APPENDIX 14.2
NOISE IMPACT ASSESSMENT FOR RESIDENTIAL PLANNING

Bidwells

T6118
Noise Impact Assessment
25th May 2022

LAND OFF MILTON AVENUE, NORTH CAMBRIDGE DEVELOPMENT

temple

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Bidwells

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Introduction

Temple Group has been appointed by Bidwells to undertake a noise and vibration impact assessment for the Proposed Development at Milton Avenue, North Cambridge.

The purpose of the assessment is to assess its suitability for noise and vibration sensitive mixed use residential/commercial development. Attended and unattended noise measurements have been completed at the site to characterise the existing typical noise environment over the day and night. Attended vibration measurements have been completed to determine the impact from existing railway lines and the Cambridgeshire Guided Busway, situated to the east and west respectively of the Proposed Development.

The measured noise and vibration levels have then been assessed in line with the local and national planning policy guidance and relevant standards. Where necessary, additional noise mitigation measures have been recommended to help protect future occupants of the proposed buildings against noise disturbance from nearby noise sources.

Details of the assessment methodology used, together with the results of the survey undertaken and the subsequent conclusions and recommendations drawn are presented in this report.

A glossary of acoustic terms and their meanings has been included in **Appendix A**.

Noise Principles and Standards Used

National Planning Policy Framework

The National Planning Policy Framework[1] (NPPF) sets out the government's planning policies for England and how these are expected to be applied. It was revised in 2018 following a review of the 2012 document and was updated in July 2021.

The recently revised NPPF comments on noise in the following ways:

Paragraph 174: Planning policies and decisions should contribute to and enhance the natural and local environment by:

> *"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 or land instability."*

Paragraph 185: "*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; and*
>
> *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."*

Noise Policy Statement for England

The Noise Policy Statement for England[2] (NPSE) seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

The statement sets out the long-term vision of the government's noise policy, which is to *"promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development".*

1 Department of Communities and Local Government (July 2021), The National Planning Policy Framework

2 Defra (March 2010), The Noise Policy Statement for England

The guidance promotes the effective management and control of noise, within the context of Government policy on sustainable development and thereby aims to:

- 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 improvements of health and quality of life.

The statement adopts established concepts from toxicology that are currently being applied to noise impacts. The concept details noise levels, at which the effects of an exposure may be classified into a specific category. The classification categories as detailed within NPSE are as follows:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

It is recognised that SOAEL does not have a single objective noise-based level that is applicable to all sources of noise in all situations and therefore the SOAEL is likely to be different for different sources, receptors and at different times of the day.

No guidance has been issued at the time of writing to identify the SOAEL and LOAEL for typical noise sources and receptors.

Planning Practice Guidance – Noise

The National Planning Practice Guidance[3] (NPPG) expands on the use of SOAEL:

"If the exposure is above this level the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused."

The NPPG also goes on to identify unacceptable noise exposure:

"At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring."

3 Department for Communities and Local Government (DCLG) (July 2019), National Planning Practice Guidance

In addition, NPPG refers to further considerations to mitigating noise on residential developments. NPPG states that the noise impact may be partially offset if the residents of those dwellings have access to:

- a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling, and/or;
- a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or;
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or;
- a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).

Local Policy

Cambridge and South Cambridgeshire Local Plans

The Cambridge[4] (adopted October 2018) and South Cambridgeshire[5] (adopted September 2018) set out proposals for 33,500 new homes and seek to ensure that sufficient land is available to allow the forecast of 44,100 new jobs. Set against this context of a growing and highly successful area is the need to ensure that growth is implemented as sustainably as possible. This will help ensure that Greater Cambridge reduces its environmental impact – minimising carbon emissions, flood risk, pollution and pressure on resources such as water. In order to achieve this, the Cambridge and South Cambridgeshire Local Plans (2018) set out visions and objectives for the Greater Cambridge area to 2031 for new development to help support the transition to a more environmentally sustainable and successful low carbon economy and respond to the challenges posed by our changing climate.

South Cambridgeshire Local Plan (2018) Policy SC/10: Noise Pollution states the need for a noise impact assessment for residential and non-residential development. Details on noise pollution, including vibration can be found within the Greater Cambridge Sustainable Design and Construction Supplementary Planning Document (SPD)[6], adopted in January 2020.

[4] Cambridge City Council (October 2018), Cambridge Local Plan

[5] South Cambridgeshire District Council (September 2018), South Cambridgeshire Local Plan

[6] Greater Cambridge Sustainable Design and Construction Supplementary Planning Document (SPD), Adopted January 2020)

Greater Cambridge Sustainable Design and Construction Supplementary Planning Document (SPD)

The Greater Cambridge Sustainable Design and Construction Supplementary Planning Document (SPD) sets out the guidance to assist applicants in producing their Sustainability Statement and associated Checklist, together with other documents required to support planning applications. The checklist enables applicants to show that specific design guidance has been considered on issues such as e.g. noise pollution.

Contents covered includes:

- Noise pollution
- Policy Overview
- Initial site noise risk assessments, internal design noise levels, design noise levels for external amenity spaces and assessment of other relevant issues
- Ventilation and cooling
- Planning permissions requirements
- Good acoustic design
- Vibration
- Construction and demolition work

Appendix 8, Annex A summarises the types of development and instances when an acoustic assessment / report is likely to be required for both New Noise Sensitive Development (NSD) and Noise Generating Development (NGD). Appendix 8, Annex B details what a typical report should include and where details of acoustic consultants (Suitably Qualified and Competent Persons) may be obtained from. Appendix 8, Annex C includes tables with guideline "absolute" noise levels for "anonymous noise" and guideline "relative" noise level standards for "non-anonymous noise".

Guideline "absolute" noise levels for "anonymous noise" are as follows:

- <40dB during daytime (NOEL), evening (NOEL), and night-time (NOEL) - no observed effect on health or quality of life. "Grant Consent - No Objection on Noise Grounds", no specific measures required.
- 41 – 45dB during the daytime (NOEL), evening (NOEL), and night-time (LOAEL) - sleep disturbance in bedrooms with window open. "Grant Consent - No Objection – Minimise Noise", no objection in principle subject to the inclusion of suitable noise conditions.
- 46 – 50dB - during the daytime (NOEL), evening (LOAEL), and night-time (SOAEL) - speech intelligibility within living areas with windows open resulting in moderate annoyance. Greater potential for sleep disturbance and adverse health impact. "Grant Consent - No Objection – Minimise Noise", no objection in principle subject

to the inclusion of suitable noise conditions mitigating and reducing noise to a minimum.

- 51 - 55dB - during the daytime (LOAEL), evening (SOAEL), and night-time (SOAEL) - increased potential for sleep disturbance, including significant adverse health effects. Gardens and amenity spaces affected. "Grant Consent - No Objection – Minimise Noise", no objection in principle subject to the inclusion of suitable noise conditions mitigating and reducing noise to a minimum.
- 56 - 60dB - during the daytime (SOAEL), evening (SOAEL), and night-time (SOAEL) - noticeable and disruptive. Significant adverse health effects likely to all habitable rooms. Occupants unable to open windows due to noise ingress and unable to enjoy garden / amenity areas. "Refusal / Object - Avoid on Noise Grounds", possibly Object - Should avoid but may be possible to mitigate and reduce noise to a minimum.
- 60-69dB - during the daytime (SOAEL+), evening (SOAEL+), and night-time (SOAEL+) - noticeable and disruptive. High risk of significant adverse health impact. Unable to use garden and amenity space or have windows open for ventilation. "Refusal / Object - Avoid on Noise Grounds", possibly Object - Presumption against planning permission being granted. Avoid.
- >69+dB - during the daytime (Unacceptable Adverse Effect), evening (Unacceptable Adverse Effect), and night-time (Unacceptable Adverse Effect) - noticeable and very disruptive. Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects. "Refusal / Object - Prevent on Noise Grounds", Object: Prevent - Planning consent should be refused on noise grounds regardless of other considerations ("prevent").

Guideline "relative" noise level standards for "non-anonymous noise" are as follows:

- < -10dB – NOEL - noise is likely to be inaudible and have no discernible impact on health or quality of life. "Grant Consent - No Objection on Noise Grounds", no objection and no specific noise measures required.
- -10dB to -5dB – NOEL – noise will become audible, although should not cause a change in behaviour or have an adverse impact on health or quality of life. "Grant Consent - No Objection – Minimise Noise", no objection, but developers should consider good design principles to preserve and enhance the noise environment.
- -5dB to 0dB – NOEL - sound will become more noticeable, particularly if the sound has characteristics which make it distinguishable from general environmental noise. However, this should not result in a change in behaviour or adverse impact on health, although the context and attitude to the noise source could influence the subjective response to the sound. "Grant Consent - No Objection – Minimise

Noise", consider good design principles to preserve and enhance the noise environment, with particular emphasis on protecting habitable rooms.

- +1dB to +5dB – LOAEL - sound from the source is likely to be noticeable and can give rise to an adverse response, such as annoyance and behaviour change, for example having to close windows to cut out unwanted noise. Approved Plans and / or conditions to include structural noise mitigation and satisfactory window specification to all habitable rooms with facades exposed to LOAEL noise. Potential refusal if noise mitigation not included.
- +6dB to +10dB – SOAEL - sound is increasingly likely to be noticeable and intrusive resulting in significant adverse impacts such as sleep disturbance, annoyance and have an adverse health impact. Details of noise mitigation to be supplied as part of planning approval process. Conditions required to implement control measures within the noise report. Refusal if noise report is inadequate.
- > +10dB – Unacceptable Adverse Effect - Sound is very likely to be very noticeable and intrusive resulting in unacceptable significant adverse impact on health and quality of life. Presumption against planning permission being granted, unless detailed noise impact assessment and approved mitigation measures implemented through conditions. Post completion verification of mitigation measures required.

Cambridge Local Plan 2018

The Cambridge Local Plan 2018[7] was adopted on 18 October 2018. This plan replaces the Cambridge Local Plan 2006 and sets out policies and proposals for future development and spatial planning requirements to 2031.

Noise and vibration policies are included in Section 4: Responding to climate change and managing resources, Policy 35: Protection of human health and quality of life from noise and vibration. The overall aim is to minimise environmental pollution and impact on the local. Development will be permitted where it is demonstrated that:

a) it will not lead to significant adverse effects and impacts, including cumulative effects and construction phase impacts wherever applicable, on health and quality of life/amenity from noise and vibration; and

b) adverse noise effects/impacts can be minimised by appropriate reduction and/or mitigation measures secured through the use of conditions or planning obligations, as appropriate (prevention through high quality acoustic design is preferable to mitigation).

[7] Cambridge City Council, Planning Services (October 2018), Cambridge Local Plan 2018

Replacement Structure Plan

"The RSP includes policies aimed at controlling polluting, hazardous and noisy developments (Policy BE6) and minimising the impact of pollution (BE7)."

Standards and Guidance

British Standard 7445

British Standard 7445 Part 1 (BS 7455-1:2003)[8] defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site.

British Standard 7445 Part 2 (BS 7455-2:1991)[9] describes methods for the acquisition of data which provide descriptors that enable:

a) a description of the environmental noise in a specified area of land to be made in a uniform way.
b) the compatibility of any land use activity or projected activity to be assessed with respect to existing or predicted noise.

Using the data as a basis, authorities may establish a system for selecting the appropriate land use, as far as levels of noise are concerned, for a specified area, or the sources of noise - existing or planned - which are acceptable with respect to land use, existing or planned.

British Standard 8233

British Standard 8233:2014[10] (BS 8233) 'Guidance on Sound Insulation and Noise Reduction for Buildings' provides criteria for the assessment of internal noise levels for various uses including dwellings and commercial properties. The standard suggests suitable internal noise levels within different types of space with examples for dwellings shown in **Table 1.**

8 British Standards Institute (BSI), (2003): 'BS 7445 – Description and Measurement of Environmental Noise. Part 1: Guide to Quantities and Procedures'. BSI, London.

9 British Standards Institute (BSI), (1991): 'BS 7445 – Description and Measurement of Environmental Noise. Part 2: Guide to the Acquisition of Data Pertinent to Land Use'. BSI, London.

10 British Standards Institute (BSI), (2014). 'BS 8233 – Guidance on sound insulation and noise reduction for buildings. BSI, London.

Table 1 BS 8233 Guideline indoor noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

Note 7: Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

The suitability of the use of outdoor amenity spaces within the Proposed Development has been assessed using BS 8233 criteria. BS 8233 states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."

"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB LAeq,T or less might not be possible at the outer edge of these areas but should be achievable in some areas of the space."

World Health Organisation

The World Health Organisation (WHO) Guidelines for Community Noise[11] also sets out guidance on suitable internal and external noise levels in and around residential properties. The following internal noise levels are recommended by the WHO:

- 35 dB L_{Aeq} in living rooms over a 16-hour day;
- 30 dB L_{Aeq} in bedrooms during the 8-hour night; and
- 45 dB L_{AFmax} in bedrooms during the 8-hour night.

This document states that, in dwellings, the critical effects of noise are on sleep, annoyance and speech interference. These indoor noise levels correspond to sound pressure levels at the outside facades of the living spaces (bedrooms) of 45 dB L_{Aeq} and 60 dB L_{Amax}. These external values have been obtained by assuming that the noise reduction of a facade from outside to inside with a window partly open is 15 dB(A).

Additional WHO environmental noise guidelines were published in 2018, however the 1999 document is currently considered to be the most relevant guidance given its reference in BS 8233 and ProPG.

ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise New Residential Development

Current Government guidance on planning and noise for new residential developments is found in the National Planning Policy Framework (NPPF). One of the strengths of the NPPF is that it sets clear objectives. However, the Institute of Acoustics (IOA), Association of Noise Consultants (ANC) and Chartered Institute of Environmental Health (CIEH) feel there is insufficient technical guidance to practitioners and developers on how to deliver the Government's objectives. Therefore, these professional bodies have jointly produced the ProPG[12] which aims to complement existing Government advice and provides a recommended approach that can be applied proportionately to each development site to encourage good acoustic design.

The ProPG seeks to promote the use of good acoustic design to:

- enable new homes to be built in areas previously considered unsuitable because of noise by appropriate evaluation and careful use of suitable mitigation;

11 World Health Organisation (1999), WHO Guidelines for Community Noise.

12 CIEH, IOA and ANC (2017), ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise New Residential Development.

- allow rapid identification of sites where noise is unlikely to be a constraint for new residential developments, hence saving developers time and unnecessary costs on considering the matter further;
- permit swift recognition of noisy sites that are very unlikely to be suitable for new residential developments, hence saving developers time and unnecessary costs pursuing schemes that are unlikely to be permitted; and
- help to reduce the harmful impact of noise on those moving into the properties and the surrounding communities.

The ProPG internal noise level guidelines reflect and extend current practice contained in Table 4 of BS 8233 and this is shown in **Table 2** below.

Table 2 – ProPG additions to the guidance in Table 4 of BS 8233

Activity	Location	07:00 to 23:00	23:00 to 07:00
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ hour}$	35 dB $L_{Aeq,8\ hour}$ 45 dB L_{AFmax}*

** NOTE 4 For a reasonable standard in noise-sensitive rooms at night (e.g. bedrooms) individual noise events should not normally exceed 45dB L_{AFmax} more than 10 times a night.*

Calculation of Road Traffic Noise

Department of Transport/Welsh Office Memorandum "Calculation of Road Traffic Noise"[13] (CRTN) describes procedures for traffic noise calculation and is suitable for environmental assessment of schemes where road traffic noise may have an impact.

This document includes a shortened daytime measurement method for sites dominated by road traffic, which is an alternative to 18-hour monitoring. This method requires L_{A10} noise levels to be measured over three consecutive 1-hour periods between 10:00 and 17:00 hours. By using the $L_{A10,3hours}$ as the arithmetic mean of the measured $L_{A10,1hour}$ values, the $L_{A10,18hours}$ value can then be calculated by subtracting 1dB.

British Standard 6472

British Standard 6472-1: 2008[14] 'Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources other than Blasting' presents recommended frequency weighted vibration spectra (for continuous vibration) and vibration dose values (VDV) (for intermittent vibration) above which adverse comment is likely to occur in residential properties. **Table 3** shows vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings.

13 Department of Transport Welsh Office, HMSO. (1998). Calculation of Road Traffic Noise.

14 British Standards Institution (June 2008), British Standard 6472-1: 2008 'Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources other than Blasting'

Table 3 Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and Time	Low Probability of adverse comment $m/s^{1.75}$	Adverse comment possible $m/s^{1.75}$	Adverse comment probable $m/s^{1.75}$
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Acoustics Ventilation and Overheating: Residential Design Guide

'Acoustics Ventilation and Overheating: Residential Design Guide' (AVO Guide)[15] recommends an approach to acoustic assessments for new residential development that takes due regard of the interdependence of provisions for acoustics, ventilation, and overheating. Application of the AVO Guide is intended to form part of demonstrating good acoustic design as described in the ProPG when considering internal noise level guidelines.

Building Regulations Part O (Approved Document O)

Approved Document O[16] (ADO) takes effect from 15 June 2022 for use in England and provides practical guidance in common building situations in residential buildings on how to meet the requirements of the Building Regulations with regards to overheating.

Requirement O1(2)(a) ensures the safety and reasonable enjoyment of the occupant is accounted for by the buildings overheating mitigation strategy. Guidance on night-time noise levels relating to this requirement states the following:

"In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:

a) 40dB $L_{Aeq,\ T}$ averaged over 8 hours (between 11pm and 7am).

b) 55dB L_{AFmax} more than 10 times a night (between 11pm and 7am).

15 Association of Noise Consultants (2020) Acoustics Ventilation and Overheating: Residential Design Guide, January 2020, Version 1.1

16 HM Government. The Building Regulations 2010 - Approved Document O, Overheating (2021)

Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating strategy in use."

PPG24

Planning Policy Guidance 24 Planning and Noise[17] (PPG24) was superseded by guidance in NPPF/NPSE and supplementary guidance notes, however the guidance is referred to under Cambridge Local Plan 2018 policy to avoid noise sensitive dwellings being exposed to excessive noise.

Four noise exposure categories for new noise sensitive development are given in **Table 4**.

Table 4 PPG24 Noise Exposure Categories

Category	Explanation
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should beimposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

The associated daytime and night-time noise exposure levels dependant on the character of the noise source are summarised in **Table 5.**

Table 5 Noise levels corresponding to the Noise Exposure Categories for new dwellings ($L_{Aeq,\ T}$ dB)

Noise Exposure Category					
Noise Source	Period	A	B	C	D
Road traffic	07:00 – 23:00	<55	55 - 63	63 - 72	>72
	23:00 – 07:00	<45	45 - 57	57 - 66	>66
Rail traffic	07:00 – 23:00	<55	55 - 66	66 - 74	>74
	23:00 – 07:00	<45	45 - 59	59 - 66	>66
	07:00 – 23:00	<57	57 - 66	66 - 72	>72

[17] Ministry of Housing, Communities and Local Government (1994). Planning Policy Guidance 24 Planning and Noise

Noise Exposure Category					
Noise Source	Period	A	B	C	D
Air traffic	23:00 – 07:00	<48	48 - 57	57 - 66	>66
	07:00 – 23:00	<55	55 - 63	63 - 72	>72
Mixed sources	23:00 – 07:00	<45	45 - 57	57 - 66	>66

Furthermore, on sites where individual noise events regularly exceed 82 dB L_{ASmax} several times in any hour during the night (23:00 – 07:00), the site should be treated as being in NEC C, regardless of the $L_{Aeq, 8hr}$ (except where the $L_{Aeq, 8hr}$ already puts the site in NEC D).

British Standard 4142:2014+A1:2019

British Standard 4142:2014+A1:2019[18] (BS 4142) describes methods for rating and assessing sound of an industrial and/or commercial nature. The method uses 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. The method is suitable for the purpose of assessing sound at proposed new dwellings or premises used for residential purposes.

The method of assessment requires that the existing external background noise level, L_{A90}, be subtracted from the predicted specific sound level plus any adjustment for the characteristic features of the sound.

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. Where such features are present at the assessment location, an acoustic character correction is required. The corrected specific sound level is the Rating Level.

BS 4142 contains several methods for the determination of tones and their corresponding penalties. For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.

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 3 dB for impulsivity which is just

[18] British Standards Institution (June 2019), British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

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 3 dB can be applied.

BS 4142 states that typically the greater the difference between the Rating Level and the background noise level, the greater the magnitude of the impact:

- 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 +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 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 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.
- The consideration of context is of particular importance when assessing the effect of an existing noise source on proposed noise-sensitive dwellings. In its scope definition, BS 4142 states that it is "not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels". As part of the assessment of effect, BS 4142 discusses the need to consider all pertinent factors which may modify the initial assessment. In this regard it states:

"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

a) facade insulation treatment;

b) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and

c) acoustic screening."

Therefore, when considering effects on residents inside their property, such as the potential for sleep disturbance, BS 4142 suggests that the guidance in BS 8233 (see above) is more applicable.

Design Manual for Roads and Bridges

Highways England 'Design Manual for Road and Bridges Volume 11 Section 3 Part 7 – Traffic Noise and Vibration'[19] (DMRB) provides guidance on the appropriate level of assessment to be used when assessing the noise and vibration impacts arising from all road projects, including new construction, improvements, and maintenance.

[19] Design Manual for Roads and Bridges, Volume 11, Environmental Assessment, Section 3, Environmental Assessment Techniques, Part 7, LA 111, Noise and Vibration, (formerly HD 213/11, IAN 185/15), Highways England, May 2020

The Proposed Development and Surroundings

The Proposed Development plot lies on the land to the north of Cambridge North Station, to the west of the railway, off Milton Avenue & Cowley Road.

Based on observations during the daytime survey, the surrounding noise climate of the Proposed Development consists of contributions from the following sources:

- The mainline Fen Line railway;
- A railway siding line feeding the Tarmac Cambridge Asphalt facility (noise was not prevalent during the survey);
- Road traffic from Milton Avenue, Cowley Road, Milton Road and A14;
- The Cambridgeshire Guided Busway;
- Cambridge North Station operations (i.e. PA System and Mechanical Plant); and
- Cowley Road Industrial estate (noise was not prevalent during the survey).

The proposal is to develop 6 new buildings intended for business use and 3 new buildings, consisting of 10 blocks, for residential use. A breakdown of the proposed buildings and heights can be seen below:

- S4 – One Milton Avenue (30.8m)
- S5 – Mobility Hub (18.3m)
- S6 – Laboratory (22.1m)
- S7 – Laboratory (22.1m)
- S8 – Office (23.8m)
- S9 – Science Hub (26m)
- S11 to S21 – Residential (13m to 28.8m)

Appendix B shows the site plans.

Measurement Methodology

Environmental Health Officer Consultation

On 28/01/2022, Richard Evans, a consultant at Temple contacted Nick Atkins at South Cambridgeshire District Council via email. The correspondence summarised the proposed methodology for undertaking the noise survey and subsequent assessments. Results of the consultation are as follows:

- Residential units proposed would be expected to follow processes contained within the ProPG Planning and Noise guidance document (May 2017). Noise from the A14 should be included.
- The use of a BS4142 assessment should be carried out in relation to operational phase impacts on existing nearby residential premises, which should include the Network Rail compound area and its impact, principally on the occupiers of Fen Road to the west, as well as others further afield.
- Current government and industry standards, best practise and guidance, and local policy Section 3.6 Pollution - Noise Pollution (including vibration) (pages 89-113) and appendix 8 of the 'Greater Cambridge Sustainable Design and Construction Supplementary Planning Document, adopted in January 2020' should all be considered
- An assessment of all relevant sources of construction noise and vibration must be carried out in accordance with BS5228: 2009 (+A1: 2014): Part 1 - Noise and BS5228: 2009 (+A1: 2014): Part 2 – Vibration.
- Noise from construction and operational traffic should be assessed in accordance with the methodology of the Calculation of Road Traffic Noise (CRTN) and the Design Manual for Roads and Bridges (DMRB) LA111 (where relevant).

Unattended Noise Monitoring

An unattended environmental noise survey was carried out at the Proposed Development between 03/02/2022 and 08/02/2022 to obtain full daytime and night-time ambient noise levels during weekdays and at a weekend. The environmental noise survey was undertaken in accordance with BS 7445: Part 2.

The unattended sound level meter's microphones were positioned at a height of 1.2 (m) above the ground level, and more than 4 (m) away from any reflective surface and therefore are considered to be free-field measurements. The measurement microphones were fitted with a windshield and appropriate corrections applied.

The sound level meters were set to log continuously over 15-minute periods measuring octave band and A -weighted L_{eq}, L_{Fmax}, L_{10} and L_{90} parameters.

UN1 was located on the eastern boundary of the Proposed Development, parallel to the Fen Line railway that runs through Cambridge North station, and its purpose was to collect noise data from trains passing through Cambridge North train station.

UN2 was located inside a small carpark to the east of Milton Avenue, currently used as a staff carpark for the Novotel. Its purpose was to collect noise data from traffic on Milton Avenue.

Attended Noise Monitoring

An attended noise survey was also carried out at two locations around the Milton Avenue development plot on 03/02/2022.

The meter was set to log in 15-minute periods measuring octave band and A-weighted L_{eq}, L_{Fmax}, L_{10} and L_{90} along with other metrics. The microphone was considered to be in free field conditions at all locations.

AN1 was located on the north-western boundary of the Proposed Development, at the intersection of Milton Avenue and Cowley Road.

AN2 was situated on the southern boundary of the Proposed development, adjacent to the Fen rail line and Cambridge North station, and the north-easterly corner of the Novotel building.

Attended Vibration Monitoring

An attended vibration survey was carried out at two locations on 03/02/2022 and on 11/02/2022.

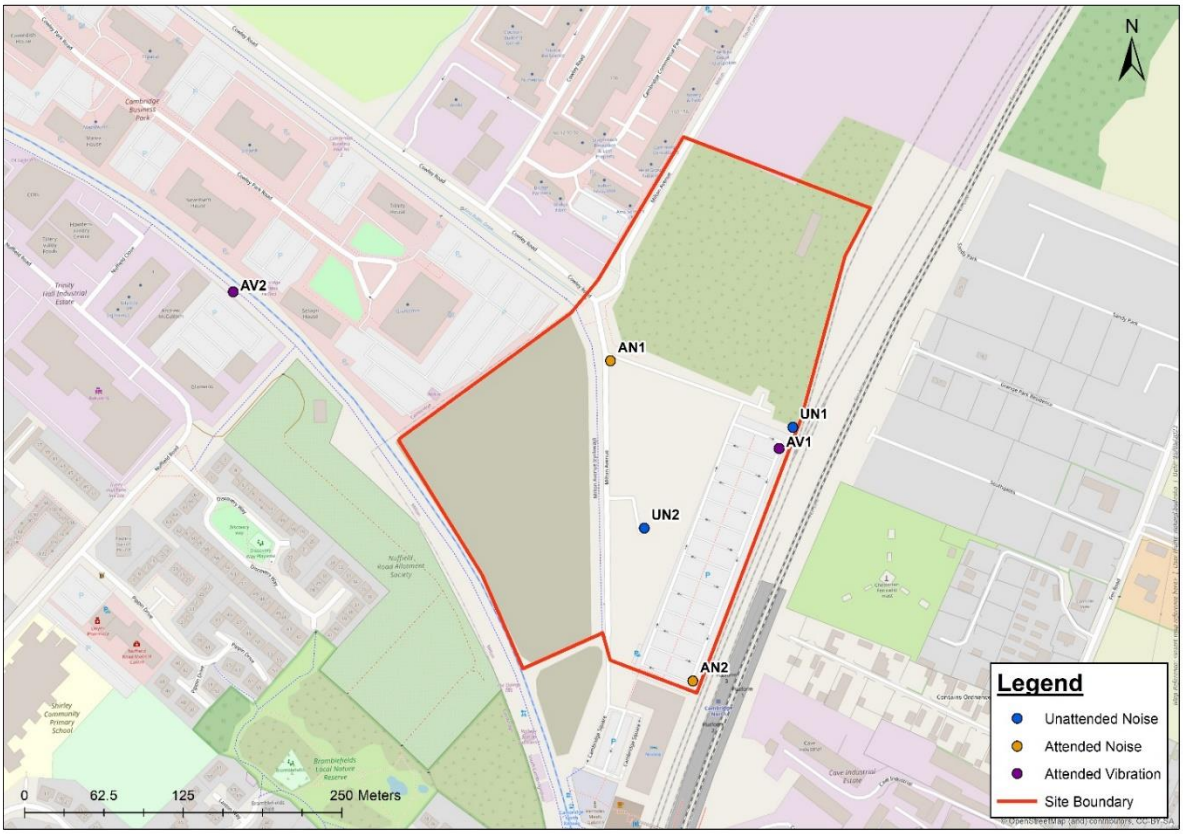
Vibration measurements were carried out using a vibration monitor and a triaxial accelerometer. VDV and PPV measurements were taken in all three axes (X, Y, Z) with the X-axis parallel to the road/railway, Y-axis perpendicular to the road/railway and Z as the vertical axis.

At AV1, the accelerometer was mounted on a DIN plate and placed on a flat block-paved surface within the application site approximately 30m away from the mainline Fen rail line to the east of the site to determine the vibration levels caused by passing trains.

At AV2, the accelerometer was mounted on a DIN plate and placed on a flat tarmac surface at the nearest suitable representative location to the application site boundary approximately 5m away from the nearest (west-bound) lane of the Cambridgeshire Guided Busway to determine the vibration levels caused by guided buses.

The unattended and attended measurement positions are shown in **Figure 1.** Measurement location photos can be seen in **Appendix C**.

Figure 1 – Survey locations



Equipment and Weather Conditions

The equipment used is detailed in **Table 6** below. The microphones were fitted with windshields. The SLMs were field checked for calibration before and after their respective measurement periods and no significant variation in level was observed. The equipment is subject to manufacturer's certificates of periodic verification within one year for the field calibrator and two years for sound level and vibration meters. Copies of these certificates are available upon request.

Table 6 - Survey Equipment

Manufacturer	Item	Type	Serial Number	Calibration Date
RION	Sound Level Meter	NL-52	00410086	27/08/2021
RION	Sound Level Meter	NL-52	00510141	27/08/2021
RION	Sound Level Meter	NA-28	00881067	28/01/2022
RION	Sound Level Meter	NA-28	01260205	28/01/2022
RION	Vibration Meter	VM-56	00680014	15/07/2021
RION	Calibrator	NC-74	34936353	29/10/2021

To verify that periods of potential adverse weather conditions did not significantly impact

the data collected, the local wind speed levels were collected using Wundermap[20] data from weather station ICAMBRID5, located approximately 1.8km from Cambridge North train station. Weather data from the dates and times the surveys were completed can be found in **Appendix E**.

[20] Wundermap https://www.wunderground.com/wundermap

Noise Survey Results

Survey Observations

During the daytime visit to site, observations regarding perceptible noise and vibration sources were noted by the surveyor at each measurement location, a summary of which is presented below.

UN1 – Railside

The noise climate at this location was dominated by rail noise when present and road traffic accessing carpark. Other noise source contributing to a lesser degree included distant aircraft noise.

UN2 – Small carpark adjacent to Milton Avenue

The noise climate at this location was dominated by road traffic noise on Milton Avenue and construction noise from One Cambridge Square when present. Other noise sources contributing to a lesser degree included rail noise and distant aircraft noise.

AN1 – Corner of Milton Avenue & station carpark access

The noise climate at this location was dominated by road traffic noise on Milton Avenue. Other noise sources contributing to a lesser degree included construction noise from One Cambridge Square and distant aircraft noise.

AN2 – Novotel, north east corner

This location was not directly exposed to a singular continuous noise source and was affected by rail noise, railway PA-system, construction noise from One Cambridge Square and road traffic accessing carpark. Other noise source contributing to a lesser degree included distant aircraft noise.

AV1 – Railway

During the survey, there was no perceptible vibration felt by the surveyor at this location.

AV2 – Cambridgeshire guided busway

During the survey, there was no perceptible vibration felt by the surveyor at this location.

Unattended Noise Results

A summary of the results of the daytime and night-time continuous noise measurements at the unattended locations are presented in **Table 7**. A graph showing the time history of the measured results is given in **Appendix D**. Octave band data is available on request.

In order to meet ProPG internal noise level guidelines, the tenth highest L_{AFmax} has been used for the internal noise assessment.

Table 7 – Unattended Noise Survey Results

Location	Date	$L_{Aeq,T}$, dB		10th Highest L_{AFmax}, dB		Typical L_{AF90}, dB		Typical Lowest L_{AF90}, dB	
		Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00
UN1	03/02/22	55	49	73	66	44	38	40	37
UN1	04/02/22	53	48	72	72	48	39	42	37
UN1	05/02/22	50	46	73	62	44	40	42	38
UN1	06/02/22	50	49	70	60	46	42	43	37
UN1	07/02/22	51	45	73	62	45	39	40	36
UN1	Whole period	52	48	79	74	46	40	42	37
Location	Date	$L_{Aeq,T}$, dB		10th Highest L_{AFmax}, dB		Typical L_{AF90}, dB		Typical Lowest L_{AF90}, dB	
		Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00	Day 07:00-23:00	Night 23:00-07:00
UN2	03/02/22	54	43	68	61	48	38	40	37
UN2	04/02/22	52	44	69	62	48	39	43	38
UN2	05/02/22	48	45	67	61	44	41	42	39
UN2	06/02/22	51	46	67	61	47	42	43	38
UN2	07/02/22	52	41	72	53	45	38	40	36
UN2	Whole period	51	44	73	64	46	40	42	37

Attended Noise Results

The results from the attended daytime noise survey are presented in **Table 8.**

Table 8 – Attended Noise Survey Results

Date/Time	Location	$L_{Aeq,15min}$ (dB)	$L_{Amax,15min}$ (dB)	$L_{A10,15min}$ (dB)	$L_{A90,15min}$ (dB)
03/02/22 14:15	AN1	55	73	57	49
03/02/22 15:00	AN1	56	72	60	49
03/02/22 15:40	AN1	54	71	57	48
03/02/22 14:40	AN2	56	70	58	54
03/02/22 15:20	AN2	53	68	54	52
03/02/22 16:00	AN2	57	79	58	54

Attended Vibration Results

Results from the daytime attended vibration survey are presented in **Table 9** and **Table 10**, this summarises the VDV levels from observed passing trains and buses on the rail line and guided busway.

Table 9 - Attended Vibration Survey Results for AV1 (Railway)

Date	Time	X-axis VDV $mm/s^{1.75}$	Y-axis VDV $mm/s^{1.75}$	Z-axis VDV $mm/s^{1.75}$	Train type	Vehicle direction
11/02/22	16:01	0.0003	0.0005	0.0037	170	South
11/02/22	16:06	0.0002	0.0004	0.0029	377	South
11/02/22	16:08	0.0004	0.0005	0.0032	377	North
11/02/22	16:22	0.0003	0.0003	0.0021	755 FLIRT	North
11/02/22	16:32	0.0003	0.0004	0.0025	377	South
11/02/22	16:38	0.0001	0.0001	0.0003	755 FLIRT	South
11/02/22	16:40	0.0004	0.0005	0.0031	377	North
11/02/22	16:59	0.0002	0.0003	0.0018	377	South
11/02/22	17:03	0.0003	0.0005	0.0040	170	North
11/02/22	17:06	0.0003	0.0005	0.0034	170	South

Table 10 - Attended Vibration Survey Results for AV2 (Busway)

Date	Time	X-axis VDV $mm/s^{1.75}$	Y-axis VDV $mm/s^{1.75}$	Z-axis VDV $mm/s^{1.75}$	Vehicle type	Vehicle direction
03/02/22	14:38	0.0002	0.0002	0.0042	Guided bus	South
03/02/22	14:40	0.0002	0.0002	0.0043	Guided bus	North
03/02/22	15:30	0.0002	0.0002	0.0039	Guided bus	South
03/02/22	15:33	0.0002	0.0002	0.0043	Guided bus	North
03/02/22	15:42	0.0002	0.0002	0.0047	Guided bus	South
03/02/22	15:44	0.0003	0.0003	0.0062	Guided bus	North
03/02/22	15:58	0.0034	0.0005	0.0046	Guided bus	South
03/02/22	16:00	0.0002	0.0002	0.0051	Guided bus	North

Date	Time	X-axis VDV $mm/s^{1.75}$	Y-axis VDV $mm/s^{1.75}$	Z-axis VDV $mm/s^{1.75}$	Vehicle type	Vehicle direction
03/02/22	16:16	0.0002	0.0002	0.0045	Guided bus	South
03/02/22	16:19	0.0002	0.0005	0.0122	Guided bus	North
11/02/22	13:46	0.0001	0.0002	0.0027	Guided bus	South
11/02/22	13:49	0.0002	0.0005	0.0059	Guided bus	North
11/02/22	14:09	0.0002	0.0003	0.0033	Guided bus	South
11/02/22	14:11	0.0002	0.0007	0.0076	Guided bus	North
11/02/22	14:19	0.0002	0.0002	0.0026	Guided bus	South
11/02/22	14:22	0.0002	0.0004	0.0048	Guided bus	North
11/02/22	15:32	0.0001	0.0002	0.0024	Guided bus	South
11/02/22	15:35	0.0002	0.0006	0.0062	Guided bus	North

Noise Assessment

External Noise Levels

Based on proposed development plans provided by the client, a noise model has been produced to predict noise levels at the facades of the proposed dwellings. The noise model has been built using CadnaA noise modelling software, which implements calculation methods from Calculation of Road Traffic Noise (CRTN). Noise input source levels for Milton Avenue, the Cambridgeshire guided busway and railway lines were calibrated in the noise model based on measured survey data, enabling noise levels to be predicted across the applications site.

ProPG Site Noise Risk Assessment

The predicted noise levels were compared with the ProPG noise risk values, the daytime and night-time risk levels vary from 'Negligible' to 'High' risk for all of the Site, with the latter towards the roads and railway line. As such, a detailed Acoustic Design Statement (ADS) is required to demonstrate how adverse impacts of noise will be mitigated and minimised and which clearly demonstrates that a significant adverse noise impact will be avoided.

Figure 2 and Figure 3 show the results of the ProPG initial risk assessment of the undeveloped site during daytime and night-time periods respectively.

Note that the initial site risk assessment is carried out for an undeveloped site (no buildings) and therefore does not take into account the reduction in noise levels due to screening caused by the development itself (once built).

Figure 2 - ProPG- Daytime Risk Assessment

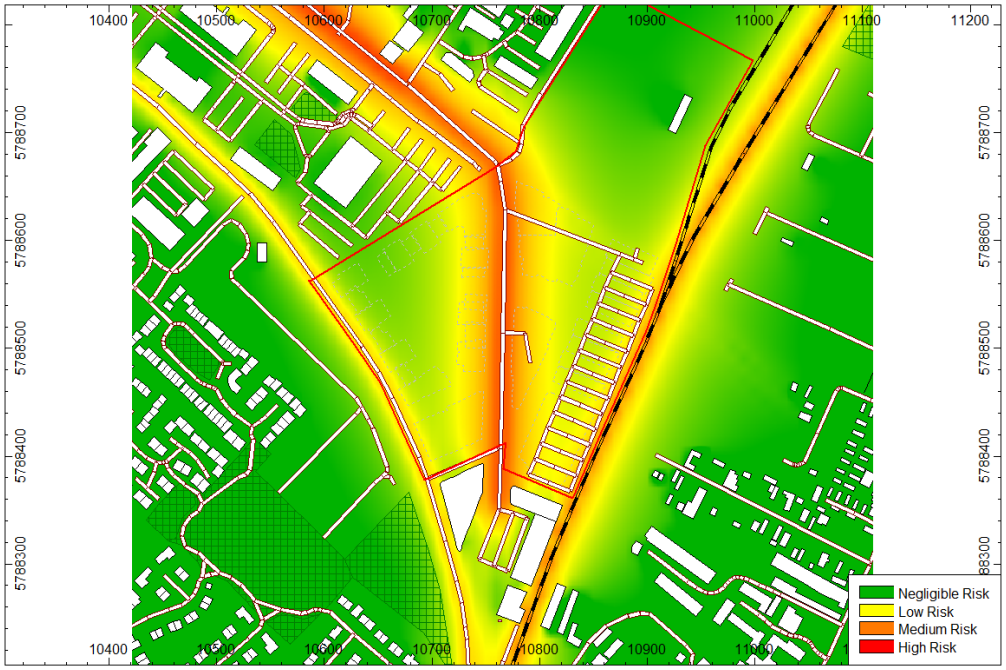
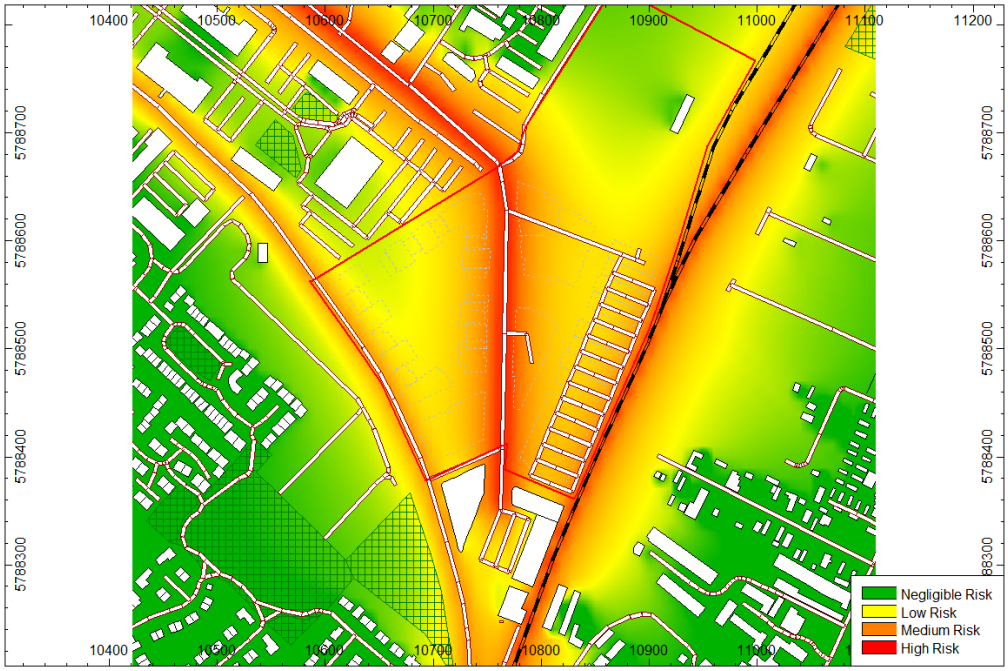


Figure 3 - ProPG- Night-time Risk Assessment



External Amenity Area

It is desirable that the external noise level in amenity spaces such as private gardens does not exceed 50 dB $L_{Aeq,\ 16hr}$, with an upper guideline value of 55 dB $L_{Aeq,16hr}$, which would be acceptable in noisier environments. **Figure 4** shows the modelled daytime noise levels for external amenity areas at a height of 1.5m.

The assessment of external noise levels to BS 8233 and WHO guideline levels indicates that the guideline level of 50 dB $L_{Aeq,16hr}$ is achieved for the majority of the Residential Quarter of the Proposed Development, with the spaces between the blocks facing Milton Avenue and facades facing Cambridgeshire guided busway achieving the upper guideline value, as they have a direct line of site to Milton Avenue and Cambridgeshire guided busway, and do not benefit from any screening. External facing facades on Milton Avenue are unlikely to achieve guideline noise levels for external amenity areas.

As explained in **Section 2.3**, BS 8233 guidance states that limits are often not achievable in areas where development is desirable, such as urban and built-up areas adjoining the strategic transport network. The raised external noise levels will not cause reason for the development to be prohibited, however, should be taken into consideration in the future design. BS 8233 states:

"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation".

Despite noise levels being in excess of guideline values at external facing facades the impact can be off set as residents will have access to areas at the rear of the development where $L_{Aeq,16hr}$ levels are less than 50 dB. Pro PG states:

'Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:

…

A relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings".

Figure 4 Noise Levels in External Amenity Areas

Internal Noise Levels

Daytime internal noise levels should be controlled to allow reasonable resting conditions in living rooms and bedrooms. Night-time internal noise levels should be controlled to allow reasonable sleeping conditions in bedrooms. These can be controlled through use of appropriate mitigation measures to meet the guideline internal noise levels from BS 8233 detailed in **Table 1** and by controlling regular the L_{AFmax} during the night-time to below 45 dB.

Table 11 presents a summary of the worst-case noise exposure levels identified for the Residential Quarter of the Proposed Development against the required sound insulation to achieve the BS 8233 and WHO guidance. The $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ noise exposure levels have been derived from the noise model. The L_{AFmax} night-time level has been derived from the baseline survey at UN2.

Table 11 – Worst case external noise levels for assessment and approximate required sound insulation performance

Façade/Elevation	Room Type	External Noise Levels, dB			Outline guidance on the required façade sound insulation to achieve BS 8233:2014 & WHO guidelines, $D_{ntw} + C_{tr}$, dB	
		$L_{Aeq,16hr}$	$L_{Aeq,8hr}$	10th Highest $L_{AFmax,\ 2300\ -0700}$	Day	Night
North	Living Room	55	45	64	20	n/a
	Bedroom					19
East (Façades facing Milton Ave)	Living Room	59	53	64	24	n/a
	Bedroom					23
South	Living Room	55	49	64	20	n/a
	Bedroom					19
West (Façades facing Busway)	Living Room	51	46	64	16	n/a
	Bedroom					19

External noise ingress calculations have been undertaken and indicate that it is feasible to meet the internal noise level criteria outlined in BS 8233 at the most exposed facades using glazing with minimum weighted sound reduction index of 25 dB $R_w + C_{tr}$; this may typically be achieved using glazing with a 4/6/4 configuration, and typical sound insulation for walls and ventilation.

On the facades facing the inner courtyard, lower levels of sound insulation façade elements will be required.

The Site is also exposed to industrial noise from Tarmac Cambridge Asphalt facility and Cowley Road Industrial estate however noise from these facilities was not prevalent during the attended survey, so the assessment is based on traffic and rail noise only. Sound insulation measures to control traffic noise as well as separation distance from Tarmac Cambridge Asphalt facility and Cowley Road Industrial estate would also have the effect of minimising the industrial noise.

It should be noted that the detailed prediction of noise ingress is dependent upon façade make up (glazed area, ventilation solution etc.) and the acoustic characteristics of the final proposed internal spaces. During detailed design stage, specific calculated assessment is required of the sound insulation of the building envelope to review whether the proposed solution is suitable to meet the guideline internal noise levels. All the related information above is not currently available, as such the above advice has been provided to demonstrate the feasibility of the mitigation. A more detailed assessment should be undertaken as the design progresses.

Planning Policy Guidance 24 Planning and Noise (PPG24) Site Noise Risk Assessment

Although PPG24 has been effectively superseded by guidance in ProPG, the Cambridge Local Plan 2018 refers to PPG24, and so a site risk assessment in line with that guidance is presented here.

Table 12 below identifies the noise exposure category of the most exposed (east) façades facing Milton Avenue of the Residential Quarter of the Proposed Development.

Table 12 - Noise Exposure Category Assessment

Façade	$L_{Aeq,16hr}$ (dB)	NEC (day)	$L_{Aeq,8hr}$ (dB)	NEC (night)
East Façade	59	B	53	B

The Residential Quarter of the development has been assessed as falling within NEC B during the day and night-time periods. The L_{Amax} criteria of 82 dB is unlikely to be exceeded more than several times a night, so the site should be considered category B in any case. Based on the above, the following applies:

"NEC B: Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise."

The practical design approach for Noise Exposure Categories (NEC) B may be summarised as follows:

- specific calculated assessment required of sound insulation for all elements of the building envelope;
- specific calculated assessment required of sound insulation for all elements of the building envelope;
- standard performance double glazing; and
- standard sound insulation for walls, roof and ventilation.

Building Services, Commercial Unit Plant and Delivery Noise

At this stage, the building services and commercial unit plant requirements have not been finalised, therefore there is no plant sound emission data available.

For the purpose of this assessment, it is considered appropriate to propose noise limits applicable to any future plant associated with the development.

BS 4142 proposes an assessment based on the comparison of the Rating Level of the noise against the 'typical' background sound level. The typical lowest background measured levels, L_{AF90}, during the daytime and night-time were determined to be 42 dB during the day and 37 dB during the night-time.

Based on the above, it is proposed that the noise from all items of plant operating simultaneously at normal design duty are not to exceed a Rating Level of **42 dB during the day** and **37 dB during the night-time**, when assessed at 1m from the nearest noise sensitive receptor. This would equate to a low impact, depending on the context, in accordance with BS 4142.

It is important to recognise that the Rating Level is based on the specific sound level, i.e. the sound level of the source being assessed, with corrections made to account for acoustic features that could increase the significance of the impact, for example: tonality, impulsivity or intermittency. These corrections can lead to a much higher rating level than the specific level alone and therefore it is important that any prominent acoustic features are adequately addressed at the design stage.

It is proposed that appropriate noise assessments be undertaken for any sources of noise of an industrial nature once details are available. Should the assessment(s) indicate that noise levels would be excessive, suitable mitigation measures should be put in place prior to operation.

It is recommended that the installation of plant on the roof should be located in the centre to increase the screening to nearby noise sensitive receptors. If plant is to be wall-mounted, vibration isolation measures are to be employed where necessary to minimise the risk of structure-borne noise transmission to nearby adjacent dwellings.

The sound insulation performance between a plant room and an adjacent space needs to be such that the performance standards are met for indoor ambient noise level in the adjacent space. Since the sound insulation is calculated using the noise levels of the actual equipment within the plant room, the final selection of the separating element between a plant room and the adjacent space will need to be made when details of the noise levels of the equipment to be located within the plant room are confirmed.

There are a number of noise sources relating to delivery noise to service the proposed commercial units, namely the vehicle noise itself, warning signals during reversing, the loading and unloading of goods and the transfer of the goods via either forklift truck or by wheeled trolleys. Any on-street loading would operate within the servicing times as dictated by South Cambridgeshire District Council.

At this stage, no information (i.e. route, location, times) has been provided regarding deliveries. The use of loading bays could potentially cause a noise disturbance in residential properties along Discovery Way. Further considerations, i.e. limitation of deliveries during daytime, planning of delivery times and broadband (multi-frequency) noise reversing alarms may be required to minimise the impact of noise from deliveries.

Overheating

Table 13 show the results of the initial ADO and AVO Guide assessment to determine where acceptable internal noise levels can be achieved when mitigating overheating by means of openable windows.

For the purposes of the assessment, it is assumed that a standard opening window will provide an outside-to-inside level difference of 13 dB. This level difference is considered representative of typical domestic rooms with simple façade openings of around 2% of the floor area. The daytime assessment has assumed that the overheating condition occurs 'rarely to some of the time'. The assessment also considers L_{Amax} levels during the night-time in line with criteria in ADO.

Table 13 - ADO/AVO Guide overheating assessment

Receptor	**External Noise Levels**			**ADO Assessment**			**AVO Level 1 Assessment** (in line with Table 3-2 of AVO Guide)
Façade/ Elevation	Predicted Day $L_{Aeq,16hr}$ dB	Predicted Night $L_{Aeq,8hr}$ dB	10th Highest L_{AFmax}, 2300 -0700	Exceedance of 40 dB $L_{Aeq,8hr}$ Criteria	Exceedance of 55 dB $L_{Amax,8hr}$ dB Criteria [not exceed more than 10 times per night]	Suitable levels achieved when using openable windows	Risk
North	55	45	64	-8	-4	Yes	LOW
East	59	53	64	0	-4	Yes	MEDIUM
South	55	49	64	-4	-4	Yes	LOW
West	51	46	64	-7	-4	Yes	NEGLIGIBLE

The assessment indicates that the internal levels are likely to achieve ADO reasonable conditions if overheating control is provided by means of partially open windows. There is a low to medium risk, according to AVO Level 1 assessment, at the most exposed facades and the use of opening windows as primary means of mitigating overheating may result in an adverse effect depending on the duration of the overheating condition.

A Level 2 detailed assessment may optionally be carried out during the detailed design stage to demonstrate that the potential noise impacts at worst case facades during the overheating condition can be mitigated.

The inner courtyard facades of the Residential Quarter that are screened from road and rail noise are at a lower risk of adverse effects and opening windows as a means to control overheating is likely to be acceptable.

The above assessment relates only to overheating mitigation and therefore openable windows may be used for purge ventilation on all facades without acoustic constraint.

Vibration Assessment

Vibration measurements were obtained from the passing by of several passenger trains. During the survey, there was no perceptible vibration felt by the surveyor on site.

Using data sourced from Realtimetrains.co.uk, the approximate number of trains passing the application site is 200 during each day and 32 during the night. The 16hr day and 8hr night VDV have been calculated along each axis (see **Table 9**) based on the above number of events and the average measured VDV for the trains passing presented in **Table 14**.

Table 14 - Day and night-time predicted VDV for the rail line

	X-axis	Y-axis	Z-axis
VDV_{16hr} $mm/s^{1.75}$	0.002	0.002	0.015
VDV_{8hr} $mm/s^{1.75}$	0.001	0.001	0.010

Based on the measured vibration levels on all three axes (X, Y and Z), there is a low probability of adverse comment according to the BS 6472 criteria.

Vibration measurements were also obtained from the passing by of several buses. During the survey, there was no perceptible vibration felt by the surveyor on site.

Using data sourced from thebusway.info, the approximate number of guided buses passing the application site is 56 during each day and 4 during the night. The 16hr day and 8hr night VDV have been calculated along each axis (see **Table 10**) based on the above number of events and the average measured VDV for the buses passing presented in **Table 15**.

Table 15 - Day and night-time predicted VDV for the guided busway

	X-axis	Y-axis	Z-axis
VDV_{16hr} $mm/s^{1.75}$	0.009	0.002	0.033
VDV_{8hr} $mm/s^{1.75}$	0.005	0.001	0.017

Based on the measured vibration levels on all three axes (X, Y and Z), there is a low probability of adverse comment according to the BS 6472 criteria.

Conclusion

Temple Group has been appointed by Bidwells to undertake a noise and vibration impact assessment for the Proposed Development at the Land off Milton Avenue, North Cambridge.

An assessment has been undertaken to determine the location's suitability for noise and vibration sensitive mixed use residential and commercial development. Unattended and attended noise measurements have been completed at the site to characterise the existing noise environment over day and night. A noise model has been used to predict noise levels at the most exposed façades of the Residential Quarter of the Proposed Development. The predicted noise levels have then been assessed in line with the local and national noise guidance and relevant standards.

The assessment of external noise levels to BS 8233, WHO and ProPG guideline levels indicate that the guideline level of 50 dB $L_{Aeq, 16hr}$ would be achieved for the majority of the Residential Quarter of the Proposed Development, with the spaces between the blocks facing Milton Avenue and facades facing Cambridgeshire guided busway achieving the upper guideline value. External facing facades on Milton Avenue are unlikely to achieve guideline noise levels for external amenity areas, however, this impact will be offset with residents being able to access the external amenity area within the inner courtyard of the Residential Quarter of the Proposed Development.

The noise assessment based on the results of the noise survey indicates that the proposed internal noise levels in accordance with BS 8233, ProPG and WHO's noise guidelines can be achieved with considerate design. To provide internal noise levels which consistently meet the guideline noise levels in the most exposed areas of the site, the practical design approach for Residential Quarter may be summarised as follows:

- specific calculated assessment required of sound insulation for all elements of the building envelope;
- standard performance double glazing; and
- standard sound insulation for walls, roof and ventilation.

On the facades facing the inner courtyard, lower levels of sound insulation façade elements will be required.

The Site is also exposed to industrial noise from Tarmac Cambridge Asphalt facility and Cowley Road Industrial estate however noise from these facilities was not prevalent during the attended survey, so the assessment is based on traffic and rail noise only. Sound insulation measures to control traffic noise as well as separation distance from Tarmac Cambridge Asphalt facility and Cowley Road Industrial estate would also have the effect of minimising the industrial noise.

It should be noted that the detailed prediction of noise ingress is dependent upon the precise facade make up (glazed area, ventilation solution etc.) and the acoustic characteristics of the final proposed internal spaces. During detailed design stage, specific calculated assessment is required of the sound insulation of the building envelope to review whether the proposed solution is suitable to meet the guideline internal noise levels. All the related information above is not currently available, as such the above advice has been provided to demonstrate the feasibility of the mitigation. A more detailed assessment should be undertaken as the design progresses.

Noise limits for any mechanical plant associated with the Proposed Development have been outlined based on guidance in BS 4142. It is proposed that the noise from all items of plant operating simultaneously at normal design duty are not to exceed a Rating Level of 42 dB during the day and 37 dB during the night-time when assessed at 1m from the nearest noise sensitive receptor. This would equate to a low impact, depending on the context, at the nearest receptor in accordance with BS 4142.

An assessment of internal noise levels for overheating mitigation strategies has been carried out following ADO and AVO guidance. The assessment indicates that the internal noise levels are likely to achieve ADO reasonable conditions if overheating control is provided by means of partially open windows. According to the AVO Level 1 assessment, there is a low to medium risk at the most exposed facades and the use of opening windows as primary means of mitigating overheating is likely to result in an adverse effect depending on the duration of the overheating condition. A Level 2 detailed assessment may optionally be carried out during the detailed design stage to demonstrate that the potential noise impacts at worst case facades during the overheating condition can be mitigated.

Based on the measured vibration levels on all three axis (X, Y and Z), there is a low probability of adverse comment according to the BS 6472 criteria.

Appendix A – Acoustic Glossary

Decibel (dB)

This is the unit sound pressure levels are presented in. They are a logarithmic ratio between the sound pressure and a reference sound pressure (20 µPa). A 3dB increase is a doubling of sound energy but is generally a just noticeable increase; a 10dB increase is a 10 fold increase in sound energy and is generally perceived as being twice as loud.

dB(A)

This indicates that the overall dB noise level has been 'A-weighted'; this is a weighting applied to instrument-measured sound levels to account for the relative loudness perceived by the human ear.

L_{Aeq}

This represents the A-weighted 'ambient noise level' also known as the equivalent continuous sound level. As almost all sounds vary or fluctuate with time it is helpful to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,16hr}$ for example, describes the equivalent continuous sound level over the 16-hour period between 7am and 11pm.

L_n

Another method of describing, with a single value, a noise level which varies over a given time period is to consider the length of time for which a particular noise level is exceeded. If a level of X dB(A) is exceeded for say 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the L_{A10} = X dB.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90}, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise.

L_{AFmax}

The maximum RMS A-weighted sound pressure level, using the Fast time weighting.

Appendix B – Site Plan

Figure B.1 - Application site plan and boundary

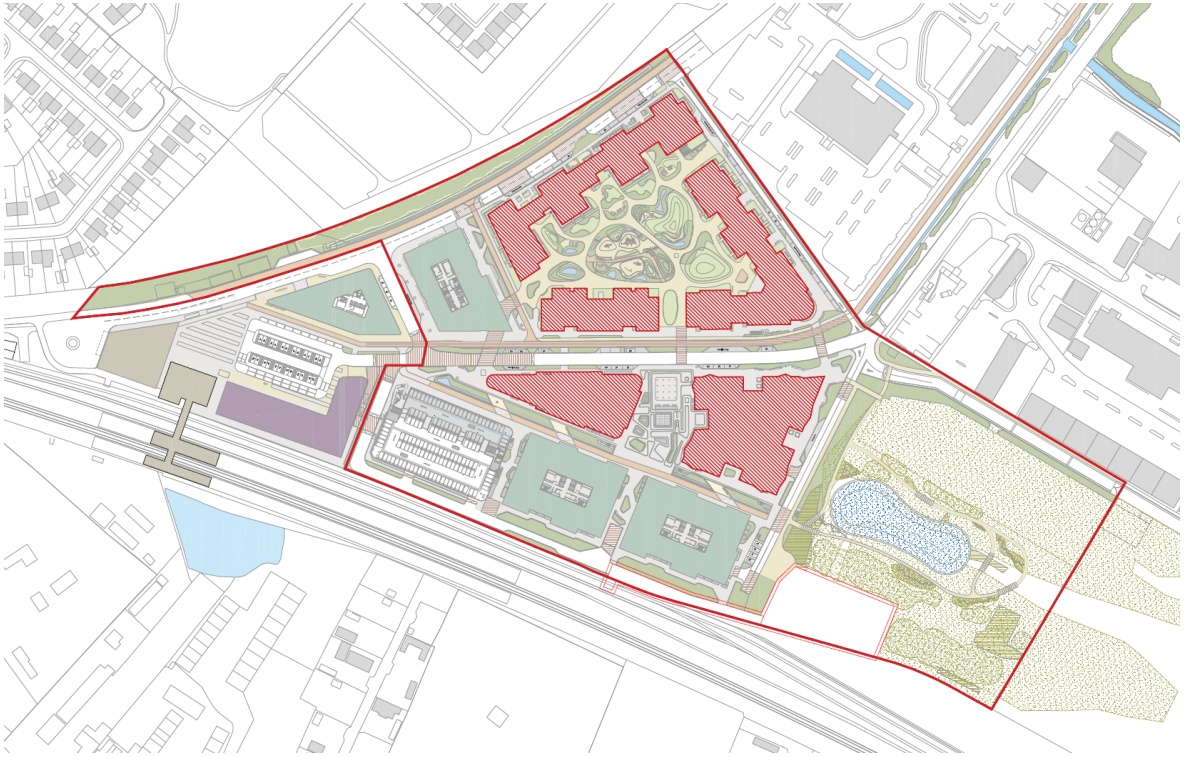
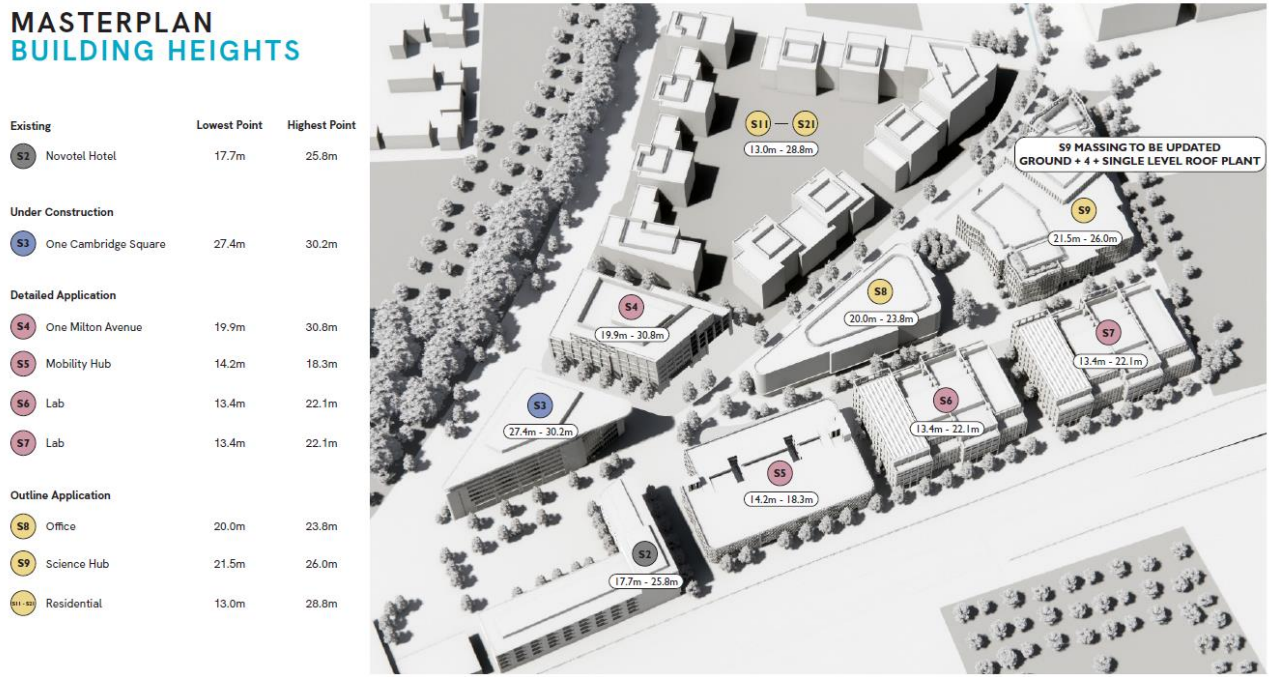


Figure B.2 – Site Master Plan

Figure B.3 – Site Master Plan Showing Building Uses



Appendix C – Survey Photos

Figure C.1 - UN1 Rail noise, facing south

Figure C.2 – UN2 Milton Ave, facing west

Figure C.3 – AN1 Corner of Novotel Hotel, facing south

Figure C.4 – AN2 Corner of Milton Ave and station carpark access, facing south

Figure C.5 – AV1 Cambridge North train station car park, facing south

Figure C.6 – AV2 Cambridge guided busway, facing south

Appendix D – Unattended Measurement Time History

Figure D.1 - Time graph of measured noise levels at UN1

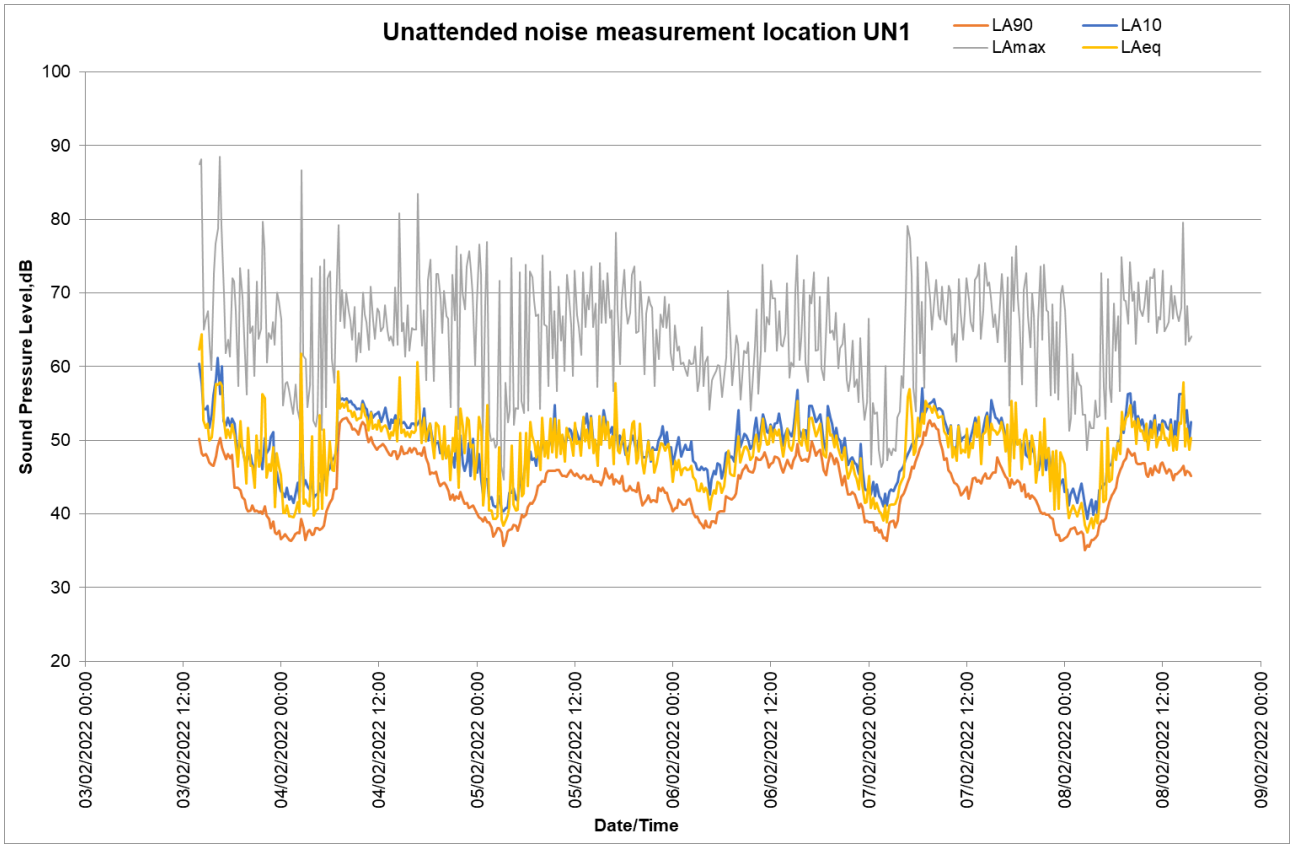
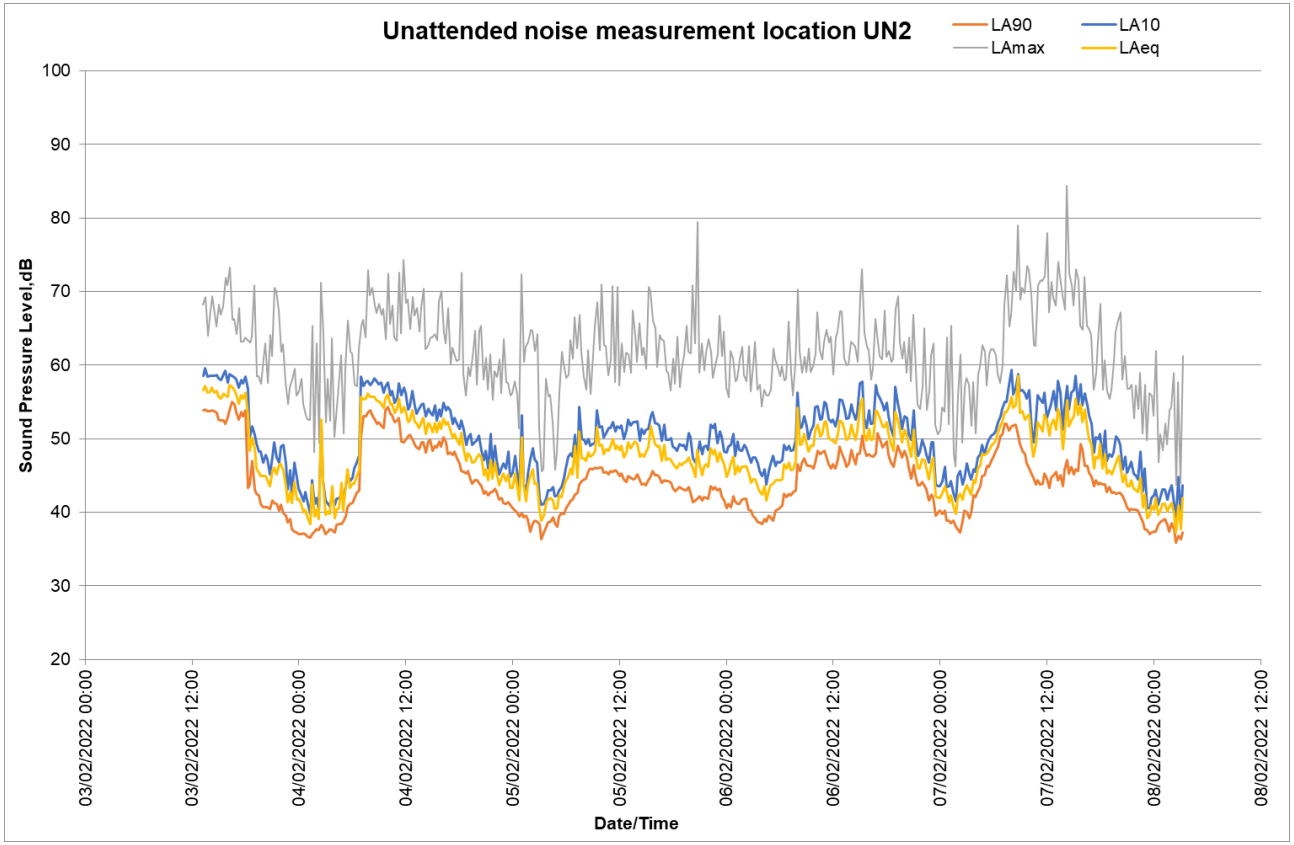


Figure D.2 - Time graph of measured noise levels at UN2



Appendix E – Weather Time History

Figure E.1 - Weather Time History Graph for 03/02/2022

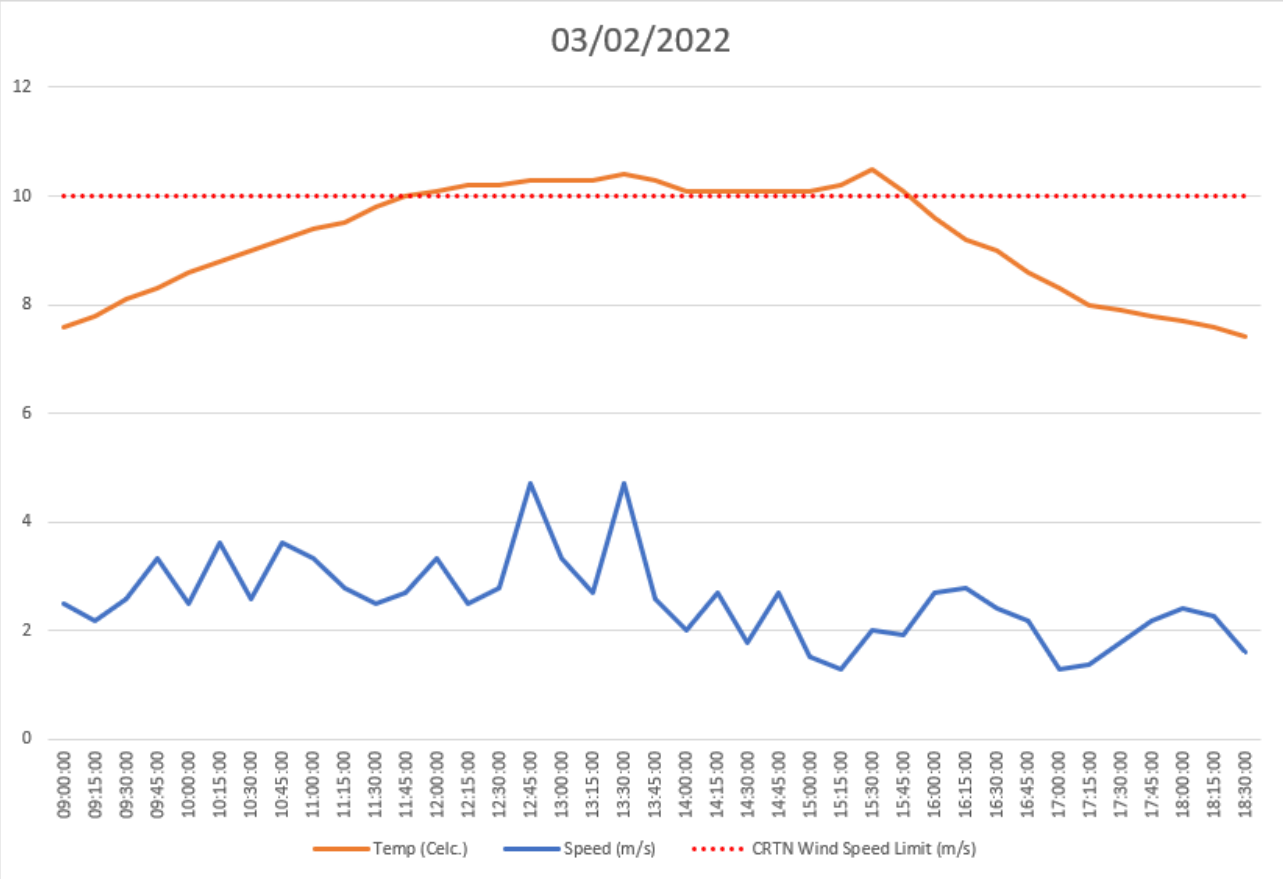


Figure E.2 - Weather Time History Graph for 11/02/2022

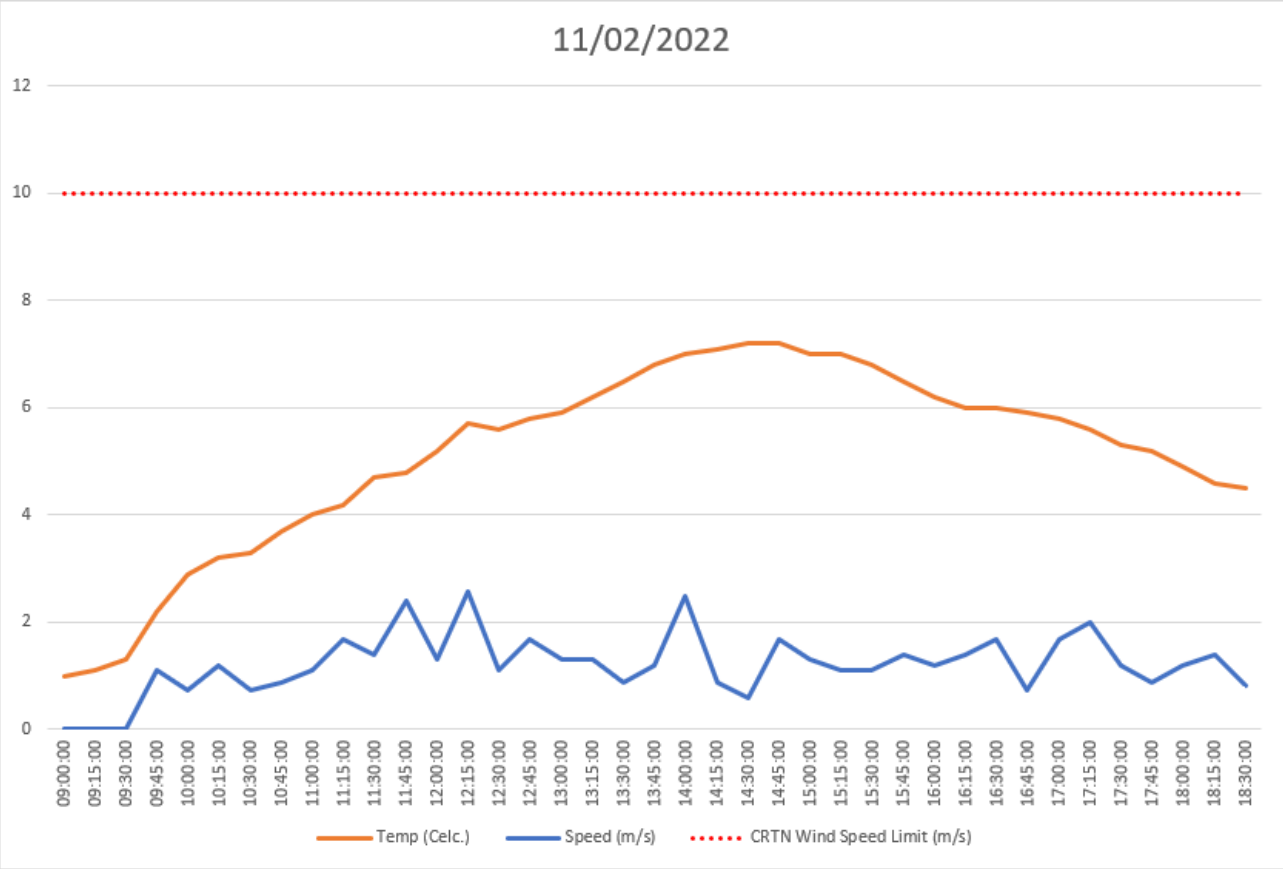
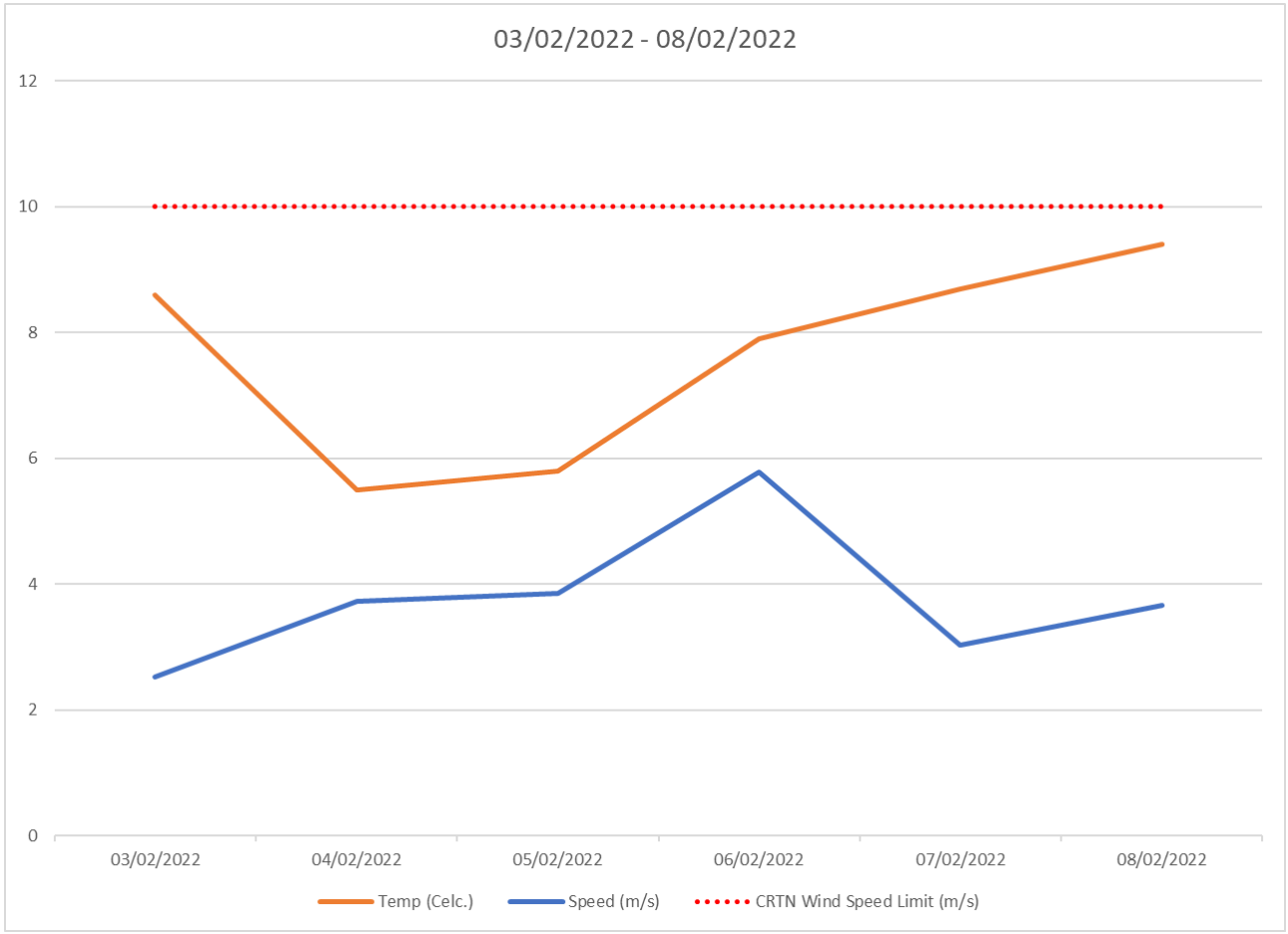


Figure E.3 - Weather Time History Graph for 03/02/2022 to 08/02/22



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