.5m to ridge with 1 open roller shutter door in the east elevation of units 10-12.
  The noise break calculations assume that all of the roller shutter doors are open but only onto areas with noise levels of 70 dBL_{Aeq}.

5.6 The internal noise levels which will occur within the new units are not known at this time. Workshop / warehouse type operations may generate relatively low internal noise levels, but some processes could generate higher internal noise levels.

5.7 For the purposes of this assessment, it has been assumed that the average internal noise levels in the ground floor workshops of Units 1-4 and the workshops of Units 5-12 will be 80 dBL_{Aeq} with the octave band spectrum given below. These levels have been applied equally to the whole of each workshop area building envelope which is conservative as normally large parts of the building envelope would be subject to lower noise levels. A noise level of 80 dBL_{Aeq} would result in noise exposure equivalent to the lower exposure action value of 'The Control of Noise at Work Regulations, 2005' over an 8-hour shift and in order for this level to be generated at the inner face of the sheeting of the walls and roof noise levels near machines would need to be higher. Therefore, this assumption is typical of units which are 'Hearing Protection Zones' where the use of hearing protection would be mandatory. In practice it is likely that new businesses would design their operations to control noise at source to reduce staff noise exposure which is the aim of 'The Control of Noise at Work Regulations'.

Table 8. Assumed internal noise levels in workshops

Internal noise levels	Octave band c.f. Hz (dBL_{eq})								dBL_{Aeq}
	63	125	250	500	1000	2000	4000	8000	
Workshops 80dBL_{Aeq}	73	73	73	73	73	73	73	73	80
Workshops 70dBL_{Aeq}	63	63	63	63	63	63	63	63	70

5.8 Noise breakout from the units has been modelled based on the following:

- A constant noise level of 80 dBL_{Aeq}, in all workshops.
- Roller shutter doors only opening onto areas with a constant noise level of 70 dBL_{Aeq}.

Predicted noise levels at receptors due to noise breakout from the proposed units

5.9 The predicted noise levels at the closest noise sensitive premises R1-R4 are given below.

Table 9. Predicted noise levels at closest noise sensitive premises due to noise breakout from proposed units

Receptor	Noise level at receptor $dBL_{Aeq,1hr}$
R1	33.3
R2	30.4
R3	32.0
R4	33.8

Noise from dispatch/delivery movements and loading/unloading

5.10 Noise due to dispatch/delivery movements and loading/unloading has been based on the assumptions given below. The calculations have been based on the following dispatch/delivery movements and loading/unloading within a 1-hour daytime reference period:

- 20 van movements.
- 8 HGV movements (4 arrivals and 4 departures),
- 4 HGV reverses including reversing alarms.
- 2 forklifts, each working for 20 minutes in a 60-minute period.

5.11 The following noise data has been used for vehicle movements.

Table 10. NoiseAssess library data for vehicle movements – Freefield SEL noise levels

Noise source	Octave band c.f. Hz (dB)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
HGV forward movement	93.2	80.5	76.3	77.4	78.4	76.7	70.3	62.8	82.7
HGV reverse inc alarm	87.9	82.6	80.7	79.1	80.4	81.1	76.1	65.3	86.0
Van movement	71.5	66.6	65.1	64.8	64.4	59.8	53.0	45.4	68.0

Table 11. NoiseAssess library data for electric forklift– Sound power dBL_{wA}

Noise source	Octave band c.f. Hz (dBL_w)								dBL_{wA}
	63	125	250	500	1000	2000	4000	8000	
Electric forklift	81.0	78.0	80.0	83.0	80.0	85.0	87.0	68.0	91.0

5.12 The predicted noise levels at the closest noise sensitive premises due to dispatch/delivery movements and loading/unloading are given below.

Table 12. Predicted external noise levels at closest noise sensitive premises due to dispatch/delivery movements and loading/unloading

Receptor	Noise level at receptor $dBL_{Aeq,1hr}$	
	HGV, vans & forklifts	Vans only
R1	34.3	18.1
R2	31.4	16.1
R3	24.7	18.1
R4	23.9	9.4

Cumulative noise due to proposed business park

5.13 The cumulative noise levels from the proposed business park at the nearest noise sensitive premises are given below.

Table 13. Cumulative noise from business park at closest noise sensitive premises

Receptor	Noise level at receptor $dBL_{Aeq,1hr}$	
	Noise breakout + HGV, vans & forklifts	Noise breakout + Vans only
R1	36.8	33.4
R2	34.0	30.6
R3	32.7	33.7
R4	34.2	33.8

6.0 NOISE ASSESSMENT

Criteria and Methodology

6.1 The impact of noise break-out from the proposed units and noise from delivery/dispatch vehicles and loading/unloading has been assessed in accordance with BS4142.

6.2 The assessment is based on the calculated noise emissions from the site with the noise control measures detailed in Section 4 in place.

6.3 BS4142 assessment have been carried out for the period 07:00-18:00 hrs Monday-Friday and 07:00-13:00 hrs on Saturdays. The results of the background noise survey are given in Section 2.

- The assessment of noise for 07:00-18:00 hrs Monday-Friday has been based on the mode of the background noise levels measured 07:00-17:00 hrs on Sunday 12/02/23.
- The assessment of noise for 07:00-13:00 hrs on Saturdays has been based on the noise levels measured during the period 14:00-15:00 hrs on Saturday 11/02/2023.
- It is likely that background noise levels measured during the proposed operating times will be higher but it was not possible to measure these levels due to construction site noise. The background noise levels used therefore make the assessment conservative.

BS4142 assessment

6.4 Noise breakout from the proposed business park has been assessed in accordance with BS4142. A 2dB tonal penalty and a 3 dB impulsive/intermittency penalty have been added as a precaution.

Table 14. BS4142 assessment: 07:00-18:00 hrs Monday-Friday

	R1	R2	R3	R4
Specific noise level, dBL_{Aeq}	37	34	33	34
Tonal Penalty, dB	2	2	2	2
Impulsive/Intermittency penalty, dB	3	3	3	3
Rating, dB	42	39	38	39
Background noise level, dBL_{A90}	43	43	43	43
Rating - background, dB	**-1**	**-4**	**-5**	**-4**

Table 15. BS4142 assessment: 07:00-13:00 hrs Saturdays

	R1	R2	R3	R4
Specific noise level, dBL_{Aeq}	33	31	34	34
Tonal Penalty, dB	2	2	2	2
Impulsive/Intermittency penalty, dB	3	3	3	3
Rating, dB	38	36	39	39
Background noise level, dBL_{A90}	39	39	39	39
Rating - background, dB	**-1**	**-3**	**0**	**0**

6.5 The differences between the ratings levels and the background noise levels indicate:

- A low noise impact during the period 07:00-18:00 hrs Monday-Friday.
- A low noise impact during the period 07:00-13:00 hrs on Saturdays.

6.6 BS4142 recommends that the noise also be judged in context.

6.7 Noise from the proposed business park during the period 07:00-18:00 hrs Monday to Friday at the closest noise sensitive premises:

- Is predicted to be well below the lowest ambient (dBL_{Aeq}) noise levels measured during the period 07:00-18:00 hrs on a Sunday and is not expected to result in any increase in the existing ambient noise levels.
- Will be well below the BS8233 upper limit of 55 dBL_{Aeq} for daytime noise in gardens.
- Is expected to result in internal noise levels of no greater than 27 dBL_{Aeq} allowing attenuation of 10 dB(A) for a partially open window. This level is below the BS8233 advice that internal noise levels should not exceed 35 dBL_{Aeq} in living rooms during the daytime.

6.8 Noise from the proposed business park during the period 07:00-13:00 hrs on Saturdays at the closest noise sensitive premises:

- Is predicted to be well below the lowest ambient (dBL_{Aeq}) noise levels measured during the period 14:00-15:00 hrs on the Saturday of the survey and is not expected to result in any increase in the existing ambient noise levels.
- Will be well below the BS8233 upper limit of 55 dBL_{Aeq} for daytime noise in gardens.
- Is expected to result in internal noise levels of no greater than 24 dBL_{Aeq} allowing attenuation of 10 dB(A) for a partially open window. This level is below the BS8233 advice that internal noise levels should not exceed 35 dBL_{Aeq} in living rooms during the daytime.

6.9 When considered in accordance with BS4142 and in context noise from the proposed business park during the proposed operating hours is expected to have a low noise impact at the closest noise sensitive properties provided that the noise control measures given in Section 4 are implemented.

7.0 DESIGN TARGET FOR EXTERNAL PLANT

7.1 At present no details are available for any external plant, e.g. air conditioning units, extract vents etc, that may be installed to serve the new unit.

7.2 To ensure that noise from any new external plant will have a low noise impact at the closest residential properties, it is recommended that the cumulative noise from any external plant installed to serve the proposed business park should not exceed:

- 27 $dBL_{Aeq,1hr}$ at the closest noise sensitive premises during the daytime, 07:00-23:00hrs.
- 20 $dBL_{Aeq,15min}$ at the closest noise sensitive premises during the night-time, 23:00-07:00hrs.

7.3 The above targets are 10 dB(A) below the lowest average/modal daytime $dBL_{A90,1hr}$ and night-time $dBL_{A90,15min}$. These recommended noise levels should result in no increase in the noise emissions from the proposed development and would give a low impact if assessed in accordance with BS4142.

7.4 It is recommended that any external plant installed on the proposed development should be mounted on the north elevations of the units only.

7.5 Noise from external plant can be controlled in the first instance by the careful selection of 'low-noise' items. Thereafter, noise emissions from plant can be controlled using measures such as barriers, enclosures, ductwork attenuators, lagging etc. If attenuators are used it may be necessary to use a ductwork expansion section to reduce velocities in order to limit re-generated noise from airflow. Plant can be mounted using anti-vibration mounts to reduce the re-radiation of noise from connected structures. Flexible connectors can be used to reduce the transmission of vibration into connected ductwork. Large steel plates can be covered with damping sheets or constructed with sound-deadened steel. Plant installed in locations where it will be screened from residential properties from the proposed building will require less attenuation measures.

8.0 CONCLUSIONS

8.1 A survey of the current noise levels representative of the closest residential properties was carried out from midday Friday 14/02/2023 to 10:00 hrs Tuesday 14/02/2023. While on site to install and retrieve the monitoring equipment the main noise sources were nearby construction activities and road traffic. Periods with construction noise have been excluded.

8.2 Recommendations have been made to control the impact of noise from the site on the closest noise sensitive premises.

8.3 Noise from the proposed business park has been predicted using noise modelling for the closest residential premises and assessed in accordance with BS4142 and in context. With eh recommended noise control measures in place the noise assessment indicates that there will be:

- A low noise impact during the period 07:00-18:00 hrs Monday-Friday.
- A low noise impact during the period 07:00-13:00 hrs on Saturdays.

8.4 A design target for external plant has been provided.

8.5 The assessment indicates that noise from the proposed business park can be controlled to give a low noise impact at the closest residential properties. It is therefore recommended that, subject to certain restrictions which can be conditioned, planning permission for the proposed development should not be refused on the grounds of noise.

9.0 REFERENCES

1. BS4142: British Standard 4142:2014, Methods for rating and assessing industrial and commercial sound.

2. BS8233: British Standard 8233, Guidance on sound insulation and noise reduction for buildings, BSI 2014.

FIGURE 1. BLOCK PLAN AND LOCATION OF SITE

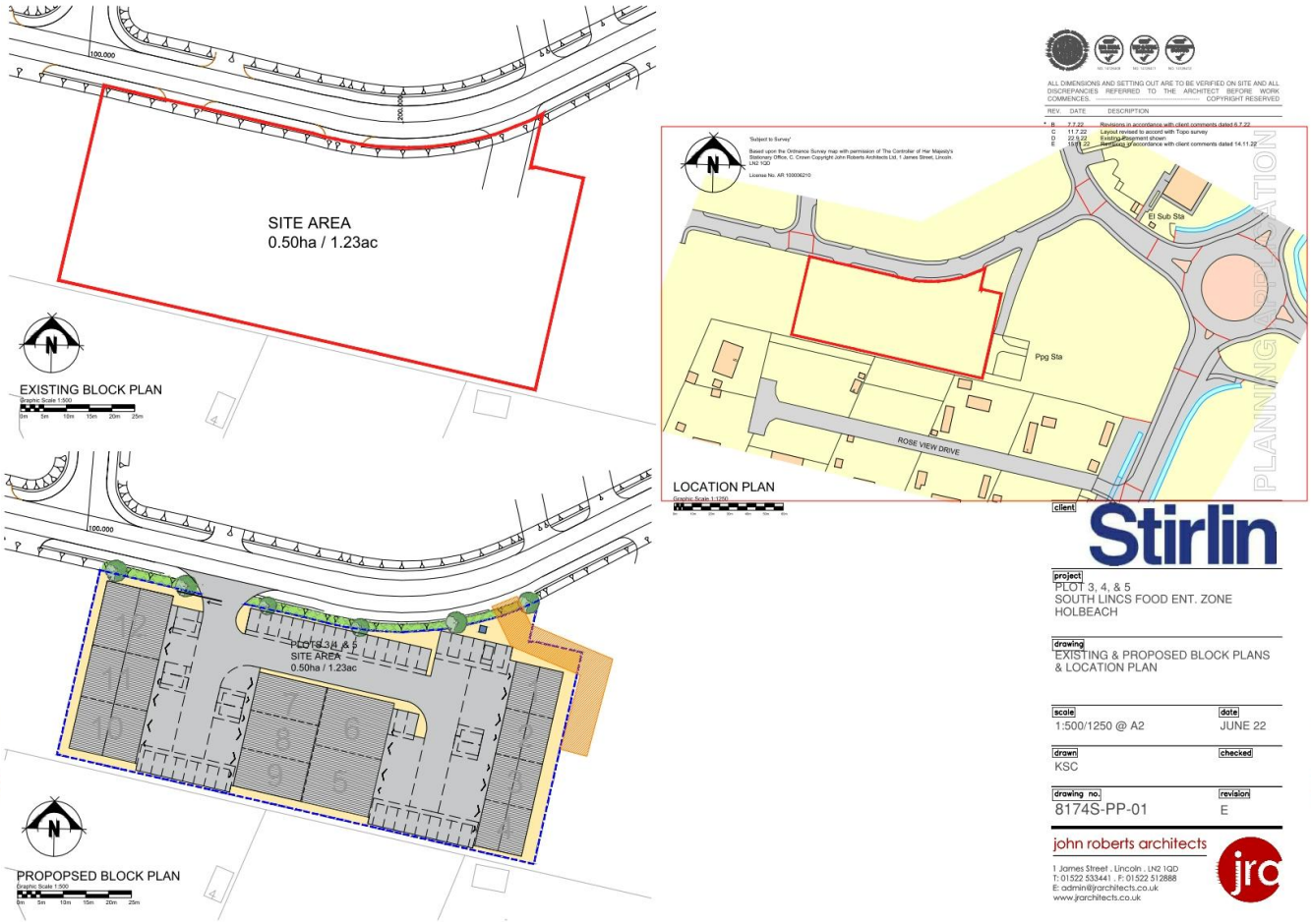


FIGURE 2. PROPOSED SITE PLAN

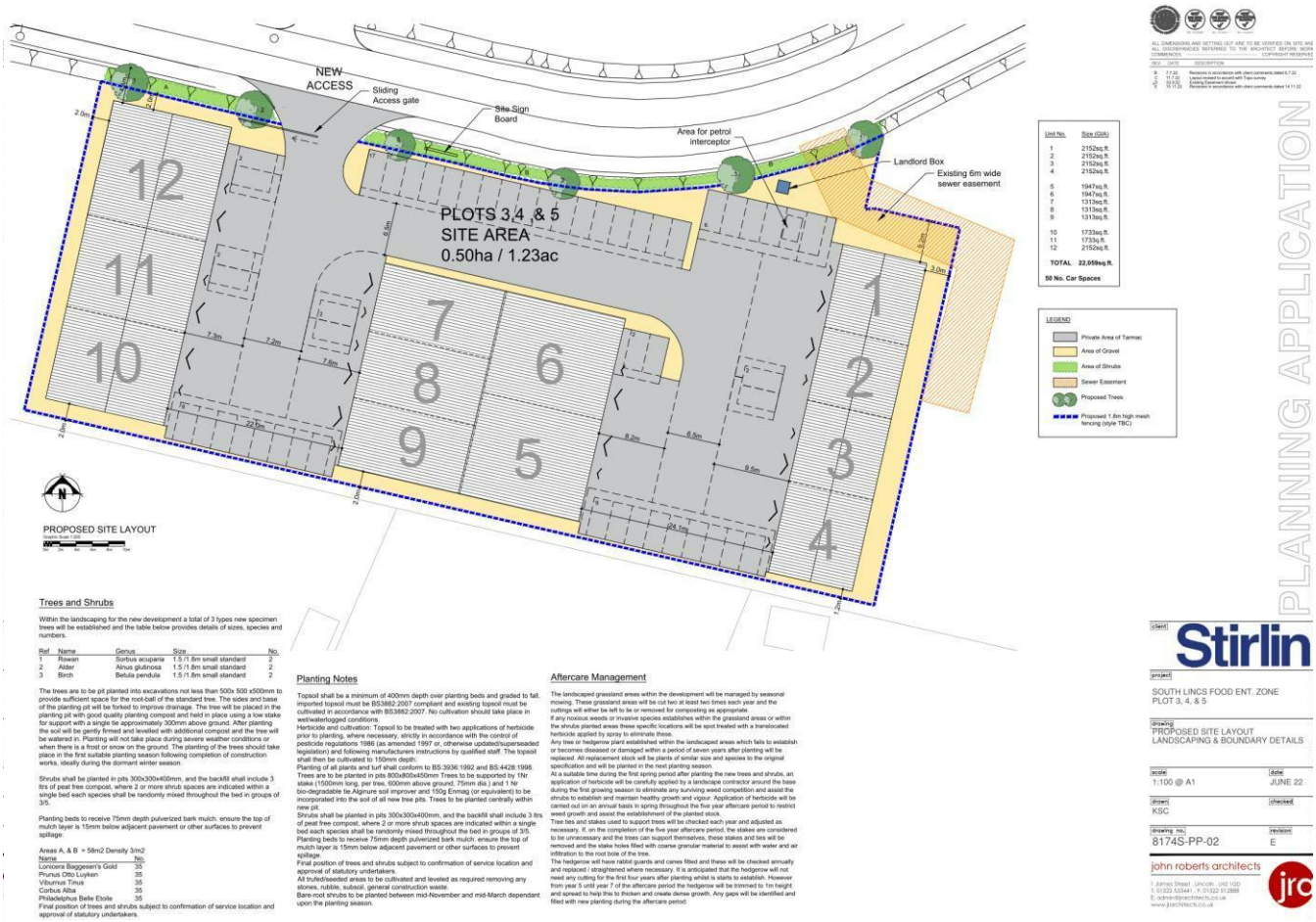


FIGURE 3. LOCATION OF NOISE SUREY AND RECEPTORS



FIGURE 4. ACOUSTIC BARRIERS



APPENDIX A1: ACOUSTIC TERMINOLOGY

Ambient noise	The sound pressure level at a given location (i.e. sound from all sources) usually measured using the L_{Aeq} parameter.
A-weighting	A weighting applied to the frequencies which make up a sound pressure level to mimic the response of the human ear which is less responsive to low frequency sounds as it is to high frequency sounds. The resultant level after application of the weighting is called the 'A-weighted sound pressure level' and is denoted by dB(A) or by using a subscript A (e.g. dBL_{Aeq}).
Background noise	The noise measured in the absence of the noise under investigation usually using the statistical parameter L_{90} which represents the quietest parts of the measurement period.
Broadband sound	Sound which contains all the frequencies.
Decibel (dB)	A logarithmic measurement scale used for sound pressure levels. This scale is used because the simple use of sound pressures would be unwieldy as the range of pressures to which the human ear responds is very large. The normal threshold of hearing at 1kHz is 0dB. A level of $120dBL_{Aeq}$ is very loud (L signifies level and the A and eq are explained under A-weighting and L_{eq}). Some night club dance floors can have sound levels of around 110 dBL_{Aeq}. In the workplace the wearing of hearing protection is compulsory for staff who experience a noise level of over $85dBL_{Aeq}$ averaged over an 8-hour day and is normally used when the levels are over $80dBL_{Aeq}$ averaged over the 8-hour day. Noise intrusion levels into bedrooms (e.g. from traffic noise) are often controlled to below $30dBL_{Aeq}$ in the design of new properties (standards sometimes vary between authorities). Noise levels of below $20dBL_{Aeq}$ are very quiet and would normally only be achieved in a well designed recording studio. Although noise calculations are normally carried out using figures to 1 decimal place the results are often presented to the nearest dB as changes of a fraction of a dB are not normally perceptible even in controlled conditions.
Facade noise level	Noise level including a contribution from the reflection from a building facade, usually measured at 1m from the facade.
Free field	Noise levels with no contribution from reflections from nearby structures.
Hertz	The units used for frequency denoted by Hz, i.e. the number of cycles of pressure fluctuation per second. K used in front of Hz represents 1000 (1kHz = 1000Hz). High frequency sounds (e.g. 8kHz) are high pitched and low frequency sounds (e.g. 63Hz) are the bass notes.

L_{eq}	A parameter used to denote the 'equivalent continuous sound pressure level'. This is the sound pressure level of a continuous sound that would contain the same energy as the varying sound being measured or investigated. L_{Aeq} is the parameter used to denote the 'A-weighted equivalent continuous sound pressure level' (see A-weighting).
L_{10}	A statistical parameter often used for the measurement of road traffic noise. It is the level exceeded for 10% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. $L_{A10,\ 1hour}$.
L_{90}	A statistical parameter often used for the measurement of background noise levels. It is the level exceeded for 90% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. $L_{A90,\ 5min}$.
L_{max}	The maximum noise level which occurred during the monitoring period. $L_{Amax,f}$ denotes the maximum A-weighted sound pressure level using the fast time constant of 125ms.
Loudness	Although a 3dB increase is equivalent to a doubling of the sound power level of a sound source this increase is the minimum perceptible under normal conditions. It takes a 10dB change in noise level for it to sound roughly twice (or half) as loud subjectively.
Rating Level	A term used in BS4142. The 'Specific Noise Level' plus a weighting if the noise has certain characteristic features which may make it more disturbing.
Residual noise	The ambient noise remaining when the specific noise source being investigating is not contributing to the noise level at that location (normally measured using the L_{Aeq} parameter).
Specific Noise Level	A term used in BS4142. The L_{Aeq} noise level produced at the assessment position by the noise source being investigated over the reference time period (1-hour in the day and 15-mins at night).
SEL	Single Event Level. The total sound energy of a noise event (e.g. a train pass-by) compressed into 1 second. i.e. . the 1 second L_{Aeq} which has the same total A-weighted energy as the entire event.

APPENDIX A2: NOISE SURVEY RESULTS

Table A2.1: Location A: Freefield daytime noise levels
Friday 10/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
10/02/2023	12:00:02	63.8	89.7	44.9
10/02/2023	13:00:02	67.5	89.0	54.5
10/02/2023	14:00:02	62.4	84.0	45.1
10/02/2023	15:00:02	58.0	83.0	47.1
10/02/2023	16:00:02	62.9	98.1	47.7
10/02/2023	17:00:02	48.6	62.4	45.9
10/02/2023	18:00:02	47.6	75.9	44.0
10/02/2023	19:00:02	46.0	66.3	42.3
10/02/2023	20:00:01	45.7	68.5	40.1
10/02/2023	21:00:01	43.7	61.8	39.0
10/02/2023	22:00:01	43.0	58.4	37.6
Average		60.6	-	44.4
Highest		67.5	98.1	54.5
Lowest		43.0	58.4	37.6
Mode		-	-	45

Table A2.2: Location A: Freefield daytime noise levels
Saturday 11/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
11/02/2023	07:00:01	51.6	75.9	45.5
11/02/2023	08:00:01	69.3	94.2	56.9
11/02/2023	09:00:01	66.5	96.4	50.3
11/02/2023	10:00:01	65.8	84.7	53.3
11/02/2023	11:00:01	60.9	91.1	46.9
11/02/2023	12:00:01	59.1	87.1	44.9
11/02/2023	13:00:00	58.9	85.7	43.0
11/02/2023	14:00:00	44.4	70.6	39.3
11/02/2023	15:00:00	42.3	63.5	37.4
11/02/2023	16:00:00	47.2	65.1	41.7
11/02/2023	17:00:00	45.5	63.4	42.1
11/02/2023	18:00:00	45.1	60.7	41.4
11/02/2023	19:00:00	43.8	59.1	39.7
11/02/2023	20:00:00	42.7	52.8	37.3
11/02/2023	21:00:00	41.8	54.9	36.0
11/02/2023	22:00:00	41.6	63.6	35.0
Average		61	-	43.2
Highest		69.3	96.4	56.9
Lowest		41.6	52.8	35.0
Mode		-	-	37

Table A2.3: Location A: Freefield daytime noise levels
Sunday 12/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
12/02/2023	07:00:02	47.4	66.6	42.1
12/02/2023	08:00:02	48.8	71.0	43.0
12/02/2023	09:00:02	47.7	74.5	44.5
12/02/2023	10:00:02	47.4	64.5	43.9
12/02/2023	11:00:02	47.0	65.3	42.5
12/02/2023	12:00:02	47.6	64.7	43.2
12/02/2023	13:00:02	48.0	69.3	44.1
12/02/2023	14:00:01	48.1	68.6	43.4
12/02/2023	15:00:01	49.2	65.3	45.3
12/02/2023	16:00:01	49.8	65.0	46.2
12/02/2023	17:00:01	50.0	64.0	45.9
12/02/2023	18:00:01	49.8	62.5	46.0
12/02/2023	19:00:01	49.5	69.6	45.2
12/02/2023	20:00:01	47.5	62.8	42.9
12/02/2023	21:00:01	46.5	58.7	41.0
12/02/2023	22:00:01	46.2	72.1	37.6
Average		48.3	-	43.6
Highest		50.0	74.5	46.2
Lowest		46.2	58.7	37.6
Mode		-	-	43

Table A2.4: Location A: Freefield daytime noise levels
Monday 13/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
13/02/2023	07:00:00	56.6	82.2	51.0
13/02/2023	08:00:00	61.2	85.8	51.9
13/02/2023	09:00:00	76.3	92.5	52.6
13/02/2023	10:00:00	59.8	90.4	53.9
13/02/2023	11:00:00	61.6	86.8	49.9
13/02/2023	12:00:00	54.2	75.2	45.9
13/02/2023	13:00:00	54.6	84.6	46.3
13/02/2023	14:00:00	61.1	81.4	49.0
13/02/2023	15:00:00	58.7	79.2	48.8
13/02/2023	16:00:00	61.1	85.0	49.5
13/02/2023	17:00:00	54.5	65.2	52.0
13/02/2023	18:00:00	53.4	64.2	50.9
13/02/2023	19:00:00	50.5	65.4	46.8
13/02/2023	20:00:00	49.6	64.7	45.6
13/02/2023	21:00:00	48.8	64.6	43.9
13/02/2023	22:00:00	47.9	66.0	42.2
Average		65.1	-	48.8
Highest		76.3	92.5	53.9
Lowest		47.9	64.2	42.2
Mode		-	-	46

Table A2.5: Location A: Freefield daytime noise levels
Tuesday 14/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
14/02/2023	07:00:02	62.7	85.9	51.6
14/02/2023	08:00:01	61.2	90.1	46.3
14/02/2023	09:00:01	64.5	83.5	45.3
Average		63	-	47.7
Highest		64.5	90.1	51.6
Lowest		61.2	83.5	45.3
Mode		-	-	-

Table A2.6: Location A: Freefield night-time noise levels
Friday 10/02/2023 – Saturday 11/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
10/02/2023	23:00:01	39.3	50.6	34.6
10/02/2023	23:15:01	40.0	50.4	36.8
10/02/2023	23:30:01	39.7	55.4	35.4
10/02/2023	23:45:01	38.4	51.4	32.0
11/02/2023	00:00:01	41.0	52.4	34.2
11/02/2023	00:15:01	41.7	52.8	34.3
11/02/2023	00:30:01	45.4	67.7	30.8
11/02/2023	00:45:01	38.1	51.8	31.5
11/02/2023	01:00:01	39.7	61.7	31.6
11/02/2023	01:15:01	38.4	52.5	33.1
11/02/2023	01:30:01	37.5	53.0	32.1
11/02/2023	01:45:01	36.7	51.2	31.2
11/02/2023	02:00:01	37.8	52.3	29.7
11/02/2023	02:15:01	37.3	50.0	31.5
11/02/2023	02:30:01	38.6	48.0	33.0
11/02/2023	02:45:01	36.7	49.0	31.0
11/02/2023	03:00:01	36.2	47.0	30.4
11/02/2023	03:15:01	37.4	51.1	31.8
11/02/2023	03:30:01	37.4	48.0	31.6
11/02/2023	03:45:01	33.9	43.8	29.6
11/02/2023	04:00:01	38.1	47.7	32.3
11/02/2023	04:15:01	39.1	51.5	34.3
11/02/2023	04:30:01	37.2	49.1	32.4
11/02/2023	04:45:01	39.2	47.8	35.2
11/02/2023	05:00:01	40.0	47.5	36.1
11/02/2023	05:15:01	43.2	52.1	39.1
11/02/2023	05:30:01	43.2	49.6	40.1
11/02/2023	05:45:01	43.0	51.9	39.0
11/02/2023	06:00:01	44.2	52.2	40.0
11/02/2023	06:15:01	44.2	50.4	41.2
11/02/2023	06:30:01	43.9	57.1	39.0
11/02/2023	06:45:01	46.3	59.4	41.0
Average		40.9	-	34.2
Highest		46.3	67.7	41.2
Lowest		33.9	43.8	29.6
Mode		-	-	32

Table A2.7: Location A: Freefield night-time noise levels
Saturday 11/02/2023 – Sunday 12/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
11/02/2023	23:05:00	40.5	51.6	34.6
11/02/2023	23:20:00	40.3	48.8	34.5
11/02/2023	23:35:00	39.0	49.7	30.4
11/02/2023	23:50:00	38.1	48.7	33.7
12/02/2023	00:05:00	40.0	49.5	30.4
12/02/2023	00:20:00	39.7	52.4	30.1
12/02/2023	00:35:00	39.6	59.5	24.4
12/02/2023	00:50:00	41.6	53.2	30.7
12/02/2023	01:05:00	39.2	53.1	23.2
12/02/2023	01:20:00	40.7	59.2	26.1
12/02/2023	01:35:00	40.0	56.5	27.2
12/02/2023	01:50:00	35.2	50.5	24.2
12/02/2023	02:05:00	39.4	49.4	27.5
12/02/2023	02:20:00	39.1	53.0	24.6
12/02/2023	02:35:00	39.3	55.8	28.8
12/02/2023	02:50:00	37.4	52.3	26.9
12/02/2023	03:05:00	39.3	52.6	28.7
12/02/2023	03:20:00	38.3	50.5	28.8
12/02/2023	03:35:00	38.0	49.7	30.4
12/02/2023	03:50:00	38.3	51.3	27.1
12/02/2023	04:05:00	36.3	50.3	24.8
12/02/2023	04:20:00	35.7	49.1	24.1
12/02/2023	04:35:00	38.8	51.8	24.4
12/02/2023	04:50:00	40.9	53.0	30.0
12/02/2023	05:05:02	42.5	53.3	34.2
12/02/2023	05:20:02	43.8	53.7	36.5
12/02/2023	05:35:02	43.0	55.9	37.7
12/02/2023	05:50:02	41.7	50.2	36.2
12/02/2023	06:05:02	44.1	53.2	39.0
12/02/2023	06:20:02	43.0	52.6	38.2
12/02/2023	06:35:02	45.4	56.5	39.5
12/02/2023	06:50:02	48.2	61.3	41.8
Average		41.2	-	30.6
Highest		48.2	61.3	41.8
Lowest		35.2	48.7	23.2
Mode		-	-	30

Table A2.8: Location A: Freefield night-time noise levels
Sunday 12/02/2023 – Monday 13/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
12/02/2023	23:00:01	38.9	52.5	31.5
12/02/2023	23:15:01	41.9	53.4	35.1
12/02/2023	23:30:01	40.4	56.8	30.3
12/02/2023	23:45:01	41.4	56.8	32.8
13/02/2023	00:00:01	40.2	55.1	31.4
13/02/2023	00:15:01	40.3	55.8	32.0
13/02/2023	00:30:01	38.3	59.7	29.2
13/02/2023	00:45:01	38.2	57.2	28.8
13/02/2023	01:00:01	37.7	55.1	29.4
13/02/2023	01:15:01	39.3	56.1	29.1
13/02/2023	01:30:01	40.8	55.1	29.5
13/02/2023	01:45:01	40.6	54.4	29.9
13/02/2023	02:00:01	40.5	56.6	31.1
13/02/2023	02:15:01	35.9	51.4	28.8
13/02/2023	02:30:01	39.9	55.1	31.0
13/02/2023	02:45:01	40.9	57.0	30.4
13/02/2023	03:00:01	36.8	51.9	27.6
13/02/2023	03:15:01	42.6	61.5	32.8
13/02/2023	03:30:01	40.1	53.3	31.1
13/02/2023	03:45:01	40.3	52.4	32.4
13/02/2023	04:00:01	39.6	53.9	30.1
13/02/2023	04:15:01	41.6	55.5	33.4
13/02/2023	04:30:01	41.8	54.6	33.2
13/02/2023	04:45:01	44.1	56.1	36.4
13/02/2023	05:00:01	43.9	54.9	37.8
13/02/2023	05:15:01	46.8	57.5	41.0
13/02/2023	05:30:01	47.5	59.3	42.5
13/02/2023	05:45:01	46.5	56.9	41.7
13/02/2023	06:00:00	47.6	57.1	42.9
13/02/2023	06:15:00	51.0	71.7	44.1
13/02/2023	06:30:00	49.7	60.8	46.0
13/02/2023	06:45:00	50.5	67.7	46.1
Average		44.1	-	34.0
Highest		51.0	71.7	46.1
Lowest		35.9	51.4	27.6
Mode		-	-	30

Table A2.9: Location A: Freefield night-time noise levels
Monday 13/02/2023 – Tuesday 14/02/2023

Date	Time	dBL_{Aeq}	dBL_{Amax}	dBL_{A90}
13/02/2023	23:00:02	46.3	57.6	40.0
13/02/2023	23:15:02	45.8	56.9	38.6
13/02/2023	23:30:02	46.9	58.4	39.0
13/02/2023	23:45:02	46.0	61.5	37.4
14/02/2023	00:00:02	42.6	53.3	34.5
14/02/2023	00:15:02	45.5	58.4	36.7
14/02/2023	00:30:02	43.3	57.7	32.7
14/02/2023	00:45:02	42.4	54.3	33.4
14/02/2023	01:00:02	42.8	54.9	33.4
14/02/2023	01:15:02	44.1	61.5	33.2
14/02/2023	01:30:02	36.3	52.0	29.3
14/02/2023	01:45:02	37.5	49.8	29.9
14/02/2023	02:00:02	39.9	54.0	30.0
14/02/2023	02:15:02	41.9	56.4	31.7
14/02/2023	02:30:02	41.8	54.0	34.0
14/02/2023	02:45:02	40.5	52.2	32.8
14/02/2023	03:00:02	38.8	50.2	30.5
14/02/2023	03:15:02	38.4	52.4	33.1
14/02/2023	03:30:02	40.7	53.1	32.5
14/02/2023	03:45:02	41.1	55.6	33.0
14/02/2023	04:00:02	37.0	52.2	30.7
14/02/2023	04:15:02	40.8	53.8	33.2
14/02/2023	04:30:02	41.1	50.8	36.2
14/02/2023	04:45:02	43.0	52.9	37.4
14/02/2023	05:00:02	44.8	55.0	39.1
14/02/2023	05:15:02	45.9	58.5	40.8
14/02/2023	05:30:02	47.6	57.7	43.8
14/02/2023	05:45:02	46.7	54.8	42.6
14/02/2023	06:00:02	45.9	56.0	42.5
14/02/2023	06:15:02	47.8	64.1	43.4
14/02/2023	06:30:02	47.3	55.0	44.0
14/02/2023	06:45:02	49.3	60.5	46.1
Average		44.3	-	36.1
Highest		49.3	64.1	46.1
Lowest		36.3	49.8	29.3
Mode		-	-	33