

9.0 NOISE AND VIBRATION

9.1 Introduction

9.1.1 Purpose of the Assessment

This chapter considers the potential noise and vibration impacts associated with the proposed Carmanhall Road Strategic Housing Development (the 'Proposed Development'), both at sensitive receptors within the development site (the Site) and at off-site sensitive receptors. The Proposed Development is located at the former Avid Technology International site on Carmanhall Road, Sandyford Industrial Estate, Dublin 18, (the 'Site' / 'Application Site'). This assessment of noise impacts associated with the Proposed Development has been undertaken as part of the Environmental Impact Assessment Report (EIAR).

9.1.2 Scope of Assessment

The scope of this assessment has included the following:

- Baseline noise survey at the Site;
- Semi-qualitative evaluation of potential noise impacts associated with the construction phase;
- Prediction and evaluation of potential noise impacts at Noise Sensitive Receptors (NSRs); and
- Specification of appropriate outline mitigation, where required.

The Site lies within a predominantly commercial and light industrial area; given the absence of neighbouring high-sensitivity noise-sensitive receptors (NSRs) and the relatively short duration of construction works (approximately 24 months), this assessment considers a single worst-case scenario and determines appropriate threshold noise criteria for the construction phase. Appropriate controls will be put in place during construction such that these threshold criteria are met and these are detailed in a Construction Environmental Management Plan (CEMP; Section 9.9).

Construction activities are not anticipated to generate significant off-site vibration, and no receptors with high sensitivity have been identified within close proximity to the Proposed Development, therefore evaluation of construction phase vibration has been scoped out of this assessment. No significant sources of off-site vibration have been identified, and the Proposed Development will not generate vibration during the occupation phase, therefore vibration impacts during the operational/occupation phase have been scoped out of this assessment.

9.1.3 Study Area and NSRs

The study area considered in this assessment comprises a buffer approximately 100 m beyond the Site redline boundary. This area includes the anticipated dominant noise sources identified during the baseline survey which will affect the Proposed Development in the operational/occupation phase, comprising Blackthorn Road and Carmanhall Road, and commercial/industrial properties to the north, east, south and west. The buffer also includes the closest NSR to the Proposed Development for the evaluation of construction noise impacts.

NSRs considered in this assessment comprise proposed dwellings within the Proposed Development, which will be sensitive to noise during the operational/occupation phase, and the closest noise-sensitive off-site receptor which will be sensitive to construction noise during the construction phase and increases in road traffic noise during the operational/occupation phase.

The closest identified non-commercial/industrial off-site NSR is Bloom Health midwifery clinic, approximately 100 m to the north-west of the site boundary. A pathology laboratory (Medlab Pathology) is noted approximately 40 m to the east of the site boundary, however, this is considered to be a commercial receptor with low sensitivity to noise, as it is assumed that patients will not attend the facility. The closest residential NSR to the Proposed Development is an apartment block approximately 120 m to the north of the site boundary. All other existing

NSRs are more remote from the Site and are screened from site-generated noise by tall buildings therefore noise impacts from the Proposed Developments at these NSRs will be negligible.

Representative NSRs within the Proposed Development considered within this assessment are shown in Figure 9.1 and are listed in Table 9.1.

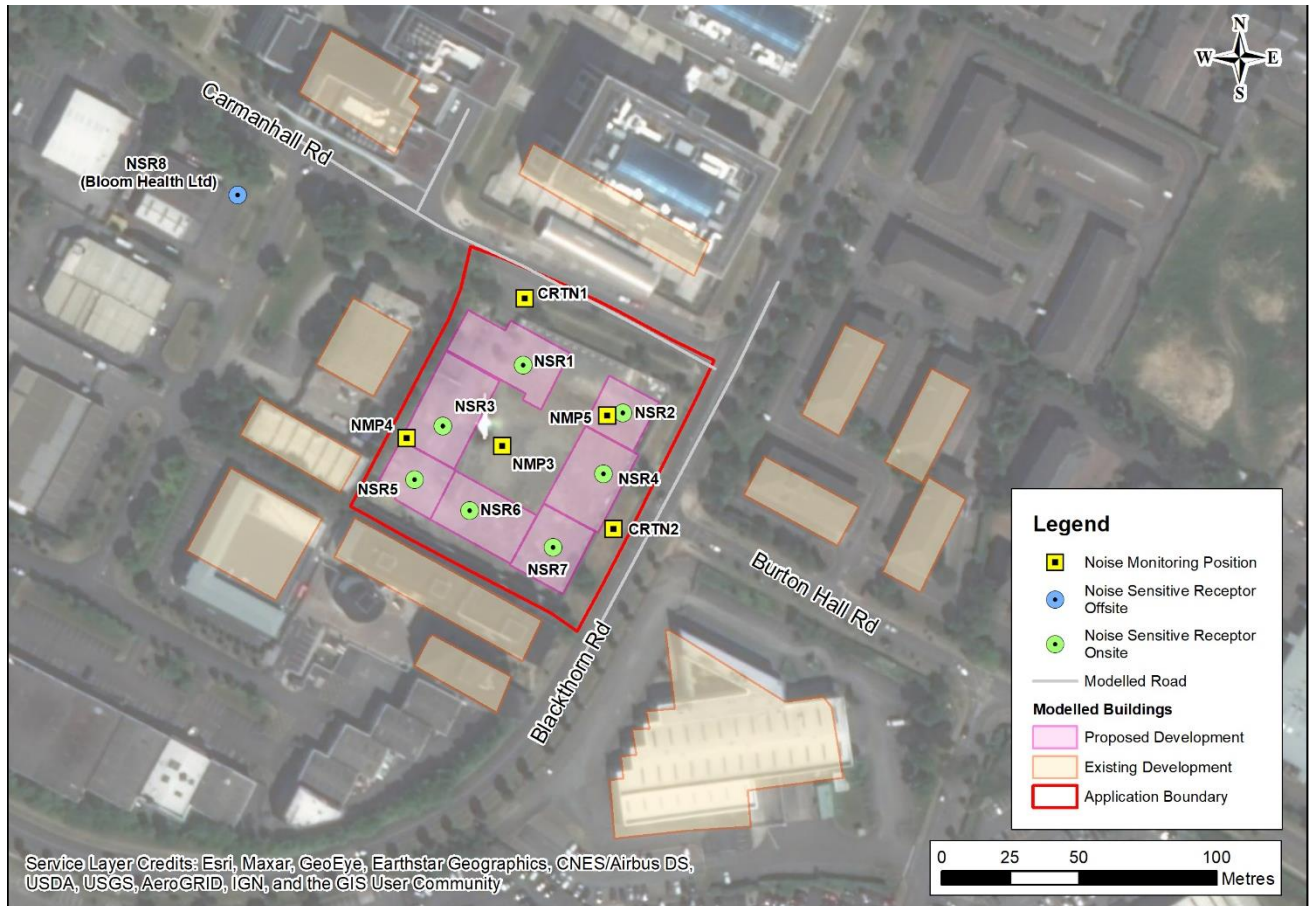


Figure 9.1: Proposed Development and Noise Sensitive Receptors.

Table 9.1: Identified representative NSRs

Receptor	Representative of
NSR1	First-floor properties in the north-western block of the development, overlooking Carmanhall Road
NSR2	First-floor properties in the north-eastern block, overlooking Carmanhall Road and Blackthorn Road
NSR3	First-floor properties in the western block, overlooking adjacent commercial unit
NSR4	First-floor properties in the eastern block, overlooking Blackthorn Road
NSR5	First-floor properties in the south-western block, overlooking adjacent commercial units
NSR6	First-floor properties in the southern block, overlooking adjacent commercial unit
NSR7	First-floor properties in the south-eastern block, overlooking Blackthorn Road
NSR8	Bloom Health midwifery clinic (weekday daytime operation only)

Representative receptors within the Proposed Development have been selected at second-floor properties, as these will receive the highest levels of road traffic noise and therefore represent the worst-case. First-floor uses of the building are non-residential and will have a lower sensitivity to noise. Noise levels received at upper floor receptors will be lower, given their greater separation distance from noise sources.

Noise effects during the construction phase arising at off-site NSRs (including the residential NSR 120 m to the north) have been evaluated using NSR8 Bloom Health as a proxy. This NSR has been assumed to be sensitive to noise arising due to the Proposed Development during the daytime period only (opening hours noted to be 10 am – 6 pm, Monday to Friday), however, this is appropriate for evaluation of construction noise, which will be confined to the daytime period.

Noise impacts arising due to the Proposed Development during the operational/occupation phase at more distant NSRs will be negligible and have been scoped out.

9.1.4 About the Author

This noise assessment has been prepared by Simon Waddell BSc (Hons). Simon is a corporate member of the UK Institute of Acoustics (IoA) and has more than 10 years' experience in environmental noise assessment. He has completed the IoA postgraduate diploma in Acoustics and Noise Control and also the Certificate of Competence in Environmental Noise Measurement. Simon has been responsible for the delivery of noise and vibration assessments in support of EIARs in Ireland and the UK for a wide range of projects including residential and mixed-use developments, large infrastructure developments, such as wind farms and large-scale manufacturing sites, as well as noise assessments for international ESIA's for mineral and oil and gas extraction.

9.2 Legislative and Policy Context

9.2.1 Legislation

Environmental Noise Regulations 2006 / EU Directive 2002/49/EC

The Environmental Noise Regulations 2006 give effect to EU Directive 2002/49/EC on the assessment and management of environmental noise. This Directive applies to noise to which humans are exposed, particularly in built-up areas, public parks or other quiet areas within built-up areas, and in quiet areas in open country, near schools, hospitals and other noise-sensitive buildings and areas. 'Environmental noise' is defined within the Directive as "*unwanted or harmful outdoor sound created by human activities, including noise emitted by means of road traffic, and from site of industrial activity...*"

Under the Directive, local authorities are required to make action plans to reduce ambient noise. The EPA exercises general supervision over the functions and actions of the local authorities in this aspect of their work.

Noise indices specified by the Directive include L_{den} and L_{night} , however, supplementary noise indicators are permitted where these are used to express relevant limit values in EU Member State legislation.

When granting planning permission, the local authority has the power to provide that conditions in relation to noise prevention or reduction be included in the permission. These conditions may apply to the construction phase and/or to the subsequent use of the building.

9.2.2 Policy

Local policy documents which have been reviewed and inform the scope of this assessment are described below.

9.2.2.1 **Sandyford County Development Plan 2016 - 2022**

The County Development Plan provides policies on road traffic noise (Policy ST28) and links to other guidance regarding the need to consider noise from road traffic, including Directive 2002/49/EC relating to assessment and management of environmental noise.

9.2.3 **Guidance**

Guidance documents which have informed this assessment are provided in the following sections.

9.2.3.1 **Calculation of Road Traffic Noise (CRTN)**

CRTN (UK Department of Transport, 1988) provides a method for the prediction of noise levels due to road traffic based on traffic flows, road type and geometry. CRTN may be used for determining the entitlement of existing properties to noise insulation where new roads are proposed, and provides criteria for this purpose.

A 'shortened measurement procedure' is provided to enable the derivation of the $L_{A10,18hr}$ from the $L_{A10,3hr}$ value.

9.2.3.2 **Design Manual for Roads and Bridges (DMRB)**

DMRB provides standards and advice regarding the assessment, design and operation of roads in the UK and sets out screening criteria, by which percentage changes in traffic flow can be related to a predicted change in road traffic noise and vibration. The guidance also provides significance criteria, by which the percentage of people adversely affected by traffic noise can be related to the total noise due to road traffic, or the increase over an existing level.

9.2.3.3 **Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping**

The study by TRL Ltd. provides formulae for converting the tenth-percentile ($L_{A10,18hr}$) noise index used in CRTN into the EU noise indices L_{day} , $L_{evening}$, L_{night} and L_{den} . Various formulae are provided in the study, and these are applied according to the available traffic and measurement data.

9.2.3.4 **ISO 9613: Attenuation of sound during propagation outdoors, Part 1 and Part 2**

ISO 9613 describes a method for calculating the attenuation of sound during propagation outdoors to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.

9.2.3.5 **British Standard BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings**

BS 8233 (BSI, 2014) provides guidance on the control of noise in and around buildings. The Standard sets out acceptable noise levels for new and refurbished buildings and amenity areas according to their use.

For external amenity areas BS8233 specifies a 'desired' level of 50 $dBL_{Aeq,T}$ and an 'upper guideline level' of 55 $dBL_{Aeq,T}$. It is acknowledged within the Standard that these guidelines may not be achievable in urban areas adjoining the transport network. It further notes that "*in such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited*".

The Standard provides noise limits for rooms within building by type of use; (bedroom, living room, office) and by time of day. Methods are provided for simplified calculation of internal noise levels from external levels, and for detailed calculations. The simplified method relies on a reduction to façade levels provided either by open or closed windows, which are assumed to provide attenuation of approximately 15 dB and 33 dB respectively. Where road traffic is the dominant noise source, a correction of -5 dB (C_{tr}) is applied to these attenuation factors, to allow for its low-frequency component.

The Standard notes that, “*in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values...*”. For bedrooms the guideline is 35 dBL_{Aeq,16hr} during the daytime (07:00 – 23:00) and 30 dBL_{Aeq,8hr} during the night-time (23:00 – 07:00). For living rooms the guideline is 35 dBL_{Aeq,16hr} (daytime-only guideline specified for living rooms).

BS8233 also provides a graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves (NR Curve). The curves account for the frequencies produced by a given noise source, and are typically used for rating noise from Heating, Ventilation and Air Conditioning (HVAC) plant.

9.2.3.6 **British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 and 2.**

BS5228 (BSI, 2014) provides a procedure for the estimation of construction noise and vibration levels and for the assessment of the significance of the predicted effects at the nearest sensitive receptors. Annex D of the Standard includes measured typical noise levels for a range of construction plant and activities.

Part 1 of the Standard provides several methods for the evaluation of the significance of construction noise effects. The ABC method considers significance by comparison to the measured baseline L_{Aeq,T} noise level, rounded to the nearest 5 dB. Three categories of threshold values are provided; A, B and C, in increasing 5 dB bands, for the periods “daytime and Saturdays”, “evenings and weekends” and “night time”. Where the measured baseline exceeds the highest category (C), a 3 dB increase over baseline is considered significant. The evaluation periods are defined as follows:

- Daytime: 07:00 – 19:00 on weekdays and 07:00 – 13:00 on Saturdays.
- Evenings and weekends: 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.
- Night-time: 23:00 - 07:00 (all days).

Part 2 of the Standard provides threshold levels at which vibration may be perceptible to people, through to becoming intolerable and frequency-weighted thresholds at which vibration may cause cosmetic damage to structures.

9.2.3.7 **British Standard BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound**

BS4142 describes methods for rating and assessing sound from industrial or commercial premises. The methods detailed in the Standard use outdoor sound levels to assess the likely effects on people inside or outside a residential dwelling upon which sound is incident.

The Standard provides methods for determining the following:

- Rating levels for sources of industrial and commercial sound; and
- Ambient, background and residual sound levels.

These may be used for assessing sound from proposed, new, modified or additional sources of sound of a commercial or industrial nature.

The Standard makes use of the following terms:

- **Ambient sound level, L_a = L_{Aeq,T}** – the equivalent continuous sound pressure level of the totally encompassing sound in a given situation at a given time, usually from multiple sources, at the assessment location over a given time interval, T.

- **Background sound level, $L_{A90,T}$** – the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90 percent of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- **Specific sound level, $L_s = L_{Aeq,T}$** – the equivalent continuous sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
- **Rating level, $L_{Ar,Tr}$** – the specific sound level plus any adjustment for the characteristic features of the sound.
- **Residual sound level, $L_r = L_{Aeq,T}$** – the equivalent continuous sound pressure level at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound, over a given reference time interval, T.

The Standard determines the degree of noise impact by comparison of the background noise level at noise sensitive receptors (NSR) in the absence of the industrial facility (the specific source) with the ambient sound level when the specific source is operational.

The daytime period and night-time period are defined in the Standard as 07:00 – 23:00 and 23:00 – 07:00, respectively.

Where particular characteristics such as tones, intermittency or impulsivity, are present in the noise emissions of the specific source, the Standard requires that “penalties” be added to the specific sound level to account for the increased annoyance that these can cause.

The following evaluation impact significance identifiers are provided in the Standard, in which the difference between the specific sound level and measured background level are considered:

- The greater the difference, the greater the magnitude of impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact;
- A difference of around +5 dB is likely to be an indication of an adverse impact;
- The lower the rating level, relative to the measured background level, the less likely that the specific sound source will have an adverse (or significant adverse) impact; and
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

9.2.3.8 *BS7445-1:2003 Description and Measurement of Environmental Noise. Guide to Quantities and Procedures.*

BS7445 provides guidance on appropriate environmental noise monitoring, including specification of equipment and appropriate calibration intervals, suitable weather conditions and observations to note regarding the nature of the noise environment.

9.3 Assessment Methodology and Significance Criteria

9.3.1 Receptor Sensitivity

This assessment considers that human receptors, including residential dwellings, have a high sensitivity to noise. Commercial and industrial receptors, comprising buildings and businesses, are considered to have a low sensitivity to noise and have been scoped out of further assessment. The assumed sensitivity of identified representative existing and proposed NSRs are provided in Table 9.2.

Table 9.2: Assumed sensitivity of representative NSRs

Receptor	Type of receptor	Sensitivity
NSR1– NSR7 proposed dwellings (eNSRs)	Human / residential	High
NSR8 – Bloom Health (pNSR)	Healthcare	High (weekday daytime only)

9.3.2 Impact Magnitude Criteria

Appropriate criteria have been adopted for the derivation of impact magnitude and are provided in Table 9.3. The criteria have been adapted from DMRB.

Table 9.3: Impact magnitude criteria

Exceedance of threshold value OR change in noise level, dBL _{Aeq,T}	Subjective reaction	Impact Magnitude
≥5	Clearly perceptible	High adverse
≥3, <5	Perceptible	Medium adverse
>0, <3	Barely perceptible	Low adverse
≤0	Inaudible	No change / none

The Proposed Development will introduce additional anthropogenic noise sources to the study area during both the construction and occupation phases, therefore all impacts are assumed to be adverse.

The criteria in Table 9.3 have been used to determine the significance of noise effects for receptors of different sensitivities, as shown in Table 9.4.

Table 9.4: Derivation of effect significance.

Magnitude	Level of significance, relative to sensitivity of receptor		
	Low	Medium	High
High	Moderate	Moderate/Large	Large
Medium	Slight	Moderate	Moderate
Low	Neutral	Slight	Slight
No change / none	Neutral	Neutral	Neutral

This assessment considers that effects of moderate and large significance are significant, and that effects of neutral and slight significance are not significant.

9.3.3 Target Noise Levels

Noise criteria have been adopted from appropriate guidance, as provided in Section 9.2. The adopted criteria are provided below.

Construction Phase

Threshold noise levels have been derived from measured baseline noise levels in accordance with BS5228, using the ABC method described in Annex E of the Standard. This assessment assumes that the Proposed Development will be constructed prior to occupation, therefore construction phase noise effects will only occur at existing NSRs. The Construction Environmental Management Plan (CEMP; Section 9.9) sets out methods which will be adopted to minimise unnecessary noise from construction. The baseline derived (refer to Table 9.5) threshold noise levels for off-site NSRs are as follows:

- Weekday daytimes (07:00 – 19:00) and Saturday mornings (07:00 – 13:00): 65 dBL_{Aeq,1hr}
- Evenings (19:00 – 23:00) and weekends (13:00-23:00 Saturday, 07:00 – 23:00 Sundays): 55 dBL_{Aeq,1hr}
- Night-time (23:00 – 07:00): 45 dBL_{Aeq,1hr}

Operational / Occupation Phase

Criteria for residential NSRs are adopted from guideline levels provided in BS8233. Measured and predicted noise levels across the Proposed Development have been evaluated against the criteria to determine the magnitude of noise impacts at proposed NSRs.

The criteria for ambient (dB L_{Aeq}) noise levels for new dwellings affected by noise from road traffic are provided below:

- Target level of 50 - 55 dBL_{Aeq,16hr} (free field) external amenity areas;
- Internal target level of 35 dBL_{Aeq,16hr} daytime (07:00 – 23:00), corresponding to external free-field level of 50 dBL_{Aeq,16hr}, assuming closed-window attenuation of 28 dB; 33 dB for standard thermal double glazing minus 5 dB C_{tr} correction; and
- Internal target level of 30 dBL_{Aeq,8hr} night-time (23:00 – 07:00), corresponding to external free-field level of 45 dBL_{Aeq,8hr}, assuming closed-window attenuation of 28 dB; 33 dB for standard thermal double glazing minus 5 dB C_{tr} correction.

Target noise levels applicable to plant items associated with proposed non-residential units have been derived from baseline background noise levels in accordance with BS4142.

9.3.4 Method of Baseline Characterisation

Baseline noise measurements were undertaken over two days, from 22nd July – 23rd July 2020. Monitoring locations were selected to characterise noise from roads and existing commercial/industrial properties adjacent to the Site. The monitoring locations are listed below and shown in Figure 9.1.

- NMP1 – shortened CRTN measurement representative of Carmanhall Road;
- NMP2 – shortened CRTN measurement representative of Blackthorn Road;
- NMP3 – centre of the Site;
- NMP4 – south-western area of the Site; and
- NMP5 – north-eastern area of the Site.

Monitoring was undertaken in accordance with BS7445 or CRTN guidance, as appropriate, using a Norsonic Nor-140 Class I sound level meter (SLM). The SLM was mounted on a tripod at a height of 1.2 – 1.5m above ground level. The SLM was field calibration tested at the start and end of each measurement, with no significant drift noted. The SLM and calibrator were within their laboratory calibration period.

Weather conditions during the survey were in accordance with the requirements of BS7445, with no rain and wind speeds below 4 m/s throughout. Road surfaces were dry and free from standing water during the CRTN measurements. The temperature was generally within the range 16 – 21°C.

The following noise indices were recorded:

- $L_{Aeq,T}$ – the equivalent continuous level is the constant noise level that would result in the same sound energy over a given period and is used to represent varying noise levels over a time, T, as a single number. Typically referred to as the ‘ambient’ noise level.
- $L_{A90,T}$ – the ‘background’ or 90th percentile noise level, i.e. the noise level that is exceeded for 90 percent of a time, T. Representative of the quieter moments experienced at a location, this index is unaffected by short-duration noisy events.
- $L_{A10,T}$ – the 10th percentile noise level, i.e. the noise level that is exceeded for 10 percent of a time, T. Typically used to characterise road traffic noise.
- $L_{Amax,T}$ – the maximum noise level recorded over a time, T.

A 1-minute averaging period (T) was used for on-site measurements, such that the variability of noise across the Site could be investigated.

For CRTN measurements a 1-hour averaging period was used, in accordance with the guidance.

9.3.5 Method of Prediction

Construction Noise

Detailed information on construction methods, schedules and hours of work is not currently available, however, it is understood that no driven (percussive) piling will be undertaken. Secant piling will be required around the basement construction and will be installed by rotary methods. While detailed noise predictions of multiple stages of construction is beyond the scope of this assessment, an assemblage of plant representative of the assumed noisiest stage of construction works, rotary piling, has been placed within the Site boundary in the noise model to determine likely worst-case noise levels for the construction phase at the closest high-sensitivity NSR. We note that the closest neighbouring buildings are non-residential and of low sensitivity to noise. Noise levels from construction activity at more distant, noise-sensitive, properties will be lower.

Operational / Occupation Phase Noise

During the baseline noise survey, the dominant noise source across the Site was determined to be road traffic on Blackthorn Road and Carmanhall Road. Noise effects during occupation of the Proposed Development will therefore predominantly arise from road traffic. Road traffic noise has been predicted as $L_{A10,18hr}$ values for roads surrounding the Proposed Development in accordance with the CRTN method.

Projected traffic flows for the baseline year (2020), and the future baseline and future-with-development scenarios for 2023 and 2038 have been provided by the traffic consultant (AECOM Consulting Engineers) as 18-hour Annual Average Daily Traffic (AADT) flows, including HGV composition percentage. Traffic has been assumed to be travelling at the speed limit of the road.

A road traffic verification model has been undertaken to compare predicted baseline noise due to road traffic with measured baseline noise levels. The predicted baseline levels using measured data were found to be 2.7 dB and 2.1 dB below measured levels at CRTN monitoring locations NMP1 and NMP2 (i.e. under-prediction). While this may typically be considered to be an acceptable degree of accuracy, given the potential reduction of traffic flows arising due to the Covid-19 restrictions, a +2.7 dB correction has been

applied to predicted operational road traffic noise levels. The results of the model verification exercise are provided in Appendix 9.1.

The predicted increases in noise from road traffic noise arising from development-generated flows have been evaluated against criteria provided in Table 9.3 to determine potential impacts at off-site NSRs.

Noise levels at proposed NSRs, comprising outdoor amenity spaces and proposed dwellings of the Proposed Development have been predicted in accordance with CRTN. Predicted $L_{A10,18hr}$ values have been converted to EU noise indices L_{day} , L_{night} and L_{den} using Method 3 of the TRL study. In accordance with BS8233, predicted external noise levels have been converted to internal levels assuming a reduction of 33 dB for thermal double glazing, minus a 5 dB correction for the low-frequency component of road traffic (+ C_{tr}), giving an overall reduction to external noise levels of 28 dB(A).

Noise from commercial and industrial sources has been considered using measured baseline values; no predictive modelling of commercial / industrial noise sources has been undertaken.

9.4 Baseline Conditions

9.4.1 Characterisation of Baseline Noise Environment

The noise environment in the vicinity of the Site was dominated by road traffic on Carmanhall Road and Blackthorn Road, with a lesser contribution from the M50 (approximately 550 m away). Lesser contributors to measured noise levels included;

- intermittent vehicle movements in the business park;
- nearby construction works, comprising the construction of scaffolding on an adjacent site;
- low-level fan noise from HVAC plant on nearby buildings;
- wind-induced rustling from vegetation;
- bird calls; and
- infrequent aircraft and trams.

The measured noise levels within the Site were characterised by measurements at NMP3, NMP4 and NMP5, these are summarised in Table 9.5.

Table 9.5: Summary of measured baseline noise levels

Noise monitoring position ID	Duration of measurement, T	Measured Noise Level			
		Ambient, $dBL_{Aeq,T}$	Maximum, dBL_{Amax}	10 th Percentile, $dBL_{A10,T}$	Background, $dBL_{A90,T}$
NMP3 – Day	2 hr	51.6	68.4	52.6	50.1
NMP3 – Night	2 hr	38.9	58.4	40.3	36.0
NMP4 – Day	20 min	50.8	68.2	51.9	48.8
NMP5 - Day	20 min	52.9	64.6	53.9	51.7

Measured noise levels across the Site were highly consistent and varied little throughout the daytime and night-time measurements, as shown in Figure 9.2 (daytime) and Figure 9.3 (night-time).

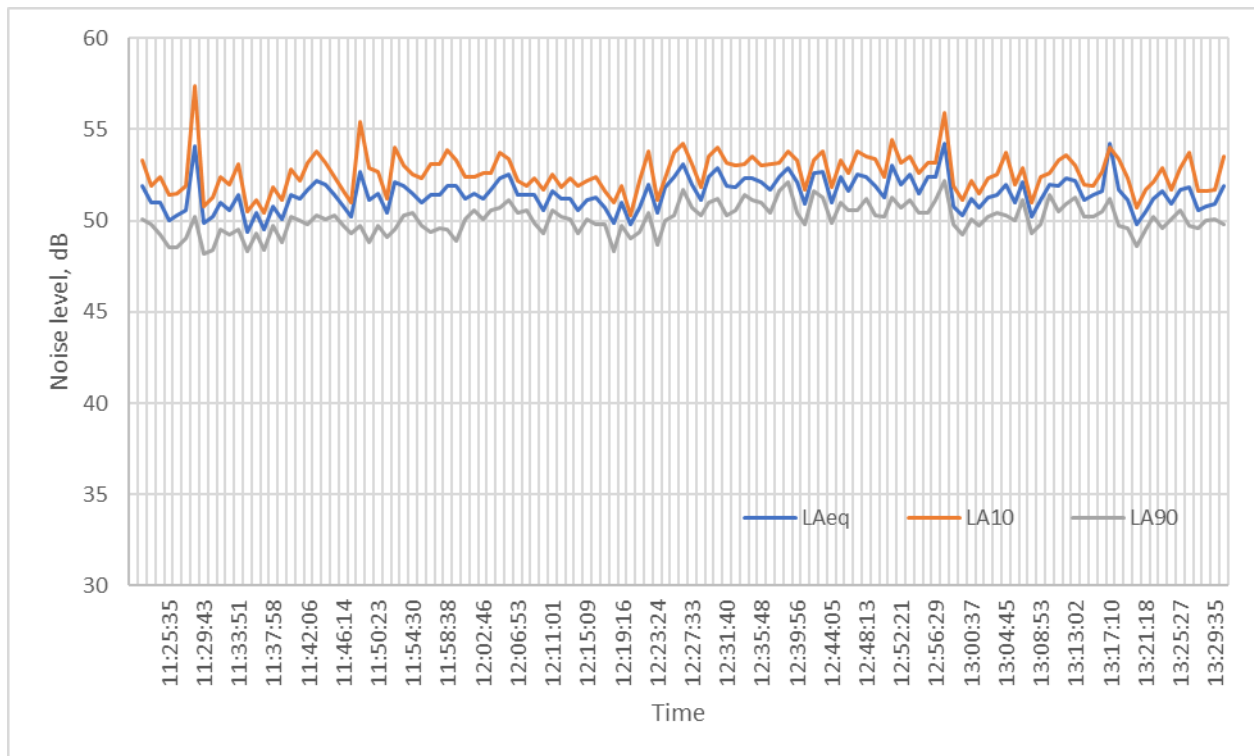


Figure 9.2: Measured noise levels – NMP3 daytime period

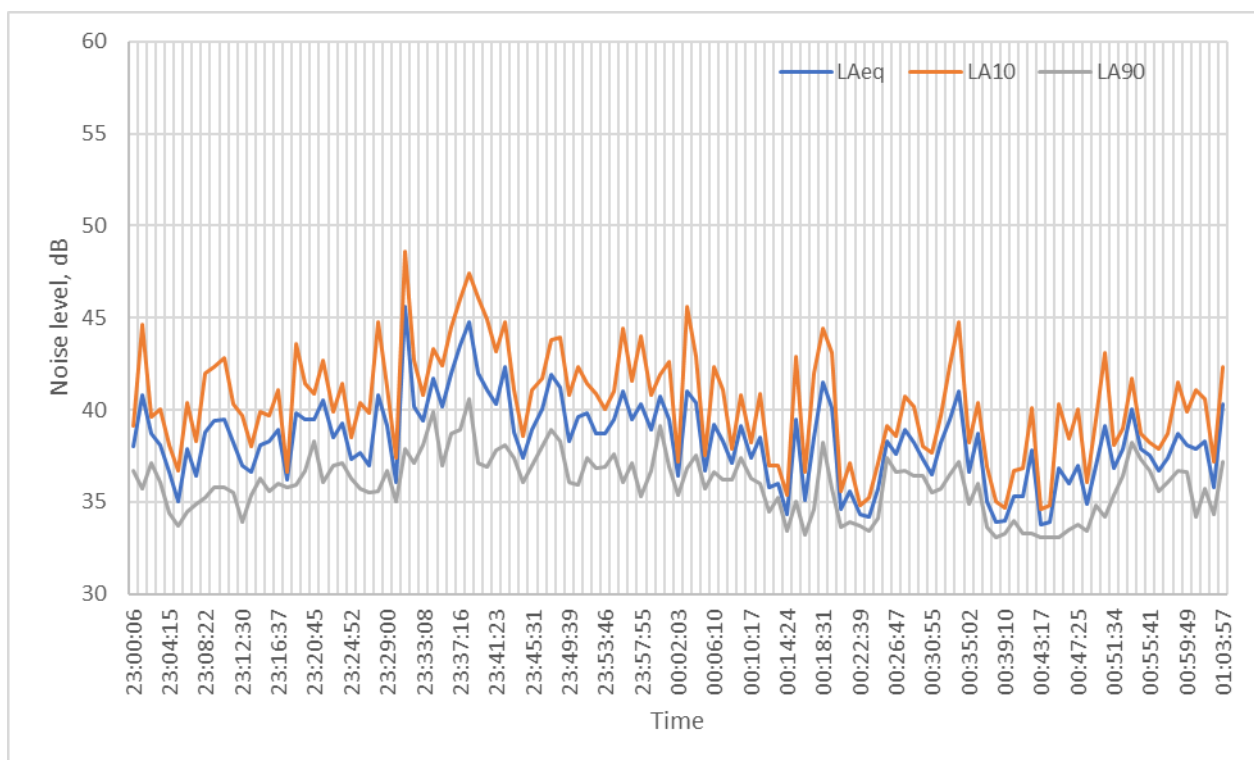


Figure 9.3: Measured noise levels – NMP3 night-time period

Figure 9.2 shows the variation in measured noise levels during a 2-hour measurement at the centre of the Site during the day-time period. All of the noise indices show a maximum variation of approximately 5 dB, indicative of a very steady noise environment, consistent with road traffic noise from a busy road. The measured ambient

noise level was typically marginally above the BS8233 'desired' 50 dB guideline for external areas and was below the 55 dB "upper guideline level" throughout the measurement.

Figure 9.3 shows the variation in measured noise levels at the same location during a two-hour measurement in the night-time period. All of the noise indices show a greater variability during the night-time, however, the noise levels are substantially (approx. 10 dB) lower than during the daytime measurement. The measured ambient level remained below 45 dBL_{Aeq} throughout the measurement and noise levels are generally low, given the urban surroundings.

Charts of measured noise levels at short-duration monitoring locations NMP4 and NMP5 are provided in Appendix 9.2.

On the basis of the relative prominence of road traffic noise and the absence of audible commercial or industrial noise sources, other than 'slightly audible' HVAC plant, a BS4142 assessment of potential impacts of commercial / industrial noise on proposed NSRs has been scoped out of this assessment.

9.4.2 Characterisation of Road Traffic Noise

Measured noise levels at NMP1 and NMP2 are provided in Table 9.6.

Table 9.6: Characterisation of road traffic source levels

Noise monitoring position ID	Duration of measurement, T	Measured Noise Level			
		Ambient, dBL _{Aeq,T}	Maximum, dBL _{Amax}	10 th Percentile, dBL _{A10,T}	Background, dBL _{A90,T}
NMP1	1hr	62.1	79.0	66.2	53.1
	1hr	63.3	79.6	67.6	53.4
	1hr	63.2	86.5	67.0	54.1
	3hr total	62.9	86.5	66.9	53.5
NMP2	1hr	62.9	81.5	66.2	54.2
	1hr	62.7	85.8	65.5	53.4
	1hr	61.0	79.2	64.5	53.4
	3hr total	62.3	85.8	65.4	53.7

Noise emissions from Carmanhall Road and Blackthorn Road have been characterised using the relationship provided in CRTN whereby the $L_{A10,18hr} = L_{A10,3hr} - 1\text{dB}$, with appropriate corrections applied for the distance of the measurement location from the edge of the carriageway.

9.5 Characteristics of the Proposed Development

The Proposed Development will comprise of:

- (i) construction of a Build-To-Rent residential development within a new part six, part eight, part nine, part eleven storey rising to a landmark seventeen storey over basement level apartment building (40,814sq.m) comprising 428 no. apartments (41 no. studio, 285 no. one-bedroom, 94 no. two-bedroom & 8 no. three-

bedroom units) of which 413 no. apartments have access to private amenity space, in the form of a balcony or lawn/terrace, and 15 no. apartments have access to a shared private roof terrace (142sq.m) at ninth floor level;

(ii) all apartments have access to 2,600sq.m of communal amenity space, spread over a courtyard at first floor level and roof terraces at sixth, eighth and ninth floor levels, a 142sq.m resident's childcare facility at ground floor level, 392sq.m of resident's amenities, including concierge/meeting rooms, office/co-working space at ground floor level and a meeting/games room at first floor level, and 696sq.m of resident's amenities/community infrastructure inclusive of cinema, gym, yoga studio, laundry and café/lounge at ground floor level. The café/lounge will primarily serve the residents of the development and will be open for community use on a weekly/sessional basis;

(iii) provision of 145 no. vehicular parking spaces (including 8 no. mobility parking spaces, 2 no. club-car spaces and 44 no. electric charging spaces), 5 no. motorcycle parking spaces, bin stores, plant rooms, switch room and 2 no. ESB sub-stations all at ground floor level; provision of bicycle parking (752 no. spaces), plant and storage at basement level; permission is also sought for the removal of the existing vehicular entrance and construction of a replacement vehicular entrance in the north-western corner of the site off Carmanhall Road;

(iv) provision of improvements to street frontages to adjoining public realm of Carmanhall Road & Blackthorn Road comprising an upgraded pedestrian footpath, new cycling infrastructure, an increased quantum of landscaping and street-planting, new street furniture inclusive of bins, benches and cycle parking facilities and the upgrading of the existing Carmanhall Road & Blackthorn Road junction through provision of a new uncontrolled pedestrian crossing; and,

(v) All ancillary works including provision of play equipment, boundary treatments, drainage works - including SuDS drainage, landscaping, lighting, rooftop telecommunications structure and all other associated site services, site infrastructure and site development works. The former Avid Technology International buildings were demolished on foot of Reg. Ref. D16A/0158 which also permitted a part-five rising to eight storey apartment building. The development approved under Reg. Ref. D16A/0158, and a subsequent part-seven rising to nine storey student accommodation development permitted under Reg. Ref. PL06D.303467, will be superseded by the Proposed Development.

The Proposed Development will comprise buildings of varying heights and numbers of floors almost entirely enclosing a central courtyard at first-floor level. The first floor will comprise outdoor amenity space for the residents, as well as a childcare facility, concierge, meeting rooms and further amenity facilities for residents. The residential apartments will overlook Carmanhall Road, Blackthorn Road and the neighbouring commercial / industrial units. Some of the apartments overlooking the roads on the northern and eastern sides of the building will include balconies. BS8233 notes that target noise levels for external amenity areas do not apply to balconies, as they are commonly within urban environments, where noise levels are higher. The layout of the building will screen the central courtyard from road traffic and commercial / industrial noise.

The Proposed Development will be served by a ground floor car park providing 145 vehicle spaces, 5 motorcycle spaces and bicycle parking. As such, the Proposed Development will generate some additional vehicle movements on the surrounding road network, albeit the number of parking spaces relative to the number of apartments is relatively small.

9.6 Potential Effects

9.6.1 Construction Phase Effects

The construction phase is anticipated to take approximately 24 months, and a Construction Management Plan (CMP) will be prepared by the Main Contractor for the works. Proposed construction working hours will be 08:00

– 19:00 Monday to Friday, and 08:00 – 14:00 on Saturdays (it is noted that the final hour of Saturday working falls within the ‘evenings and weekends’ category of BS5228).

Potential worst-case noise effects during the construction phase are anticipated to arise during site preparation works and foundation construction by rotary piling in the early stages of construction. The worst-case predicted noise levels at the closest off-site NSR (NSR8) are provided and evaluated against derived BS5228 threshold values provided in (Section 9.3.4.) and impact magnitude criteria (from Table 9.3) in Table 9.7. Predicted levels at NSR8 are external and actual noise levels within buildings will be lower. Assuming open-window transmission a reduction of 15 dB to construction noise levels may be assumed, or approximately 30 dB for closed window transmission.

Table 9.7: Evaluation of predicted worst-case construction phase noise levels against derived criteria

Threshold criterion using BS5228 ‘ABC method’	Predicted level, dBL _{Aeq,1hr}	Comparison of predicted with criterion (predicted minus threshold)	Magnitude of impact	Significance of effect (high sensitivity receptors)
Weekday daytimes & Saturday mornings 65 dBL _{Aeq,1hr}	64	-1	No change	Neutral
Evenings and weekends 55 dBL _{Aeq,1hr}		+9	Major adverse	Large
Night-time 45 dBL _{Aeq,1hr}		+19	Major adverse	Large

We note that no evening or night-time working is proposed, however, worst-case predicted noise levels are evaluated against the criteria for all BS5228 periods for completeness.

Noise effects associated with the proposed construction activities during weekday daytimes and Saturday mornings have been evaluated as being of ‘neutral’ significance and are therefore ‘not significant’. Construction management measures are required to be implemented to ensure compliance with noise criteria for construction activities occurring during the final hour of work on Saturdays. These measures will be managed in the CEMP.

Noise effects associated with construction activities during evenings, weekends and the night-time period have been evaluated as being of ‘large’ significance, based on worst-case predicted noise levels. This assessment notes, however, that no evening or night-time working is proposed and assumes that if any out-of-hours work is required, a noise assessment of the proposed activities will be undertaken to demonstrate predicted compliance of the proposed activities with the evening, weekend or night-time noise limits and submitted to the Dún Laoghaire Rathdown County Council for review and approval prior to works being undertaken.

9.6.2 Operational / Occupation Phase

Proposed Development - Internal noise levels

The conversion from predicted L_{10,18hr} values to L_{day} and L_{night} values is demonstrated in Appendix 9.3. Predicted noise levels within proposed residential dwellings via closed-window transmission are evaluated against BS8233 target internal noise levels in Table 9.8.

Table 9.8: Evaluation of predicted worst-case operational / occupation phase noise levels against derived criteria via closed window transmission

NSR ID	Internal ambient level via closed window transmission, $dBL_{Aeq,T}$	Comparison with criterion (predicted level minus target level), dB	Impact magnitude	Effect significance
Daytime period (07:00 – 23:00)				
NSR1	35.4	0.4	Low adverse	Slight
NSR2	37.0	2.0	Low adverse	Slight
NSR3	28.1	-6.9	No change / none	Neutral
NSR4	37.4	2.4	Low adverse	Slight
NSR5	24.0	-11.0	No change / none	Neutral
NSR6	27.0	-8.0	No change / none	Neutral
NSR7	37.0	2.0	Low adverse	Slight
Night-time period (23:00 – 07:00)				
NSR1	27.1	-2.9	No change / none	Neutral
NSR2	28.6	-1.4	No change / none	Neutral
NSR3	20.2	-9.8	No change / none	Neutral
NSR4	29.0	-1.0	No change / none	Neutral
NSR5	16.3	-13.7	No change / none	Neutral
NSR6	19.1	-10.9	No change / none	Neutral
NSR7	28.6	-1.4	No change / none	Neutral

Note - Where the comparison with criterion produces a negative value, this indicates compliance with the target noise level.

During the night-time period, predicted noise levels within most-exposed proposed dwellings on second-floor level meet the target internal noise levels, via closed-window transmission. The resultant impact magnitude at all NSRs is 'no change / none' and the effect significance at high sensitivity NSRs is 'neutral'.

During the daytime period, predicted levels within most-exposed proposed dwellings range from meeting the target level by 11 dB, to up to 2.4 dB above the target level. The resultant impact magnitude ranges from no change / none to low adverse and the effect significance at high sensitivity NSRs ranges from 'neutral' to 'slight'.

Noise effects during the occupation phase are therefore 'not significant'.

Proposed Development - External amenity areas

Figure 9.4 presents predicted daytime noise levels within the proposed courtyard area and in the outdoor amenity space on the southern side of the Proposed Development. Predicted L_{day} levels are below the 50 dB BS8233 'desired' level across the majority of the external amenity space and below the 55 dB 'upper guideline' in almost all of the space. The impact magnitude is therefore no change / none and the resultant effect significance is 'neutral'. Noise effects in external amenity areas of the Proposed Development are therefore 'not significant'.

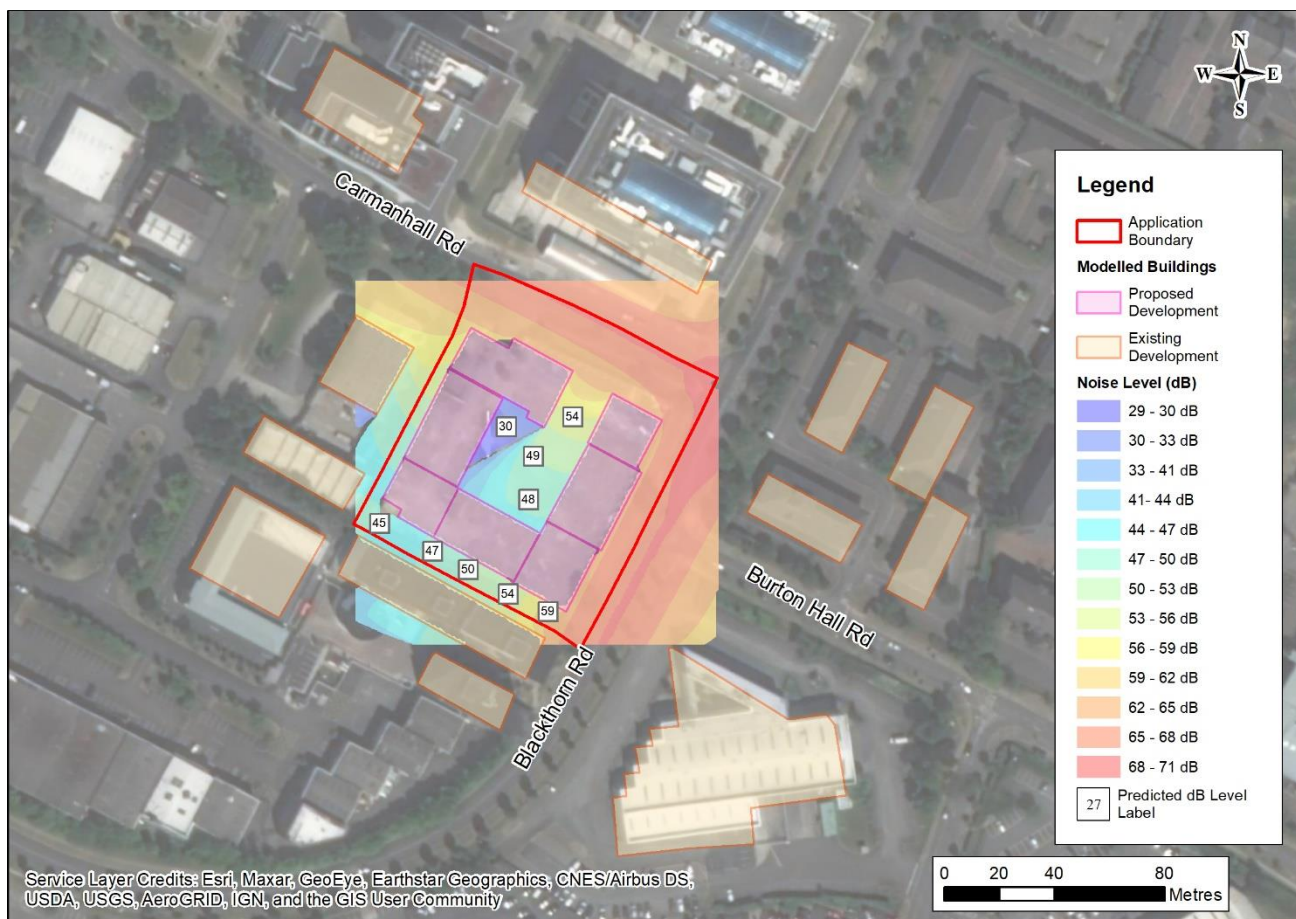


Figure 9.4: Predicted daytime noise levels surrounding the Proposed Development.

Off-site NSRs

With reference to Appendix 9.1 the change in the source level of Carmanhall Road and Blackthorn Road arising due to development-generated flows, as shown at prediction locations CRTN1 and CRTN2, is 0.1 dB and 0.2 dB, respectively, in the 2023 and 2038 scenarios. Evaluating these projected increases against the criteria in Table 9.3 gives an impact magnitude of 'low adverse'. At high sensitivity NSRs, such as NSR8 and more distant residential properties, the significance of effect is 'slight', and is therefore 'not significant'.

9.6.3 'Do-Nothing' Scenario

The Site is currently vacant and generates no noise, either directly from the Site or indirectly by generation of off-site traffic movements. In the absence of the Proposed Development no construction noise effects would arise, however, given its urban location it is likely that the Site would be developed at some point and construction noise would be generated. Impacts from construction of alternative developments may be assumed to be similar in character to those associated with the Proposed Development, however the duration of construction may differ.

The Proposed Development will introduce new NSRs to the area; if the Site was not put to residential use, no new high-sensitivity residential receptors would be introduced to the study area, and noise impacts associated with existing noise sources would remain unchanged.

9.7 Mitigation and Management

Construction phase mitigation

Predicted worst-case construction phase noise levels meet the threshold at the closest NSR during the proposed construction hours (weekday daytimes, Saturday mornings), therefore no specific mitigation is required to prevent the occurrence of significant impacts. Adoption of good practice measures, however, will prevent the generation of unnecessary noise and vibration beyond the site boundary.

Predicted worst-case construction noise levels exceed the thresholds for the evenings and weekends and the night-time periods, such that significant impacts would arise if the assumed worst-case works were undertaken during these times, albeit the closest identified NSR (Bloom Health midwifery clinic) does not operate during these times and would therefore be of low sensitivity outside weekday daytimes.

Following the completion of a detailed construction programme by the appointed Main Contractor, and once any requirements for out-of-hours activities have been identified, detailed noise predictions will be undertaken for these activities to determine any specific mitigation measures required such that the noise thresholds are met at NSRs. Any out-of-hours work specific to the relevant phases of the Main Contractor's works will be addressed within the final CMP and updated in the Site's CEMP. These management measures will identify appropriate measures to ensure that construction noise meets the derived criteria at all sensitive receptors, during the out-of-hours activities and also works between 13:00 and 14:00 on Saturdays.

Noise control measures which will be considered and implemented as appropriate are as identified below. Relevant Measures will be specific to the program of works which is being conducted.

- Specification and substitution:
 - Be cognisant of noise when choosing plant and activities to be employed on site; and
 - If noise problems arise during construction of the proposed development, where reasonably practicable, replace noisy plant or activities with quieter alternatives.
- Modification of plant and equipment:
 - Seek to modify existing plant and equipment or apply improved sound reduction methods, to reduce noise generated;
 - Consult the original equipment manufacturer and a specialist in noise reduction techniques when undertaking any modifications;
 - Fit all pneumatic tools with silencers or mufflers;
 - Use rubber linings in chutes and dumpers;
 - Noise from diesel engines can be reduced by fitting a more effective exhaust silencer system or by designing an acoustic canopy to replace the normal engine cover;
 - If necessary, reduce noise caused by resonance of body panels and cover plates by stiffening with additional ribs or by increasing the damping effect with a surface coating of special resonance damping material; and

- Minimise direct metal-to-metal contact.
- Timing of operations:
 - Move plant onto and around the site within core construction working hours; and
 - Ensure that any plant and equipment required for operation at night (23:00 - 07:00) is mains electric powered where practicable, or suitably silenced and shielded.
- Noise enclosures:
 - Where practicable and necessary, contain fixed plant and equipment (e.g. compressors and generators) within suitable acoustic enclosures or behind acoustic screens; and
 - Ensure that a reflecting surface, such as a parked lorry, is not located opposite the open side of noise enclosures. Any openings in complete enclosures (e.g. for ventilation) should be effectively sound-reduced. The effectiveness of partial noise enclosures and screens is reduced if they are used incorrectly.
- Location of plant and equipment:
 - Position noisy plant and equipment away from noise-sensitive areas; and
 - Wherever practicable, orientate plant so that the noise generated is directed away from noise-sensitive areas.
 - Loading and unloading of materials:
 - Take care when loading and unloading vehicles to minimise noise;
 - Lower rather than drop materials whenever practicable. If it is necessary to drop materials, minimize the drop height; and
 - Cover surfaces on to which materials are being moved with resilient material.
- Engine noise reduction:
 - Prohibit unnecessary idling of construction traffic within the site boundary or at the site access points;
 - Switch plant off when not in use (including during breaks and down times of more than 30 minutes);
 - Avoid operating plant simultaneously or close together to avoid cumulative noise impacts;
 - Avoid unnecessary revving of engines;
 - Keep internal haul routes well maintained and avoid steep gradients; and
 - Close engine acoustic covers when engines are in use and idling.
 - Maintenance of plant and equipment:
 - Ensure that trained personnel regularly maintain equipment and plant, as increases in noise are often indicative of future mechanical failure;
 - Frictional noise from the cutting action of tools and saws can be reduced if the tools are kept sharp;
 - Noises caused by friction in conveyor rollers, trolleys and other machines can be reduced by proper lubrication; and

- Noise caused by vibrating machinery having rotating parts can be reduced by attention to proper balancing.

Operational / Occupation phase mitigation – off-site NSRs

Effects at off-site NSRs have been determined to be not significant, therefore no mitigation is proposed.

Operational / Occupation phase mitigation – proposed NSRs

Noise levels within the most-exposed proposed dwellings meet the target noise level via closed-window attenuation, assuming standard thermal double glazing is used (i.e. not requiring high-specification acoustic glazing). The proposed Mechanical Ventilation Heat Recovery Unit in each apartment will facilitate ventilation and has insulated ductwork to reduce external noise into the apartments.

Ambient noise levels within the proposed dwellings will depend on the surface area of the noise-exposed façade, the sound reduction indices of the building materials used and the volume of the room and the effective area of acoustic absorption. However, as a rule the vents used should provide a sound reduction equivalent to that of the assumed glazing performance, giving approximately 33 dB reduction to external noise levels.

Any HVAC plant associated with the proposed café and non-residential uses on the first floor of the Proposed Development will be specified such that it meets appropriate criteria within the closest NSRs. The closest NSRs will be residential properties of the Proposed Development itself. Plant items within the Proposed Development will be specified such that they do not adversely affect residents of the proposed dwellings, such as noise rating NR25 during the daytime and NR15 during the night-time.

For noise impacts from any such plant items to not exceed 'low adverse' and therefore remain 'not significant' the rating level of any proposed plant items at the closest NSR should not exceed the measured night-time background level by more than 5 dB. Based on a measured night-time background noise level of 36 dB (refer to Table 9.5), noise from HVAC plant should not exceed 41 dB at the closest off-site NSR.

9.7.1 Monitoring

Appropriate noise monitoring will be undertaken by the contractor during the construction phase. The method and duration of monitoring are detailed within the CEMP and agreed with Environmental Health prior to commencement of works on site, however, an example schedule is as follows:

- Quarterly monitoring for up to 4 hours per monitoring location. Monitoring will be agreed with Environmental Health prior to commencement of the survey;
- Additional monitoring in the event of a complaint, at a location representative of the complainant's property; and
- Additional monitoring during out-of-hours works. Should noise levels due to the works be determined by monitoring to meet the threshold level, monitoring may be discontinued for the duration of a specific activity, unless a complaint is received.

Monitoring will be undertaken by an appropriately-qualified person, using equipment which meets the minimum requirements provided in BS5228.

9.8 Residual Effects

Once appropriate construction management measures are implemented to ensure works meet appropriate noise limits at all sensitive receptors during works between 13:00 and 14:00 on Saturdays it is considered that no additional mitigation is required, therefore residual effects remain 'not significant', for the construction phase.

No further out-of-hours works are currently anticipated, however, mitigation and monitoring has been specified to minimise noise impacts should a need for such works be identified once a detailed construction programme has been confirmed. Residual effects during the construction phase therefore remain 'not significant'.

No additional mitigation is proposed beyond the specification of an appropriate ventilation strategy for the proposed residential dwellings within the Proposed Development. Residual effects during the operational / occupation phase therefore remain 'not significant'.

9.9 Difficulties Encountered

This assessment has been undertaken during the Covid-19 global pandemic, and as such it is possible that road traffic and commercial activities were at lower levels than before Covid-19 restrictions came into force. As a result, baseline noise levels recorded may be lower than would have been expected in the pre-Covid situation.

Baseline road traffic noise from Carmanhall Road and Blackthorn Road has been predicted using traffic flows measured pre-Covid. The predicted source noise levels of modelled road links have been verified using the CRTN measurements undertaken during the baseline survey and found to be within acceptable levels of accuracy, (due to the Covid-19 restrictions, a +2.7 dB correction was applied to predicted operational road traffic noise levels).

9.10 Summary and Conclusions

This assessment considers potential noise impacts associated with the construction and occupation of a proposed residential development, incorporating built-to-rent apartments and associated amenities for residents.

The assessment has comprised a desk study to determine an appropriate study area and identify potentially sensitive receptors, characterisation of the baseline noise environment, prediction of worst-case construction and operational / occupation phase noise levels and evaluation against appropriate criteria. The Proposed Development lies within a predominantly commercial and light industrial area, with no high-sensitivity NSRs nearby.

Potential construction phase noise impacts (and in particular those which shall occur on Saturdays) will be controlled by implementation of the Main Contractor's final CMP and associated CEMP, and will meet threshold criteria derived from measured baseline noise levels.

Operational / occupation phase noise impacts at proposed NSRs will be mitigated through appropriate specification of alternative ventilation within residential units, such that internal target noise levels will be met using closed-window attenuation. Effects to proposed NSRs will arise from road traffic on Carmanhall Road and Blackhall Road, and noise from commercial / industrial sources, however this will not be significant.

9.11 References

EU Directive 2002/49/EC, European Parliament and Council of the European Union. 2002.

Calculation of Road Traffic Noise. UK Department of Transport, Welsh Office, 1988.

Design Manual for Roads and Bridges. Highways Agency, 1989 (live version frequently updated online)

ISO 9613: Attenuation of sound during propagation outdoors, Part 1 and Part 2. International Organization for Standardization, 1996.

British Standard BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings. British Standards Institute, 2014.

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British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 and 2. British Standards Institute, 2014.

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