Darlington Hospital SDEC

Noise impact assessment

8702.1

22nd April 2021

Revision C

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1 Contents

2 Summary

2.1 This report has been prepared in support of a Planning Application for an air handling unit and condenser to be installed on the roof of Darlington Memorial Hospital.

2.2 A limit of no higher than the background noise levels at the nearest noise sensitive receptors has been used, following an agreement with the Environmental Health Officer for a similar assessment at Darlington Memorial Hospital in September 2020.

2.3 Background sound levels have been measured at a position considered representative of the identified noise-sensitive receptors.

2.4 Plant details have been identified by the mechanical engineers.

2.5 Noise emission from the proposed plant has been determined and noise propagation calculated modelled with proprietary software CadnaA.

2.6 The potential noise impact is calculated and rated in accordance with BS 4142.

2.7 It is calculated that the current proposals satisfy the Local Authority requirements.

2.8 The plant sound impact is calculated to be 8 dB below the daytime background sound level and 2 dB below the night-time background sound level.

2.9 Considering the context of the existing acoustic environment, the BS 4142 assessment results indicate the likelihood of a low impact. This impact is considered to be a LOAEL in alignment with the NPSE aims.

4 Introduction

4.1 A development consisting of the installation of a new Air Handling Unit and 2 no. condensers has been proposed at Darlington Memorial Hospital; the site location is shown in Figure 1.

4.2 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the noise from mechanical plant associated with the development in support of a Planning Application.

4.3 The scope of our instruction includes:

- Measurement of the existing noise environment over a 24-hour period at a single location representative of the nearest noise-sensitive receptor;
- Analysis of proposed source noise levels, using manufacturers' data provided by the client;
- Calculate noise propagation using proprietary noise modelling software to the noise-sensitive receptor and assess the impact in accordance with BS 4142: 2014;
- Advise on a scheme for noise mitigation to satisfy Local Authority requirements.

4.4 This report presents the evaluation of the potential noise impact from plant associated with the proposed development on the identified worst affected noise-sensitive receptor (NSR), in support of a Planning Application.

4.5 The NSR are identified as the residential properties to the south of the proposed site Saddlewood Mews.

4.6 This assessment is based on the proposed plant details identified by the mechanical engineers.

4.7 The potential noise impact from the sources identified is calculated and rated according to the BS 4142 methodology, Reference 1.

Figure 1: Proposed site, measurement position and identified NSR

5 Planning policy and noise criteria

5.1 **National Planning Policy Framework (NPPF)**

5.2 The National Planning Policy Framework (NPPF) Reference 2, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 170, 180 and 182 of the NPPF states the following:

5.3 Paragraph 170:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution…"

5.4 Paragraph 180:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; … "

5.5 Paragraph 182:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

5.6 **Noise Policy Statement for England (NPSE)**

5.7 The Noise Policy Statement for England, Reference 3, states three policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

5.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

5.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

5.10 **Planning Practice Guidance – Noise**

5.11 Further Government guidance on how planning can manage potential noise impact in new development is outlined in Planning Practice Guidance (PPG-N) notes on the Government website: www.gov.uk/guidance/noise--2

5.12 **BS 4142**

5.13 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature in terms of the potential adverse impact on sound sensitive receptors; the residential to the east and south of the site is considered sound sensitive.

5.14 The specific sound source of an industrial and/or commercial nature is rated according to BS 4142 and compared against the measured existing background sound environment.

5.15 According to BS 4142:

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

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

"Where the rating level does not exceed the background sound level, this is an indication of the specific source having a low impact, depending on the context. "

5.16 The terminology used in BS 4142 to describe the various levels of potential adverse impact is respect to the PPG-N noise hierarchy, are summarised Appendix A.

5.17 Steve Todd, EHO from Darlington Borough Council was consulted regarding a similar assessment at Darlington Memorial Hospital in September 2020, and it was proposed that the noise level rating of the proposed plant should be below the measured background noise levels when assessed according to BS 4142.

5.18 The same limits have been adopted for this assessment.

6 Existing acoustic environment

6.1 The existing acoustic environment was measured over a 26-hour period from 11:31 hours on the 18th November 2020.

6.2 The measurement position is shown in Figure 1.

6.3 A picture of the measurement in progress is shown in Figure 2.

6.4 The microphone was located 1.5 metres above ground level and away from other reflecting surfaces such that the measurements are considered free-field.

6.5 Data was recorded in single-octave band frequencies at one-second intervals throughout the 26-hour measurement period.

Figure 2: Measurement in progress

6.6 The most significant noise sources were noise from pedestrians on surrounding paths and slow-moving vehicles in the car park.

6.7 The equipment used is listed in Table 1.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-04045-D2
Calibrator	Larson Davis CAL 200	11705

Table 1: Equipment used

6.8 Both meter and calibrator have current calibration certificates traceable to national standards. The sound level meter has been calibrated within the last two years and calibrator has been calibrated within the last year in accordance with the guidance of BS 4142; calibration certificates are available on request.

6.9 The equipment was field-calibrated before and after the measurements with no significant drift in sensitivity noted.

6.10 **Residual sound level, L_r**

6.11 As the specific sound source under assessment is not yet operating on-site, the existing acoustic environment measured during the survey period is the L_r.

6.12 A time history of the measured L_r is shown in Appendix B.

6.13 **Background sound level**

6.14 The daytime and night-time background sound levels, $L_{A90,\ 1\text{-}hour}$ and $L_{A90,\ 15\text{-}min}$, are calculated from the L_r, $L_{Aeq,\ 1\text{-}hour}$ and $L_{Aeq,\ 15\text{-}min}$, with results shown in Table 8 in Appendix B.

6.15 Statistical analysis is undertaken of the results of all the $L_{A90,\ 1\text{-}hour}$ and $L_{A90,\ 15\text{-}min}$ data following the guidance of BS 4142, to determine a background sound level considered to be representative of the assessment period. Results of the analysis are shown in Figure 4 and Figure 5 in Appendix B.

6.16 Based on the statistical analysis results, the background sound level considered representative of the daytime and night time assessment periods are shown in Table 2.

Assessment period	L_{A90} (dB)
Daytime (07:00 – 23:00 hrs)	48
Night time (23:00 – 07:00 hrs)	42

Table 2: Background sound levels representative of the assessment periods

7 Noise sources

7.1 **Proposed plant and associated noise levels**

7.2 The mechanical plant is assessed based on plant details supplied by the mechanical engineers.

7.3 The location of the all the units have been taken from the mechanical engineers' drawings, Reference 4.

7.4 The proposed plant is understood to comprise of that summarised in Table 3.

Plant	Manufacturer	Model	No. proposed
Air handling unit (AHU)	AHS	AIR FLEX 41	1
Condenser (OU)	Toshiba	RAV-GM2801AT8-E	2

Table 3: Proposed plant

7.5 Manufacturer supplied noise levels are shown in Table 4.

Plant	Data type	dB(A)	Single-octave band centre frequency (Hz) Linear noise levels (dB)						
			63	125	250	500	1k	2k	4k
Condenser (OU) Heating	L_{wA}	80	-						
Condenser (OU) Cooling	L_{wA}	78	-						
AHU Fresh Air Inlet	L_w	91	86	85	94	89	82	81	76
AHU Exhaust Air Outlet	L_w	89	90	82	89	85	85	79	77

Table 4: Manufacturers noise levels

7.6 The in-duct attenuator insertion losses provided by the mechanical engineers used in the calculations are shown in Table 5.

Attenuator ref.	Single-octave band centre frequency (Hz) In-duct attenuator insertion losses (dB)						
	63	125	250	500	1k	2k	4k
Fresh Air Inlet 870mm Attenuator	7	14	17	28	38	30	23
Exhaust Air Outlet 870mm Attenuator	7	14	17	28	38	30	23

Table 5: Proposed in-duct insertion loss

7.7 If plant emitting higher noise levels than those accounted for in this report is proposed, or additional plant also proposed, the impact should be reassessed to check compliance with the Planning Condition limits.

7.8 **Operation times**

7.9 All plant is assumed to operate continuously during the daytime 1-hour and night-time 15-minute assessment periods defined in BS 4142; this is a prudent assumption.

7.10 **Noise transmission and propagation**

7.11 Noise transmission and propagation is modelled to the NSR based on the noise source data detailed, using proprietary software, CadnaA, Reference 5.

7.12 This models noise propagation outdoors according to ISO 9613, Reference 6.

7.13 The model parameters and assumptions are summarised in Appendix C.

8 Assessment results – based on mechanical engineers proposals

Figure 3: Sound contours at 4 m, showing the calculated specific sound level, $L_{Aeq\ 1\ hr}$ based on current proposals

Parameter	Daytime assessment	Night-time assessment	Relevant clause of BS 4142	Commentary
Background sound level	48 dB $L_{A90,\ 16\text{-}hour}$	42 dB $L_{A90,\ 8\text{-}hour}$	8.1.4	Considered representative of the assessment period based on statistical analysis detailed in Appendix B.
Specific sound level $L_{s,}$ due to all sources for the required assessment interval	37 dB $L_{Aeq,\ 1\text{-}hr}$	37 dB $L_{Aeq,\ 15\text{-}min}$	7.3.6	The on-time for the sources during the assessment period are discussed in Section 7.8. The calculated L_s contours across the site due to all sources during the assessment period are shown in Figure 3; the L_s assessed is the highest calculated level at NSR 1.
Acoustic feature correction	+ 3 dB	+ 3 dB	9.2	A subjective assessment to determine acoustic features is undertaken, and the following penalties are considered applicable: • Tonality – 0 dB; • Impulsivity – 0 dB; • Intermittency – 0 dB; • Other – 3 dB; as the potential for intermittent operation, tonality cannot be determined form the data provided, and the calculated specific sound level is less than 5 dB below the measured background noise level, a 3 dB penalty is applied to allow for this once the plant is operational.
Rating level, $L_{Ar,Tr}$	40 dB	40 dB		
Uncertainty of assessment			10	Background data was obtained over a 24-hr period, accounting for the changing acoustic environment.
Excess of $L_{Ar,Tr}$ over background sound level	-8 dB	-2 dB	11	Considering the context of Appendix D the **assessment result indicates the likelihood of a low impact.**

Table 6: BS 4142 assessment results, based on current proposals

9 Conclusion

9.1 Based on the current development proposals it is calculated that the requirements of the Local Authority are met.

9.2 The calculated BS 4142 Rating level at the NSR is 8 dB below the measured daytime background level and 2 dB below the measure night-time background level, and therefore complies with the aims of the NPPF and limits indicated by the Local Authority.

9.3 Considering the context of the existing acoustic environment the assessment result indicates the likelihood of a low impact. This impact is considered to be a LOAEL in alignment with the NPPF and NPSE aims.

10 References

1 BS 4142 2014: A1+2019, Method for rating and assessing industrial and commercial sound.

2 National Planning Policy Framework, Ministry of Housing, Communities & Local Government, February 2019.

3 Noise Policy Statement for England, Department for Environment, Food and Rural Affairs, March 2010.

4 JCP Consulting Engineers, Mechanical services phase 2 proposed ventilation layout. Drawing no. 005 Rev T2

5 CadnaA environmental noise modelling software, version 2017, Datakustik GmbH.

6 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

7 P+HS Architects Drawing no. 3292-PHS-DA-00-DR-A-1001 Rev P01

8 ISO 12913-1:2014 Acoustics, Soundscape, Part 1: Definition and conceptual framework

Appendix A Noise exposure hierarchy

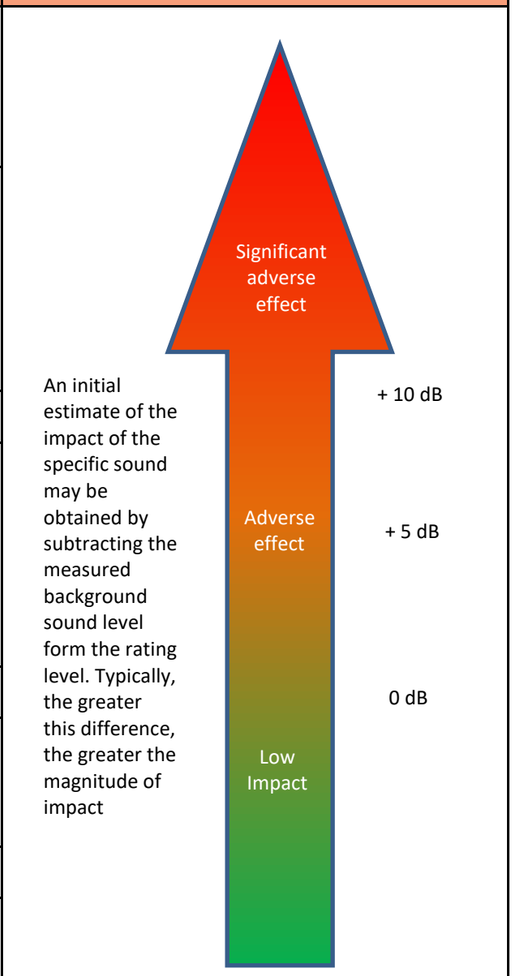
Planning Practice Guidance - Noise				BS 4142: Initial estimate of external noise risk significance
Noise	***Example of outcomes***	***Increasing effect level***	***Action***	
Present and very distributive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	**Prevent**	
Present and distributive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	**Avoid**	
Significant Observed Adverse Effect Level (SOAEL)				
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	**Mitigate and reduce to a minimum**	
Lowest Observed Adverse Effect Level (LOAEL)				
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	**No specific measures required**	
No Observed Adverse Effect Level (NOAEL)				
Not present	No effect	No Observed Effect	**No specific measures required**	
No Observed Effect Level (NOEL)				

Table 7: PPG-N Noise Exposure Hierarchy and BS 4142 initial estimate of impact

Appendix B Residual and background sound levels

B.1 Background sound level data, $L_{A90,\ 1\text{-}hour}$ and $L_{A90,\ 15\text{-}min}$

B.2 The measured daytime $L_{A90,\ 1hour}$ and night time $L_{A90,15min}$ levels are shown in Table 8 and Table 9.

Time (hh:mm)	$L_{A90,\ 1\text{-}hour}$ (dB)	Time (hh:mm)	$L_{A90,\ 1\text{-}hour}$ (dB)
18/11/2020 11:00	48	18/11/2020 21:00	41
18/11/2020 12:00	48	18/11/2020 22:00	41
18/11/2020 13:00	47	19/11/2020 07:00	48
18/11/2020 14:00	47	19/11/2020 08:00	48
18/11/2020 15:00	48	19/11/2020 09:00	46
18/11/2020 16:00	48	19/11/2020 10:00	46
18/11/2020 17:00	47	19/11/2020 11:00	46
18/11/2020 18:00	45	19/11/2020 12:00	47
18/11/2020 19:00	45	19/11/2020 13:00	50
18/11/2020 20:00	43	-	

Table 8: Measured background sound levels, $L_{A90,\ 1\text{-}hour}$

Time (hh:mm)	$L_{A90,\ 15\text{-}min}$ (dB)	Time (hh:mm)	$L_{A90,\ 15\text{-}min}$ (dB)	Time (hh:mm)	$L_{A90,\ 15\text{-}min}$ (dB)
18/11/2020 23:00	43	19/11/2020 02:00	40	19/11/2020 05:00	41
18/11/2020 23:15	42	19/11/2020 02:15	38	19/11/2020 05:15	43
18/11/2020 23:30	42	19/11/2020 02:30	38	19/11/2020 05:30	44
18/11/2020 23:45	42	19/11/2020 02:45	39	19/11/2020 05:45	44
19/11/2020	42	19/11/2020 03:00	39	19/11/2020 06:00	44
19/11/2020 00:15	42	19/11/2020 03:15	39	19/11/2020 06:15	45
19/11/2020 00:30	40	19/11/2020 03:30	39	19/11/2020 06:30	46
19/11/2020 00:45	41	19/11/2020 03:45	39	19/11/2020 06:45	46
19/11/2020 01:00	42	19/11/2020 04:00	44	-	
19/11/2020 01:15	42	19/11/2020 04:15	41	-	
19/11/2020 01:30	42	19/11/2020 04:30	41	-	
19/11/2020 01:45	42	19/11/2020 04:45	41	-	

Table 9: Measured background sound levels, $L_{A90,\ 15\text{-}min}$

B.3 Analysis to determine the typical background sound level representative of the daytime and night-time period is undertaken following the guidance of BS 4142, with results shown in Figure 4 and Figure 5 respectively.

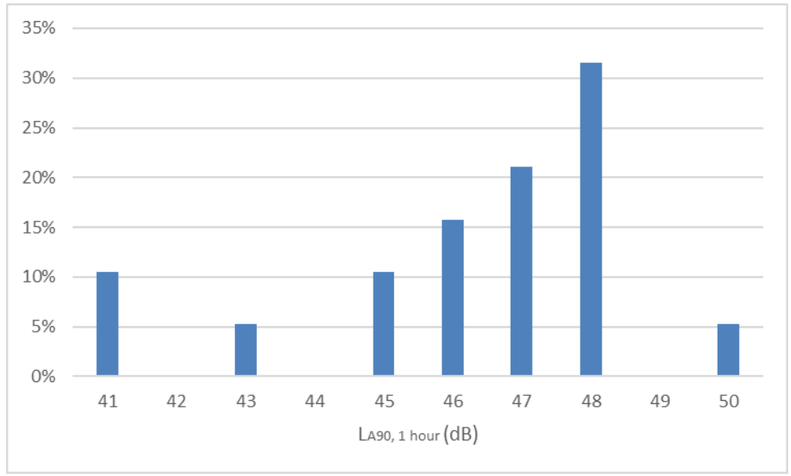


Figure 4: Analysis of daytime background levels, $L_{A90,\ 1\text{-}hour}$

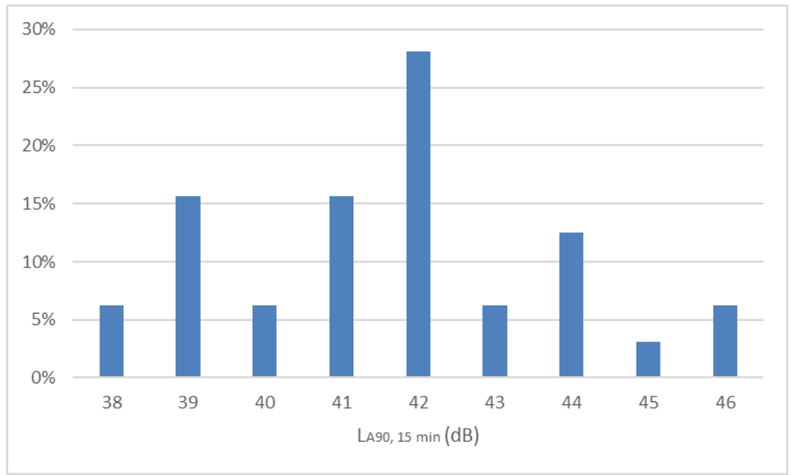


Figure 5: Analysis of night-time background levels, $L_{A90,\ 15\text{-}min}$

Appendix C Noise transmission and propagation

C.1 Noise transmission and propagation is modelled using proprietary software, CadnaA. This models noise propagation outdoors according to ISO 9613. The parameters used, source of data and details are described in Table 10.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects' drawings	Architects' drawings, Reference 7
Topography –within site	Site observations and Google Street view	Modelled with no changes in topography
Topography –Outside of site	Site observations and Google Street view	Modelled with no changes in topography
Building heights – proposed buildings	Drawings	Architects' drawings
Building heights – outside of site	Site observations and Google Street view	3 m per storey + 3 m roof (residential properties)
Receptor positions	Site observations and Google Street view	On the NSR façade closest to the source at a height of 4 m to represent first floor window heights
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 0; Porous ground, G = 1 (locally on model)
Max. order of reflections	Apex Acoustics	Three

Table 10: Modelling parameters and assumptions

C.2 A plan view and a 3D perspective of the CadnaA model are shown in Figure 6 and Figure 7 respectively.

C.3 NSR receivers are positioned as shown by the black and white circles in Figure 6.

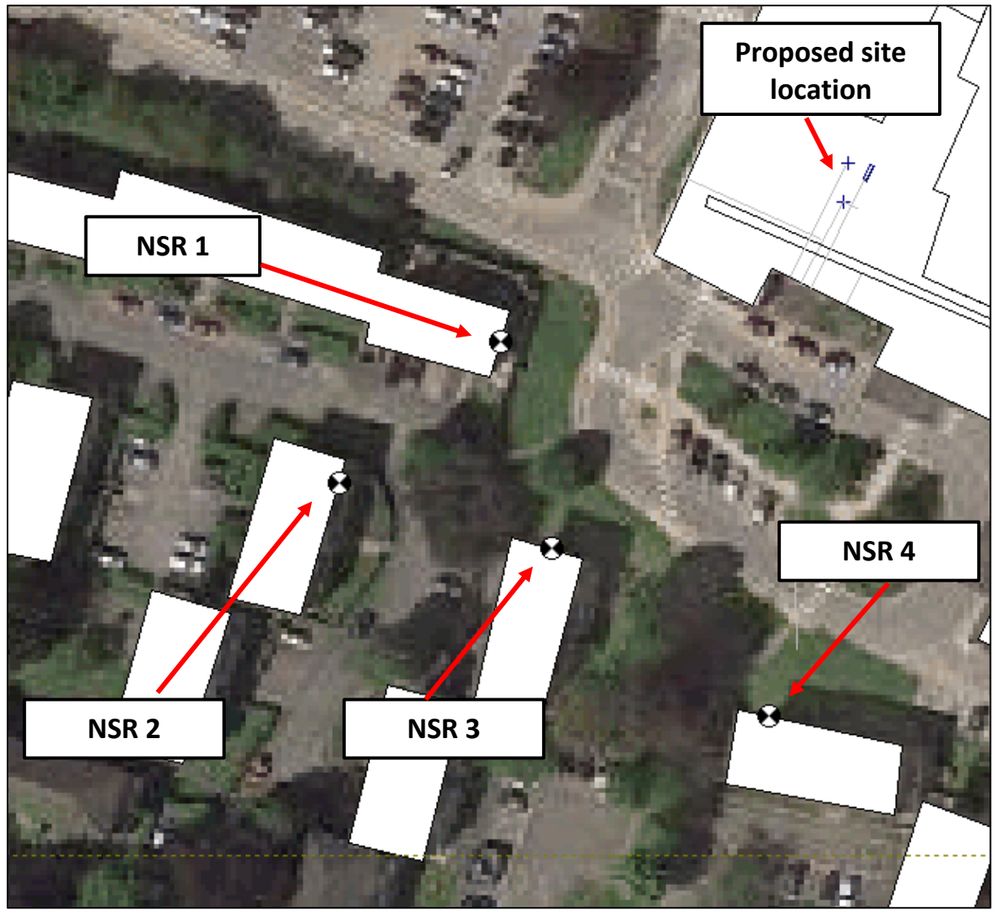


Figure 6: Plan view of the CadnaA model

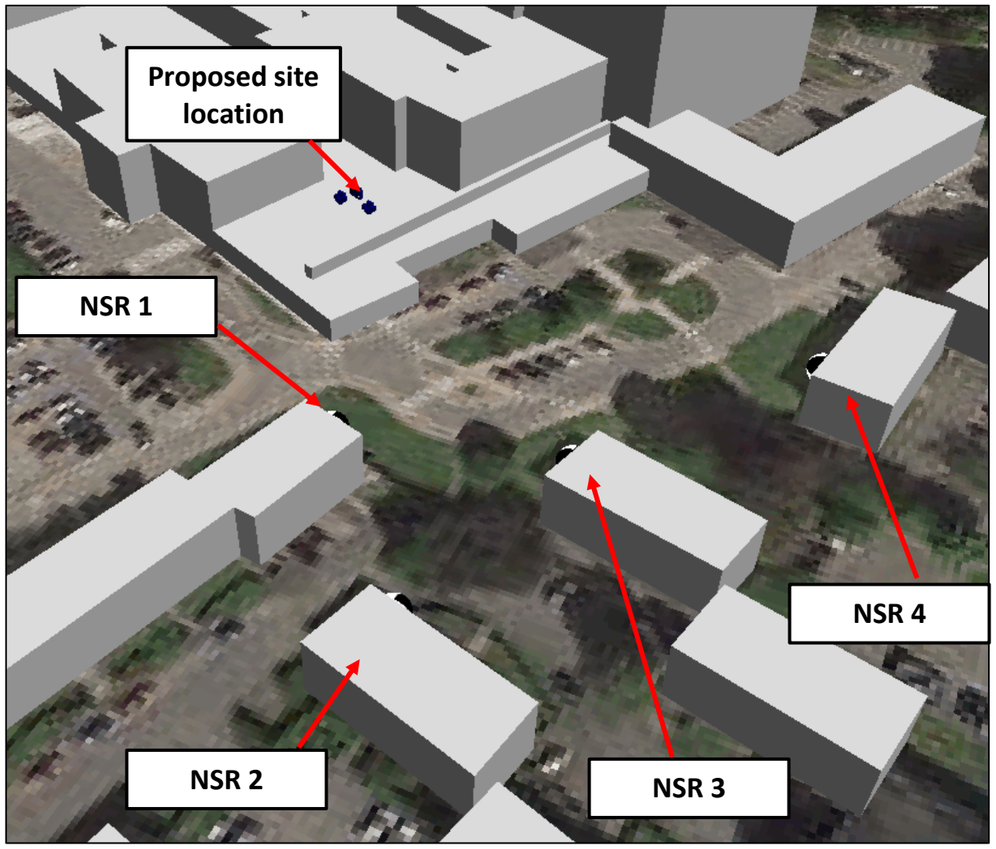


Figure 7: 3D view of the CadnaA model

Appendix D Context of acoustic environment

D.1 The context can be expressed in relation with the soundscape, as defined in BS ISO 12913-1, Reference 8.

D.2 ISO 12913-1 states that:

D.3 “The context may influence soundscape through the auditory sensation, the interpretation of auditory sensation and the responses to the acoustic environment.”

D.4 The process of experiences that describe soundscape and illustrated in Figure 8.

D.5 The acoustic environment is defined as being:

D.6 “… the sound from all sound sources modified by the environment. Modification by the environment includes effects on sound propagation, resulting for example from meteorological conditions, absorption, diffraction, reverberation and reflection.”

D.7 The auditory sensation is described as:

D.8 “… a function of neurological processes that begin when auditory stimuli reach the receptors of the ear. This is the first stage in detecting and representing the acoustic environment. Auditory sensation is influenced by masking, spectral contents, temporal patterns and spatial distribution of the sound sources.”

D.9 The interpretation of auditory sensation refers to

D.10 “… unconscious and conscious processing of the auditory signal to create useful information, which may lead to awareness or understanding of the acoustic environment. Awareness of the acoustic environment, in context, represents an experience of the acoustic environment.”

D.11 Responses describe the short-term reactions and emotions while the outcomes refer to the overall, long-term consequences facilitated or enabled by the acoustic environment.

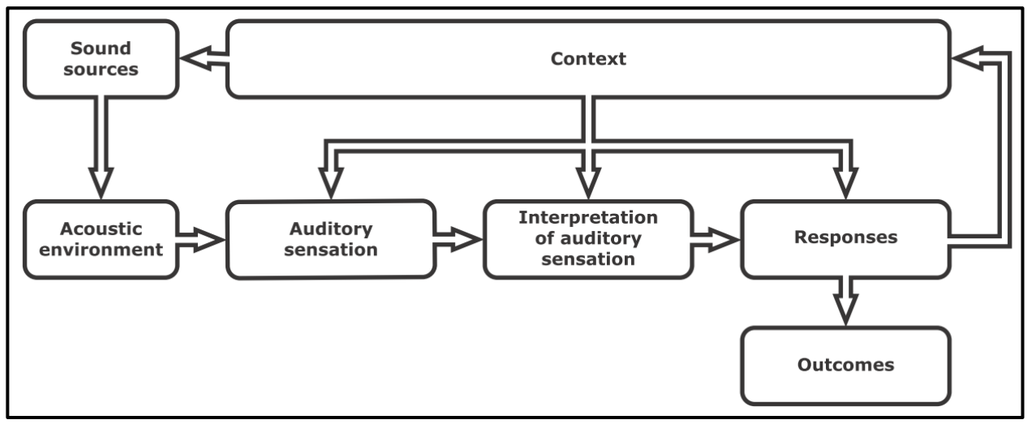


Figure 8: Elements in the perceptual construct of soundscape

D.12 The Planning Practice Guidance notes on noise state that the impact is categorised as SOAEL when “noticeable and disruptive”. It details:

D.13 “The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise.”

D.14 Such effect is typically defined as a difference between the BS 4142 rating level and the background level of +10 dB, depending on the context, and should be avoided on a regular basis.

Appendix E Professional qualifications and competence

E.1 All Apex Acoustics consultants work under the close supervision of a member who holds qualification in acoustics and is a member of the IOA.

E.2 This can be verified by searching the Institute of Acoustics' list of Members, available here, with the surname of the consultant.

http://www.ioa.org.uk/membership-check

E.3 Apex Acoustics is a member of the Association of Noise Consultants (ANC). The ANC is a trade organisation which seeks to raise the standards of acoustic consultancy and as such there are barriers to entry to ensure member's competency.

E.4 This report has been checked by an appropriately qualified and experienced acoustic consultant.