9 NOISE AND VIBRATION

9.1 INTRODUCTION

This EIAR Chapter has been prepared by AWN Consulting Ltd (AWN) to identify, describe and assess the potential noise and vibration effects of the proposed Kishoge Part X residential development which spans three sites within the Clonburris SDZ (Strategic Development Zone). This assessment has been conducted in the context of current relevant standards and guidance, as detailed in the relevant sections below.

This assessment includes a description of the receiving ambient noise climate in the vicinity of the subject site and an assessment of the potential during both the short-term construction phase and the long-term operational phase on its surrounding environment. Direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment. An assessment of noise from existing sources inward on the development has also been completed.

Mitigation and monitoring measures are included, where relevant, to ensure the proposed works are completed and operated in an environmentally sustainable manner to ensure minimal impact on the receiving environment.

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration, which are set out in the following sections. In addition to specific noise and vibration guidance documents, the Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022) were consulted and considered in the preparation of this Chapter.

9.2 ASSESSMENT METHODOLOGY

The following methodology has been prepared based on the requirements of the Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022) and on AWN's experience of preparing the noise and vibration assessments for similar developments. The following approach has been used for this assessment:

- Baseline noise monitoring has been undertaken at the development site in order to characterise the existing noise environment.
- A review of relevant standards and guidelines has been carried out in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development.
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the proposed development at the nearest Noise Sensitive Locations (NSLs) to the site.
- Predictive calculations have been performed to assess the potential effects associated with the operation of the proposed development at NSLs surrounding the site.
- An assessment has been completed of potential cumulative effects that may arise as a result of the proposed development and other existing or proposed plans and projects.
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development.
- An inward noise impact assessment from the existing noise sources on the proposed development has been conducted.

9.2.1 Construction Phase Noise Impacts

Local Authorities typically control construction activities by imposing limits on the hours of construction and consider noise limits at their discretion. Construction noise sources include construction plant and machinery, and construction related traffic on surrounding roads. Reference is made to the following guidelines and standards to inform the most appropriate construction noise and vibration significance thresholds and assessment methodologies:

- British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +A1 2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as **BS 5228–1**) (BSI 2014a);
- BS 5228-2:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as **BS 5228–2**) (BSI 2014b);
- BS 7385: 1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as **BS 7385–2**). (BSI 1993);
- BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting (hereafter referred to as **BS 6472–1**) (BSI 2008);
- UK Highways England (now National Highways) (UKHE) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability and Environmental Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as **DMRB Noise and Vibration**) (UKHE 2020)

9.2.1.1 British Standard BS 5228–1

British Standard BS 5228–1 is referred to as appropriate criteria relating to permissible construction noise threshold levels for a development of this scale.

Potential noise impacts during the construction stage of a project are often assessed in accordance with BS 5228–1. Various mechanisms are presented as examples of determining if an impact is occurring; these are discussed in the following paragraphs.

ABC Method

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value which, if exceeded at this location, indicates that a significant noise impact is associated with the construction activities, depending on context.

BS 5228–1 sets out guidance on permissible noise levels relative to the existing noise environment. Table 9.11 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors.

Assessment category and threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A [A]	**Category B [B]**	**Category C [C]**
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

Table 9.1: Threshold of Potential Significant Effect at Dwellings

A. Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D. 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance), the ambient noise level is determined and rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. It should be noted that this assessment method is only valid for residential properties and if applied to commercial premises without consideration of other factors may result in excessively onerous thresholds being set.

The closest neighbouring noise sensitive properties to the proposed development site 3 include existing residential dwellings approximately 20m to the west and north of the proposed development site. The closest neighbouring noise sensitive properties to the proposed development site 4 include existing residential dwellings at the halting site approximately 300m to the west of the proposed development site. The closest neighbouring noise sensitive properties to the proposed development site 5 include existing residential dwellings approximately 40m to the north at Foxborough Road. The closest commercial receptors are located southwest of site 4 approximately 180m south and south west of the development site.

9.2.1.2 Proposed Threshold Noise Levels

Considering the criteria outlined above and making reference to the baseline noise environment monitored around the development site (see Section 9.3), BS 5228–1 has been used to inform the assessment approach for construction noise at NSLs.

The following Construction Noise Threshold (CNT) levels are proposed for the construction stage of this development:

- For residential NSLs at sites 3, 4 and 5 it is considered appropriate to adopt 65 dB(A) CNT base on the noise monitoring carried out at the nearest NSLs.
- For commercial NSLs it is considered appropriate to adopt the 75 dB(A) CNT, given the urban, industrial environment in which the closest commercial properties reside, in line with BS 5228–1.

9.2.1.3 Interpretation of the CNT

In order to assist with interpretation of significance relating to a calculated construction noise level (CNL), Table 9.2 includes guidance as to the likely magnitude of impact associated with construction noise, relative to the CNT. This guidance is derived from DMRB: Noise and Vibration (UKHE 2020) and adapted to include the EPA EIAR Guidelines.

Construction Noise Level Per Period	Guidelines for Noise Impact Assessment Significance (DMRB)	EPA EIAR Significance of Effects	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration & baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate	
Above CNT and below or equal to CNT +5 dB	Moderate	Moderate to Significant	
Above CNT +5 dB	Major	Significant, to Very Significant	

Table 9.2: Construction Noise Significance Ratings

The adapted DMRB guidance outlined will be used to assess the predicted CNLs at NSLs and comment on the likely effects during the construction stage.

In accordance with the DMRB Noise and Vibration Guidance, construction noise and construction traffic noise effects shall constitute a significant effect where it is determined that a major or moderate magnitude of effect will occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights, or
- A total number of days exceeding 40 in any six consecutive months.

9.2.1.4 Construction Traffic

Vehicular movement to and from the construction site for the proposed development will make use of the existing road network. In order to assess the potential impact of additional traffic on the human perception of noise, the following two guidelines are referenced: DMRB Noise and Vibration (UKHE 2020) and the EPA Guidelines (EPA, 2022). For construction traffic, due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the 'short term' period in accordance with the DMRB Noise and Vibration document.

Table 9.3 sets out the classification of changes in noise level to impact on human perception based on the guidance contained in these documents.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant to Slight
3 – 4.9	Perceptible	Moderate	Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

Table 9.3: Likely Effect Associated with Change in Traffic Noise Level – Construction

9.2.1.5 Construction Vibration

Vibration standards address two aspects: those dealing with cosmetic or structural damage to buildings and those with human comfort. For the purpose of this scheme, the range of relevant criteria used for surface construction works for both building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Building Response

There is no published statutory Irish guidance relating to the maximum permissible vibration level. The following standards are the most widely accepted in this context and are referenced here in relation to cosmetic or structural damage to buildings:

- British Standard BS 5228-2 (BSI 2014b); and
- British Standard BS 7385-2 (BSI 1993)

BS7385-2 (BSI 1993) and BS5228-2 (BSI 2014b) advise that, for soundly constructed residential properties and similar light-framed structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above for transient vibration. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table B.2 of BS5228-2 (BSI 2014b) might need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges. For buildings or structures that are structurally unsound, lower vibration magnitudes will apply, typically 50% of those

for structurally sound buildings. Protected or historic buildings are not automatically assumed to be more vulnerable to vibration unless they have existing structural defects. The recommended transient vibration thresholds from BS5228-2 (BSI 2014b) for the avoidance of cosmetic damage to light framed and residential buildings are summarised in Table 9.4

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
15 mm/s	20 mm/s	50 mm/s

Table 9.4: Recommended Vibration Criteria During Construction Phase

Expected vibration levels from the construction works will be discussed further in section 9.5.1.4.

Human Perception

Human response to vibration stimuli occurs at orders of magnitude below those associated with any form of building damage, hence vibration levels lower than those indicated in Table 9.4 can lead to concern. Table 9.5 presents the significance table relating to potential effects to building occupants during construction based on guidance from BS5228-2 (BSI 2014b), the DMRB Noise and Vibration (UKHE 2020) document and the associated EPA significant ratings.

PPV range	**BS 5228-2 (Note A, B, C)**	**DMRB Impact Magnitude**	**EPA Significance Ratings**
≥10 mm/s PPV	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.	Very High	Very Significant
≥1 to 10 mm/s PPV	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents	High	Significant to Very Significant
≥0.3 to <1 mm/s PPV	Vibration might be just perceptible in residential environments.	Medium	Slight to Moderate
<0.3 mm/s PPV	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction	Low	Not significant

Table 9.5: Guidance on Effects of Human Response to PPV Magnitudes

Note A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

Note B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.

Note C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are

routinely measured or expected then an assessment in accordance with BS 6472 (BS1 2008), and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

9.2.2 Operational Phase Noise Impacts

The main potential source of outward noise from the proposed development will be limited to traffic flows to and from the development site onto the public roads. There may also be an element of mechanical and electrical plant required to service the apartment buildings and other buildings associated with the development sites such as creches. The relevant guidance documents used to assess potential operational noise and vibration impacts on the surrounding environment are summarised below.

- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (hereafter referred to as **BS 8233**) (BSI 2014c);
- BS 4142: 2014 +A1 2019 Methods for Rating and Assessing Industrial and Commercial Sound (hereafter referred to as **BS 4142**) (BSI 2019);
- ISO 1996–1:2016 Acoustics – Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as **ISO 1996–1**) (ISO 2016);
- The UK Department of Transport Calculation of Road Traffic Noise (UK Department of Transport 1988).
- UK Highways England (UKHE) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability and Environmental Appraisal LA 111 Noise and Vibration Revision 2 (UKHE 2020);
- International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (hereafter referred to as **ISO 9613–2**) (ISO 1996);

9.2.2.1 Mechanical Plant and Services

Receptors Outside the Proposed Development

The most appropriate standard used to assess the impact of a new continuous source (i.e. plant items) to a residential environment is BS 4142. This standard describes a method for assessing the impact of a specific noise source at a specific location with respect to the increase in "background" noise level that the specific noise source generates. The standard provides the following definitions that are pertinent to this application:

- "Specific sound level", $L_{Aeq,\ Tr}$ is equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
- "Rating level" $L_{Ar,Tr}$ is the specific noise level plus adjustments for the character features of the sound (if any).
- "Background noise level" is the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T. This level is expressed using the LA90 parameter. These levels were measured as part of the baseline survey.

The assessment procedure in BS4142 is outlined as follows:

1. determine the specific noise level;
2. determine the rating level as appropriate;
3. determine the background noise level; and

4. subtract the background noise level from the rating level to calculate the assessment level.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific source will have an adverse impact or a significant adverse impact. A difference of +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, dependent on the context. Where the rated plant noise level is equivalent to the background noise level, noise impacts are typically considered to be neutral.

Receptors Inside the Proposed Development

In order to determine an appropriate noise criterion for residential receptors within the proposed development that will be built in future, guidance is taken from BS 8233. Recommended internal noise levels for residential settings are set out in the standard as follows:

Activity	**Location**	**Day (07:00 to 23:00hrs) dB $L_{Aeq,16hr}$**	**Night (23:00 to 07:00hrs) dB $L_{Aeq,8hr}$**
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Table 9.6: BS 8233 Recommended Internal Noise Levels

For the purposes of this assessment, it is appropriate to derive external limits based on the internal criteria noted in the above. This is done by factoring in the degree of noise reduction afforded by a partially open window; typical 15 dB attenuation is noted in this British Standard. Using this correction value across an open window, the following external noise levels would achieve the internal noise levels noted in Table 9.6 above.

- Daytime (07:00 to 23:00 hours) 50 dB $L_{Aeq,16hr}$
- Night-time (23:00 to 07:00 hours) 45 dB $L_{Aeq,8hr}$

9.2.2.2 Additional Vehicular Traffic on Roads

Vehicular movement to and from the proposed development will make use of the existing road network and new junction arrangement. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to consider the increase in traffic noise level that arises as a result of any additional vehicular movements associated with the development.

In order to assess the potential impact of additional traffic on the human perception of noise, the following two guidelines are referenced: DMRB Noise and Vibration (UKHE 2020) and the EPA EIAR Guidelines (EPA, 2022), which categorise the magnitude of effect relating to changes in road traffic. For the operational phase, traffic noise impacts are assessed against the 'long term' magnitude ratings from the DMRB. These are discussed in Table 9.7.

Change in Sound Level (dB)	**Subjective Reaction**	**DMRB Magnitude of Impact (Long-term)**	**EPA Significance of Effect**
0	Inaudible	No impact	Imperceptible
0.1 – 2.9	Barely Perceptible	Negligible	Not significant
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate to Significant
10+	Doubling of loudness and above	Major	Significant to Very significant

Table 9.7: Significance in Change of Noise Level

9.2.2.3 Vibration

The development is residential in nature, therefore it is not anticipated that there will be any source of vibration from the development itself during the operational phase.

However, areas of the proposed development sites are adjacent to an active rail line and as such the inward impact of rail vibration on future occupants of the development must be considered. Guidance relating to human response to vibration is contained within BS 6472 Guide to evaluation of human exposure to vibration in buildings (2008): Part 1 – Vibration sources other than blasting.

BS 6472 uses the Vibration Dose Value (VDV), which is measured or forecast over the day or night-time periods in terms of m/s-1.75. The VDV parameter takes into account how people respond to vibration in terms of frequency content, vibration magnitude and the number of vibration events during an assessment period.

The following Table, as set out in the standard, details the values of VDV where various comments from occupiers are possible. The standard notes that the values are applicable for both vertical and horizontal vibration with the appropriate weighting applied.

Building Type	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential building – Day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building – Night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 9.8: VDV (m/s-1.75) above which various degree of adverse comment may be expected in residential buildings.

9.2.3 Inward Noise Impact

9.2.3.1 Dublin Agglomeration Noise Action Plan 2024 – 2028

The Dublin Agglomeration Noise Action Plan 2024 – 2028, addresses the requirements of the European Noise Directive 2002/49/EC for local authorities for managing environmental noise. The Noise Action Plan (NAP) states the following regarding planning guidance: “The appropriate use of the planning system can be used to help avoid, or minimise, the adverse impacts of noise without placing unreasonable restrictions on development”.

The action plan outlines guidance to minimise the impact in relation to noise on new developments. ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise, and BS 8233: Guidance on Sound Insulation and Noise Reduction for Buildings, are recommended as guidance to be employed in areas where people are being brought to noise in the form of existing road and rail noise.

In accordance with the guidance recommended as the NAP policy, the following Acoustic Design Statement (ADS) has been prepared to comply with the requirements of this policy.

9.2.3.2 ProPG: Planning and Noise (2017)

The Professional Practice Guidance on Planning and Noise (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA), and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since its adoption it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

The ProPG document outlines a systematic risk-based two-stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows:

- Stage 1 – Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:

o Element 1 – Good Acoustic Design Process;

o Element 2 – Noise Level Guidelines;

o Element 3 – External Amenity Area Noise Assessment; and

o Element 4 – Other Relevant Issues.

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium, or high risk, based on the pre-existing noise environment. Figure 9.1 presents the basis of the initial noise risk assessment; it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

It should be noted that a site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and the site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times a night.

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in Table 9.6 above and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

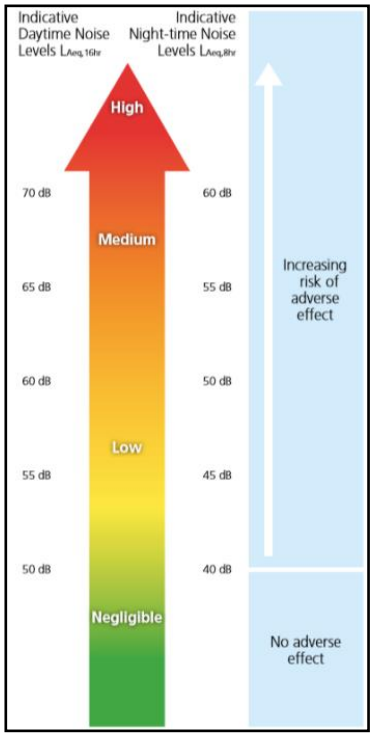

Figure 9.1: ProPG Stage 1 – Initial Noise Risk Assessment

In addition to these absolute internal noise levels, the ProPG document provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

The ProPG document provides the following advice with regard to external noise levels for amenity areas in the development:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed, and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

9.3 RECEIVING ENVIRONMENT

The proposed development is located within three individual sites, within the Clonburris SDZ. The three sites are outlined and described below.

9.3.1.1 Site 3

Site 3 is bisected by the existing Adamstown Avenue. It is bounded to the east by the R136 and to the south by the existing railway line. The nearest residential NSLs are situated within the housing estate to the west and north of the proposed development.

9.3.1.2 Site 4

Site 4 is bounded to the north by the existing railway line; further north lies Adamstown Avenue. The nearest residential NSLs are situated to the east at the existing halting site at Kishoge Road. To the south the site is bounded by industrial and commercial units.

9.3.1.3 Site 5

Site 5 is made up of two sites, A and B. Site A is bounded to the west by the existing R136 and to the north by Thomas Omer Way. The nearest NSLs are the Kishoge Community School to the east and the halting site at Lynch's Park to the southeast. Further south, the site is bounded by the existing railway line. Site B is bounded to the south by Thomas Omer Way and to the north by a cluster of residential properties. The closest NSLs to site B are these residential units within Foxborough Court and Foxborough Road.

9.3.2 Environmental Noise Survey

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment within the vicinity of the three sites. The survey was conducted in general accordance with ISO 1996–1. Specific details are set out below.

9.3.2.1 Choice of Measurement Locations

The measurement locations are described below and shown in **Figure 9.2**.

AT1 – Attended monitoring position representative of residential properties along Adamstown Avenue.

AT2 – Attended monitoring position representative of residential properties within the vicinity of Tullyhall Drive and Tullyhall Rise.

AT3 – Attended monitoring position representative of proposed residential properties along Adamstown Avenue.

AT4 – Attended monitoring position representative of residential properties at Foxborough Road.

AT5 – Attended monitoring position representative of proposed residential properties along the R136.

AT6 – Attended monitoring position representative of proposed residential properties along Thomas Omer Way.

UN3 – Unattended monitoring position representative of proposed residential properties along Thomas Omer Way.

Figure 9.2: Noise Monitoring Locations

9.3.2.2 Survey Periods

The noise survey was carried out over the following periods:

Survey Position	Survey Period
AT1	Daytime surveys were conducted over the period of 09:20 to 11:53 on the 15th March 2024. Nighttime surveys were carried out from 23:18 on the 20th March 2024 to 00:23 on the 21st March 2024.
AT2	Daytime surveys were conducted over the period of 09:53 to 12:12 on the 15th March 2024. Nighttime surveys were carried out from 23:38 on the 20th March 2024 to 00:46 on the 21st March 2024.
AT3	Daytime surveys were conducted over the period of 10:18 to 12:48 on the 15th of March 2024. Nighttime surveys were carried out from 00:02 to 01:09 on the 21st March 2024.
AT4	Daytime surveys were conducted over the period of 09:57 to 12:15 on the 15th of March 2024.
AT5	Daytime surveys were conducted over the period of 09:05 to 11:27 on the 15th of March 2024. Nighttime surveys were carried out from 23:00 on the 09th April 2024 to 01:04 on the 10th April 2024.
AT6	Daytime surveys were conducted over the period of 09:32 to 11:50 on the 15th of March 2024. Nighttime surveys were carried out from 23:10 on the 09th April 2024 to 01:00 on the 10th April 2024.
UN3	Unattended Monitoring was undertaken from the period of the 15th March to the 19th March 2024.
VM1	Attended vibration monitor located inside the south western site boundary of site 3 immediately adjacent to the rail line. Undertaken between 14:11 and 15:16 on the 20th March 2024.

Table 9.9: Noise Survey Periods

9.3.2.3 Instrumentation and Personnel

All measurements were undertaken by AWN Consulting using Class 1 Precision Sound Level Meters and associated hardware that was appropriately calibrated.

9.3.2.4 Measurement Parameters

The survey results are presented in terms of the following four parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. It is typically used as a descriptor for ambient noise.

L_{AFMax} is the maximum sound level that is exceeded during the survey period measured using fast weighting of 1 second.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for background noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

9.3.2.5 Survey Results

The survey results for the monitoring locations have been summarised for each of the periods discussed within Table 9.9 and are discussed below. The daytime period is defined as the 16 hour period between 07:00 and 23:00hrs and the nighttime period is defined as the 8 hour period between 23:00 and 07:00hrs.

Location AT1

The survey results for Location AT1 are given in Table 9.10.

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	09:20	60	77	65	48
	10:42	59	72	64	46
	11:53	60	78	64	47
	Day Average	60	72 - 78	64	47
20/03/2024	23:18	51	70	52	38
21/03/2024	00:23	45	62	42	37
	Night Average	49	62 - 70	47	38

Table 9.10: Summary of Results for Location AT1

The noise environment at the measurement location was typically dominated by noise from road traffic from the local road networks with intermittent aircraft also noted overhead; other noise sources noted included birdsong and rail noise. Ambient daytime noise levels were in the range of 59 to 60 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 46 to 48 dB $L_{A90,15mins}$. Ambient nighttime noise levels were in the range of 45 to 51 dB $L_{Aeq,15mins}$ while background noise levels were in the range of 37 to 38 dB $L_{A90,15mins}$.

Location AT2

The survey results for Location AT2 are given in Table 9.11.

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	09:53	56	79	59	45
	11:04	51	68	54	44
	12:12	51	72	53	43
	Day Average	53	68 - 79	55	44
20/03/2024	23:38	40	57	42	37
21/03/2024	00:46	45	62	42	37
	Night Average	43	57 - 62	42	37

Table 9.11: Summary of Results for Location AT2

The noise environment at the measurement location was typically dominated by noise from distant road traffic from the local road networks with intermittent aircraft noted overhead; other noise sources noted included birdsong, residential movements and distant rail noise. Ambient daytime noise levels were in the range of 51 to 56 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 43 to 45 dB $L_{A90,15mins}$. Ambient nighttime noise levels were in the range of 40 to 45 dB $L_{Aeq,15mins}$ while background noise levels were 37 dB $L_{A90,15mins}$.

Location AT3

The survey results for Location AT3 are given in Table 9.12

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	10:18	67	81	71	49
	11:28	67	84	71	49
	12:48	68	82	72	50
	Day Average	67	81 - 84	71	49
21/03/2024	00:02	55	77	54	40
	01:09	40	53	42	37
	Night Average	52	53 - 77	48	39

Table 9.12: Summary of Results for Location AT3

The noise environment at the measurement location was typically dominated by noise from road traffic and intermittent rail noise with intermittent aircraft noise also noted overhead; other noise sources noted included birdsong. No traffic movements were noted in the second nighttime measurement, resulting in lower ambient and background noise levels. Ambient daytime noise levels were in the range of 67 to 68 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 49 to 50 dB $L_{A90,15mins}$. Ambient nighttime noise levels were in the range of 40 to 55 dB $L_{Aeq,15mins}$ while background noise levels were in the range of 37 to 40 dB $L_{A90,15mins}$.

Location AT4

The survey results for Location AT4 are given in Table 9.13. No night surveys were completed at this location due to the recorded noise levels only being used to inform the construction assessment.

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	09:57	51	67	53	48
	11:05	53	67	54	50
	12:15	51	63	53	48
	Day Average	52	63 - 67	53	49

Table 9.13: Summary of Results for Location AT4

The noise environment at the measurement location was typically dominated by distant noise from road traffic and birdsong. Ambient daytime noise levels were in the range of 51 to 53 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 48 to 50 dB $L_{A90,15mins.}$

Location AT5

The survey results for Location AT5 are given in Table 9.14.

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	09:05	71	81	74	59
	10:19	69	93	73	56
	11:27	68	80	73	54
	Day Average	70	80 - 93	73	56
09/04/2024	23:00	62	76	66	48
10/04/2024	00:24	58	78	61	41
	01:04	61	81	60	42
	Night Average	61	76 - 81	62	44

Table 9.14: Summary of Results for Location AT5

The noise environment at the measurement location was dominated by noise from road traffic with intermittent rail noise noted during the nighttime periods. Ambient daytime noise levels were in the range of 68 to 71 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 54 to 59 dB $L_{A90,15mins}$. Ambient nighttime noise levels were in the range of 58 to 62 dB $L_{Aeq,15mins}$ while background noise levels were in the range of 41 to 48 dB $L_{A90,15mins.}$

Location AT6

The survey results for Location AT6 are given in Table 9.15.

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
15/03/2024	09:32	76	87	79	65
	10:41	74	85	79	62
	11:50	73	84	78	61
	Day Average	75	84 - 87	79	63
09/04/2024	23:10	68	84	72	48

Date/Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		$L_{Aeq,15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
10/04/2024	00:00	67	84	69	47
	01:00	64	86	65	42
	Night Average	67	84 - 86	69	46

Table 9.15: Summary of Results for Location AT6

The noise environment at the measurement location was dominated by noise from road traffic including emergency service sirens with intermittent rail noise noted during the nighttime periods. Ambient daytime noise levels were in the range of 73 to 76 dB $L_{Aeq,15mins}$ while daytime background noise levels were in the range of 61 to 65 dB $L_{A90,15mins}$. Ambient nighttime noise levels were in the range of 64 to 68 dB $L_{Aeq,15mins}$ while background noise levels were in the range of 42 to 48 dB $L_{A90,15mins}$.

Location UN3

The survey results for the unattended monitoring position at location UN3 are given in Table 9.16. It should be noted that a logarithmic average is used for the L_{Aeq} parameter, while an arithmetic average is used for the L_{A90} parameter.

Date	Period	Measured Noise Levels (dB re. 2x10-5 Pa)	
		$L_{Aeq,15min}$	$L_{A90,15min}$
Average of 15 to 19 March 2024	Day	64	51
	Night	58	41

Table 9.16: Summary of Results for Location UN3

Location VM1

Peak Particle Velocity (PPV)

Specific measurements were made during rail pass bys to determine the range of vibration levels attributable to passing rail. Table 9.17 summarises the results of the specific rail pass-bys.

Time	Direction	PPV (mm/s)		
		Vertical	Horizontal (Y)	Horizontal (X)
14:16	West	0.12	0.09	0.08
14:22	East	0.71	0.18	0.13
14:30	West	0.1	0.08	0.07
14:37	East	0.7	0.19	0.13
14:43	East	0.37	0.17	0.12
14:49	East	0.8	0.35	0.24
15:09	West	0.11	0.17	0.1
15:14	East	0.71	0.25	0.2

Table 9.17: Maximum PPV Levels during Rail Pass Bys

The monitoring results indicate that during rail pass-bys, maximum PPV values were measured in the range of 0.7 to 0.8mm/s. The higher values recorded over the course of the attended monitoring periods are as a result of Intercity/ Commuter trains passing east along the rail line.

Vibration Dose Value (VDV)

Measurement of vibration dose value was also undertaken during rail pass bys. The results are summarised in Table 9.18.The day and night VDV values are calculated taking account of the maximum pass by VDV measured and number of passing trains over day and night-time periods as taken from Chapter 4, Table 4.22 of the DART+ Southwest EIAR chapter, to account for the uplift in future train pass bys.

The DART+ Southwest Project is described as part of the wider DART+ Programme, which is a key transportation improvement programme to form a high-quality and integrated public transport system in the Greater Dublin Area (GDA), bringing benefits for new and existing communities. It will assist in providing a sustainable transport system and a societal benefit for current and future generations. The project will run along the rail that runs adjacent to the sites within the proposed project, and has therefore been taken into account when considering future rail noise and vibration.

Once Dart+ Southwest is operational, during the worst case daytime hour of 17:00hrs to 18:00hrs, there are approximately 23 trains per hour scheduled. During nighttime hours as a worst case there are 16 scheduled train services that pass the sites between 23:00hrs and 00:00hrs.

Notwithstanding this, the calculated VDV levels in Table 9.18 demonstrate that the day and night VDV exposure level is several orders of magnitude lower than the criteria discussed in Section 9.2.2.3 of this EIAR.

Time	**Direction**	**VDV (mm/s)**
		Horizontal
		Z_VDV
14:16	West	0.0002
14:22	East	0.029
14:30	West	0.0002
14:37	East	0.032
14:43	East	0.016
14:49	East	0.032
15:09	West	0.004
15:14	East	0.034
$VDV_{, b, day}$		0.14
$VDV_{, b, night}$		0.09

Table 9.18: VDV Levels During Train Pass Bys

9.3.2.6 Comment on Site Specific Noise Environments

Site 3

The noise environment within site 3 has been identified via survey locations AT1, AT2 and AT3. The noise environment consists of road noise, intermittent aircraft noise and intermittent rail noise.

Site 4

Due to site 4 not being accessible at the time of surveying, the noise environment is considered representative of locations AT1 and AT3. The noise environment consists of road noise, intermittent aircraft noise and intermittent rail noise.

Site 5

The noise environment within site 5 has been identified via survey locations AT4, AT5, AT6 and UN3. The noise environment is dominated by road traffic noise, with intermittent aircraft noise and intermittent rail noise also being noted as noise contributors.

9.3.3 Desktop review of Noise Mapping

A desktop review of publicly available data has been undertaken to further characterise the baseline noise environment in the study area. Reference has been made to the most recent Round 4 noise maps published by the EPA (http://gis.epa.ie) for road traffic and rail noise within the Dublin Agglomeration using the national noise maps. The published noise maps are provided for the overall day-evening-night period in terms of L_{den} and the L_{night} parameters, defined below.

L_{den} is the 24-hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5 dB penalty) and the L_{night} (plus a 10 dB penalty). L_{den} is calculated using the following formula::

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all day periods of a year. The 12-hour daytime period is between 07:00hrs and 19:00hrs.

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The four-hour evening period is between 19:00hrs and 23:00hrs.

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The eight-hour night-time period is between 23:00hrs and 07:00hrs.

The mapping available has been used to further inform the existing noise levels on each of the potential development sites. These are discussed in their respective sections below.

9.3.3.1 Site 3

The site 3 development site within the proposed development is subject to intrusive noise from both the local road network surrounding the site and the existing railway line to the south.

Site 3 – Road Noise

Figure 9.3 and Figure 9.4 present the mapped road traffic noise levels in the vicinity of the site 3 development site in terms of the L_{den} and L_{night} parameters. The main contributor in relation to road noise is the R136 to the east of site 3.

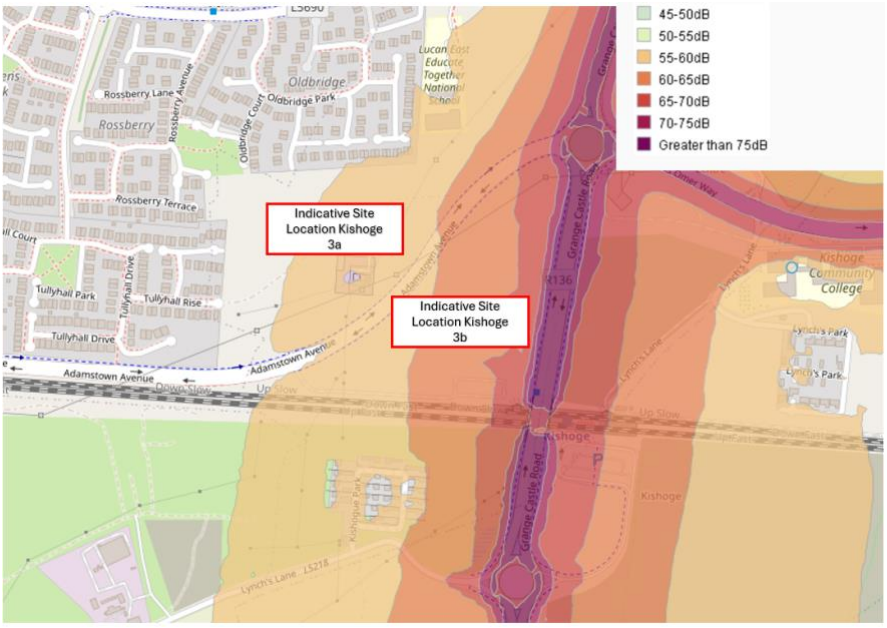

Figure 9.3: Mapped dB L_{den} Traffic Noise Level within vicinity of Site 3 of the proposed development (Source: http://gis.epa.ie)

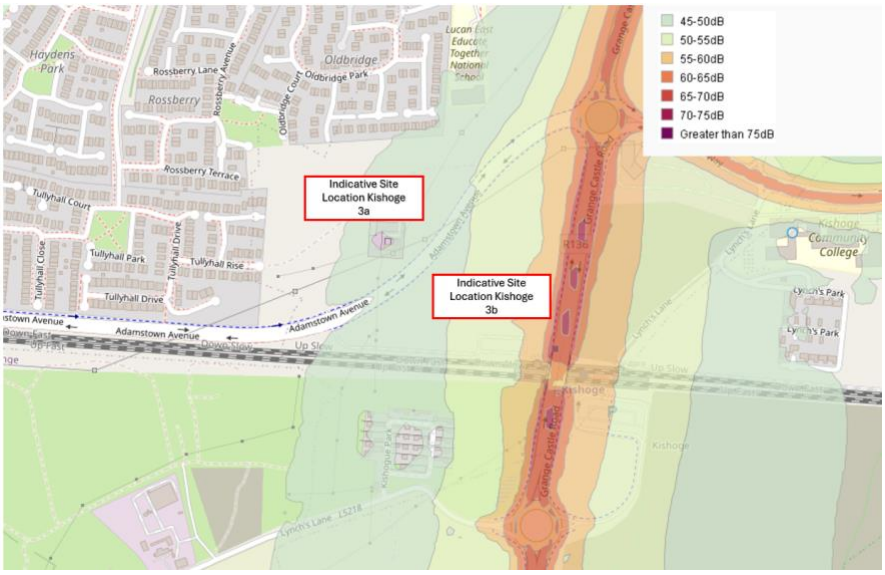

Figure 9.4: Mapped dB L_{night} Traffic Noise Level within vicinity of Site 3 of the proposed development (Source: http://gis.epa.ie)

The EPA noise maps indicate that the eastern perimeter of the site is subject to road noise from the R136. The maps indicate that the levels range from 65 to 70 dB L_{den} along the immediate eastern boundary, reducing to within the 60 to 65 dB L_{den} noise contour further into the site. The noise levels then reduce to within the 55 to 60 L_{den} noise contour beyond Adamstown Avenue. The maps indicate that the night time noise levels range from 55 to 60 dB L_{den} along the immediate eastern boundary, reducing to within the 50 to 55 dB L_{den} noise contour further into the site. The noise levels then reduce to within the 45 to 50 L_{den} noise contour beyond Adamstown Avenue.

Site 3 – Rail Noise

Figure 9.5 and Figure 9.6 present the mapped rail noise levels to the south of the site 3 development site in terms of the L_{den} and L_{night} parameters respectively

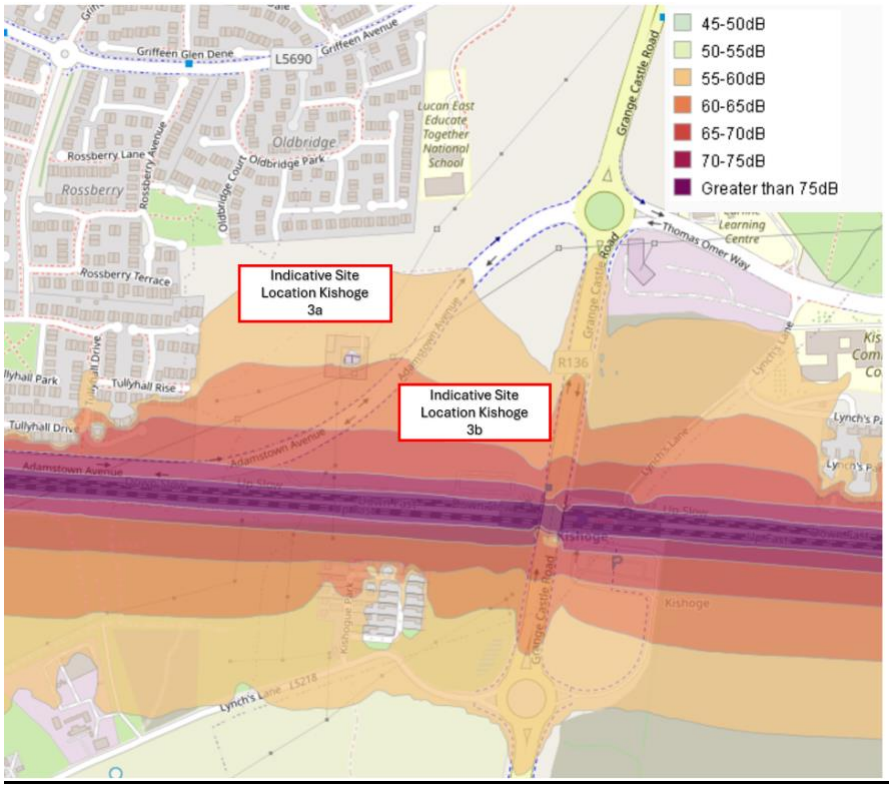

Figure 9.5: Mapped dB L_{den} Rail Noise Level within vicinity of Site 3 of the proposed development (Source: http://gis.epa.ie)

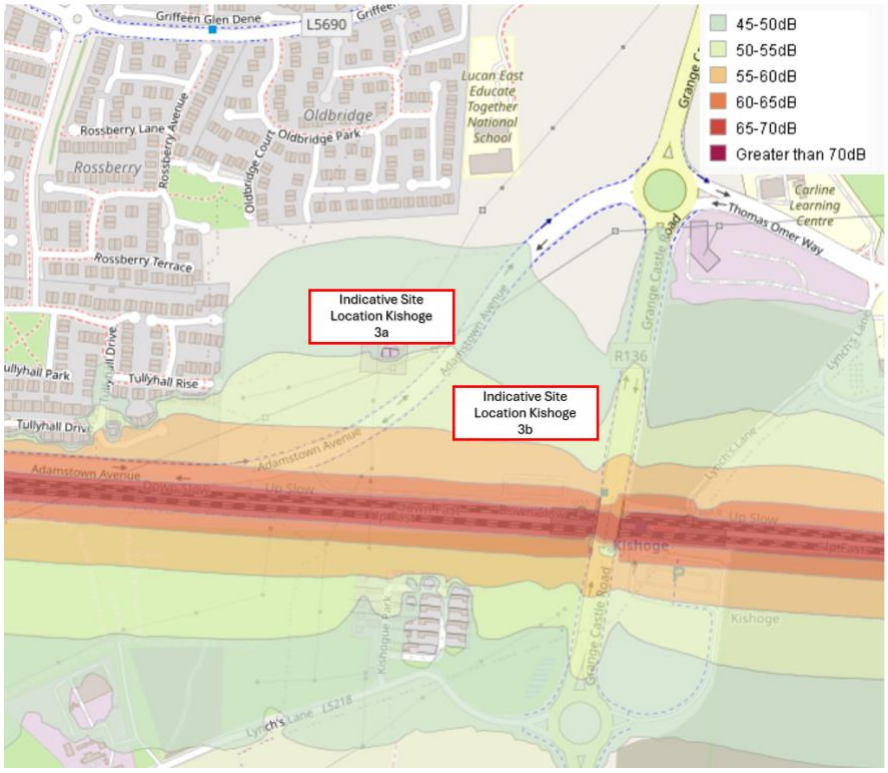

Figure 9.6: Mapped dB L_{night} Rail Noise Level within vicinity of Site 3 of the proposed development (Source: http://gis.epa.ie)

The EPA noise maps indicate that the southern perimeter of the site is subject to rail noise from the railway line to the south. The maps indicate that the levels range from 65 to 70 dB L_{den} along the immediate southern boundary, reducing to within the 60 to 65 dB L_{den} noise contour further into the site. The noise levels then reduce to within the 55 to 60 L_{den} noise contour further north into the site.

The maps indicate that the night time noise levels range from 55 to 60 dB L_{den} along the immediate southern boundary, reducing to within the 50 to 55 dB L_{den} noise contour further north into the site. The noise levels then reduce to within the 45 to 50 L_{den} noise contour for the remainder of the site.

9.3.3.2 Site 4

The site 4 development site within the proposed development is situated at distances where noise from the road network is not an issue. However, the site is subject to intrusive noise from the existing railway line to the north.

Site 4 – Rail Noise

Figure 9.7 and Figure 9.8 present the mapped rail noise levels to the south of the site 4 development site in terms of the L_{den} and L_{night} parameters.

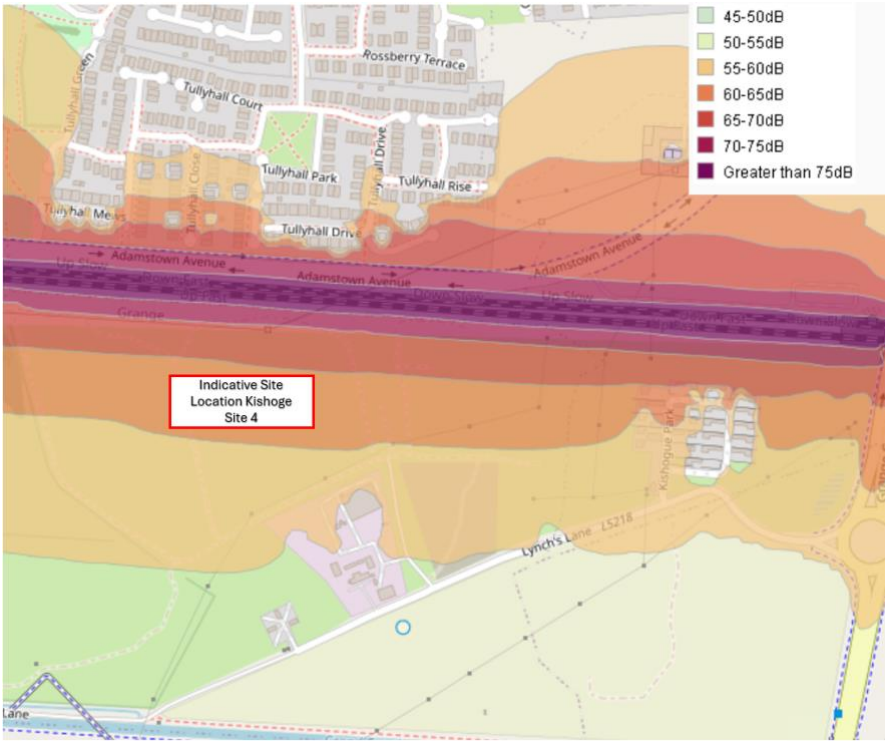

Figure 9.7: Mapped dB L_{den} Rail Noise Level within vicinity of Site 4 of the proposed development (Source: http://gis.epa.ie)

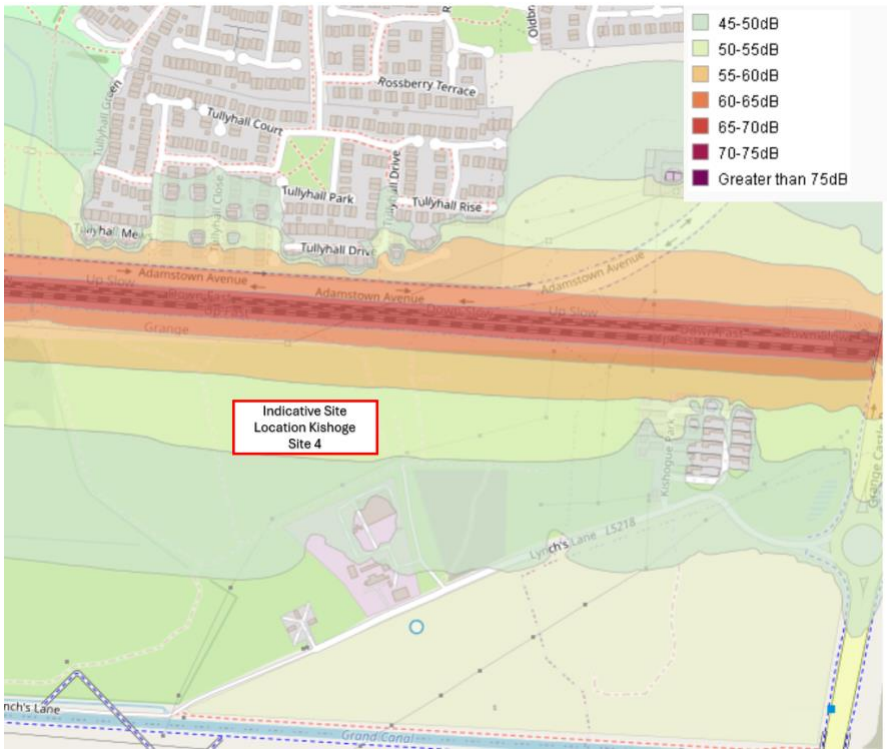

Figure 9.8: Mapped dB L_{night} Rail Noise Level within vicinity of Site 4 of the proposed development (Source: http://gis.epa.ie)

The EPA noise maps indicate that the northern perimeter of the site is subject to rail noise from the railway line to the north. The maps indicate that the levels range from 65 to 70 dB L_{den} along the immediate northern boundary, reducing to within the 60 to 65 dB L_{den} noise contour further into the site. The noise levels then reduce to within the 55 to 60 L_{den} noise contour further south into the site.

The maps indicate that the night time noise levels range from 55 to 60 dB L_{den} along the immediate northern boundary, reducing to within the 50 to 55 dB L_{den} noise contour further south into the site. The noise levels then reduce to within the 45 to 50 L_{den} noise contour for the remainder of the site.

9.3.3.3 Site 5

The site 5 development site within the proposed development is subject to intrusive noise from both the local road network surrounding the site and the existing railway line to the south.

Site 5 – Road Noise

Figure 9.9 and Figure 9.10 present the mapped road traffic noise levels in the vicinity of the site 5 development site in terms of the L_{den} and L_{night} parameters. The main contributors in relation to road noise are the R136 to the west of site 5a and the Thomas Omer way which intersects the two sections of Site 5.

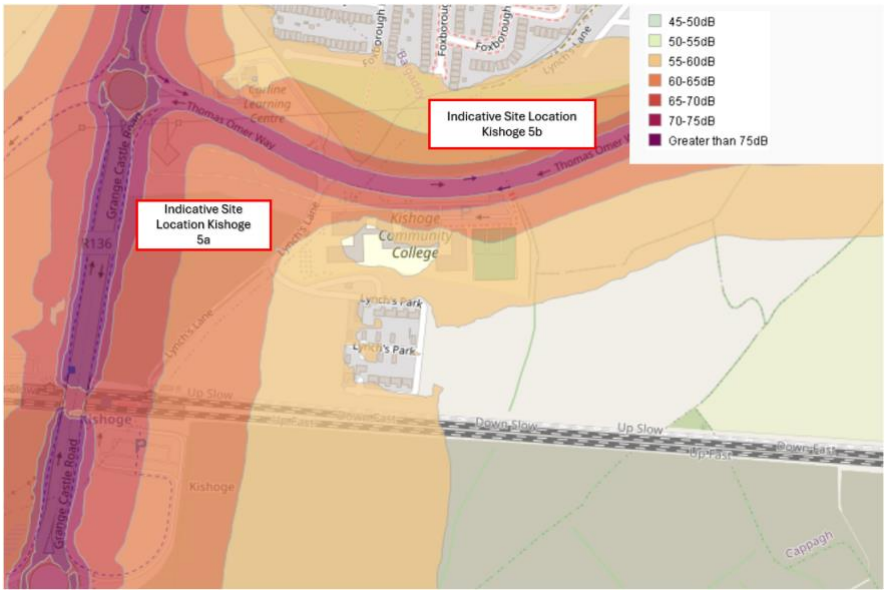

Figure 9.9: Mapped dB L_{den} Road Noise Level within vicinity of Site 5 of the proposed development (Source: http://gis.epa.ie)

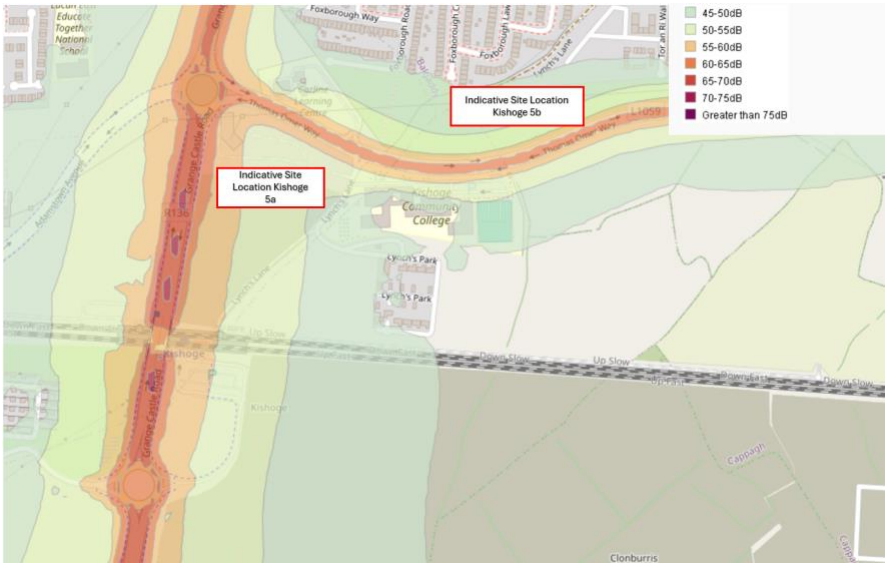

Figure 9.10: Mapped dB L_{night} Road Noise Level within vicinity of Site 5 of the proposed development (Source: http://gis.epa.ie)

The EPA noise maps indicate that the western perimeter of site 5a is subject to road noise from the R136 whilst the northern section of site 5a is subject to road noise attributed to Thomas Omer Way. The maps indicate that the levels range from 65 to 70 dB L_{den} along the immediate western and northern boundary, reducing to within the 60 to 65 dB L_{den} noise contour for the remainder of site 5a. Site 5b is largely only affected by the existing Thomas Omer Way, where noise levels range from 65 to 70 dB L_{den} along the immediate southern boundary, reducing to within the 60 to 65 dB L_{den} noise contour further north into the site and reducing to 55 to 60 dB L_{den} for the remainder of the site.

The maps indicate that the night time noise levels for site 5a range from 55 to 60 dB L_{den} along the immediate western and northern boundaries, reducing to within the 50 to 55 dB L_{den} noise contour for the remainder of site 5a. The nighttime road noise levels for Site 5b range from 55 to 60 dB L_{den} along the immediate southern boundary, reducing to within the 50 to 55 dB L_{den} noise contour further

north into the site and reducing further to within the 45 to 50 dB L_{den} noise contour for the remainder of the site.

Site 5 – Rail Noise

Figure 9.11 and **Figure 9.12** present the mapped rail noise levels to the south of the site 5 development site in terms of the L_{den} and L_{night} parameters.

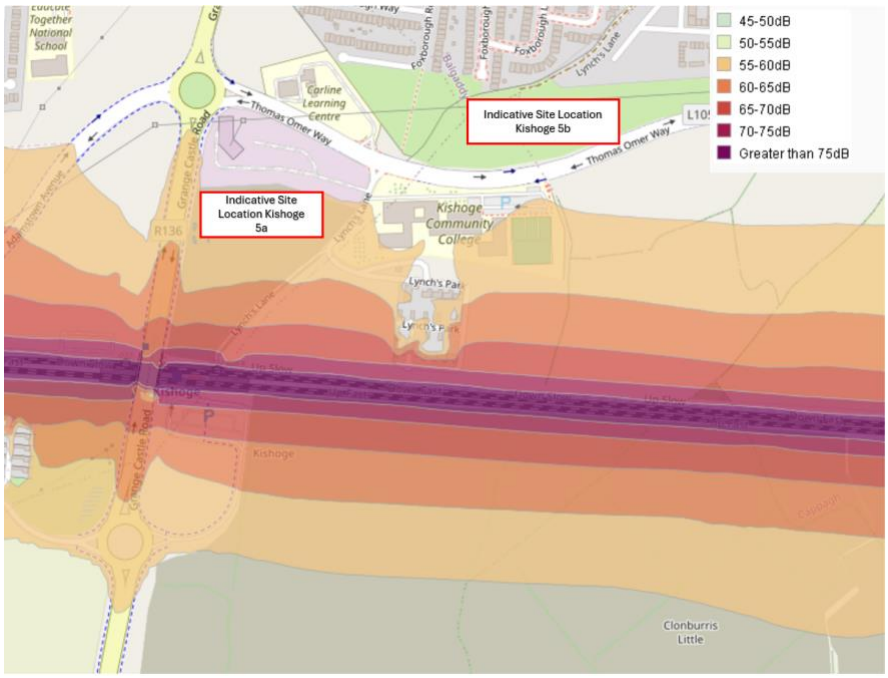

Figure 9.11: Mapped dB L_{den} Rail Noise Level within vicinity of Site 5 of the proposed development (Source: http://gis.epa.ie)

Figure 9.12: Mapped dB L_{night} Rail Noise Level within vicinity of Site 5 of the proposed development (Source: http://gis.epa.ie)

The EPA noise maps indicate that the southern perimeter of site 5a is subject to rail noise from the railway line to the south. The maps indicate that the levels range from 60 to 65 dB L_{den} along the south of the site, reducing to within the 55 to 60 dB L_{den} noise contour further into the remainder of the site.

The night time noise levels range from 50 to 55 dB L_{den} along the southern boundary, reducing to within the 45 to 50 dB L_{den} noise contour further north for the remainder of the site. Site 5b is at a distance where it is unaffected by the rail noise from the existing railway line.

9.3.4 Future Noise Environment

The noise environment within the vicinity of the proposed development and the Clonburris SDZ is expected to change in future years. The introduction of new link roads within the proposed development and SDZ area are likely to increase traffic flow, contributing to higher levels of road traffic noise.

In addition to the new link roads, there is also provision for the Dart+ Southwest project along the existing rail line. The expansion of rail infrastructure will introduce additional noise from train operations.

The combined impact of these new link roads and the Dart+ Southwest rail expansion is further assessed in the inward impact section of this report in Section 9.5.3.This section provides a detailed analysis of the expected noise levels and the potential mitigation measures that can be implemented to minimise the impact on future inward noise the proposed development.

9.3.5 Do Nothing Scenario

In the "Do Nothing" scenario, where the proposed development is not constructed, road noise levels will remain largely unchanged in the vicinity of the development sites, and road noise will continue to dominate the local noise environment. However, it is important to consider the Dart+ Southwest rail expansion being implemented in this Do Nothing scenario.

Reference is made to receptor R46 within Table 14.63 of the Dart+ Southwest noise and vibration chapter. This receptor is representative of monitoring position AT1 within section 9.3.2. At this receptor, it is predicted that noise levels will stay the same during the daytime period but will increase by approximately 3 dB during the nighttime period as a result of the Dart+ Southwest project.

Therefore, it can be considered that in the Do Nothing Scenario, where the proposed development is not built, noise levels will still likely rise slightly due to the influence of other projects in the vicinity, in particular the increase in future rail noise levels due to the Dart+ Southwest project.

9.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development is located over three development sites within the Clonburris SDZ. A detailed description of the development and associated development sites is provided in Chapter 3 (Description of Proposed Development).

When considering a development of this nature, the potential noise and vibration impact on the surroundings is considered for each of two distinct stages:

- Construction and demolition phase; and
- Operational phase.

9.4.1 Construction Phase

The highest potential noise and vibration impact of the proposed development will occur during the construction phase, due to the activity of mobile and construction plant items with high noise levels.

During the construction phase, activities will involve site clearance and excavation, and foundation works during the early stage clearance and ground works. The structural and building works associated with the house and apartment buildings and associated infrastructure will then be undertaken. Following the main ground and structural works, internal fit out works and landscaping will occur. For each stage there will be on-site plant and equipment operating, in addition to construction traffic including movement of machinery and materials within and to and from the construction site.

A variety of items of plant will be in use during these construction works, all of which have the potential to generate high levels of noise. These will include excavators, loaders, dozers, cranes and static plant such as generators, compressors and pumps.

Vibration associated with the proposed construction site activities will be low due to the absence of any intrusive ground works and the distance between the works and the nearest structures and buildings.

The potential impacts associated with these activities are discussed in the following sections.

9.4.2 Operational Phase

Once operational, there are no major noise sources associated with the proposed development, which is largely residential in nature. The range of operational activities is in line with those in the surrounding environment at nearby existing and planned residential areas (e.g. local vehicle movements, amenity and play areas etc.). None of these activities is associated with any significant noise impacts to the surrounding noise environment. The main potential source of outward noise from the proposed development is associated with traffic flows to and from the development on the surrounding road network. There will also be potential for an element of mechanical and electrical plant required to service apartment buildings.

There is also the impact of Inward noise incident on the development from existing and future noise sources, namely road traffic noise, rail noise and aircraft noise; this has also been assessed.

9.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

9.5.1 Construction Phase – Noise

9.5.1.1 Closest NSLs and Noise Thresholds

It is anticipated that the construction of the three development sites within the proposed development will occur concurrently. For the purposes of the construction calculations, each development site is assessed on an individual basis. A comment on the cumulative construction noise is also presented.

Figure 9.13 illustrates the location of the closest NSLs in the surrounding environment. These NSLs are also discussed below in Table 9.19 in relation to their position and distance to the most relevant of the development sites associated with the proposed development.

NSLs	Description	Approximate distance from NSL to closest Proposed Development Construction Works
1	NSL1 is the group of residential NSLs situated to the north and west of the site 3 development. The closest NSLs are approximately 20m from the site construction works whilst the furthest will be approximately 500m from the site construction works.	20m – 500m

NSLs	Description	Approximate distance from NSL to closest Proposed Development Construction Works
2	NSL2 is the group of residential NSLs situated to the west of the site 4 development. These NSLs are approximately 290m from the site construction works related to site 4 and approximately 90m from the site construction works related to site 3.	80m – 290m
3	NSL3 is the Carline Learning Centre to the north of site 5a and northwest of site 5B. The NSL is approximately 50m from site 5a and 150m from site 5b.	50m – 150m
4	NSL4 is the group of residential NSLs situated to the north of the site 5 development. The closest of these NSLs are approximately 20m from the closest site construction works whilst the furthest will be approximately 150m from the site construction works.	20m – 150m
5	NSL5 is the Kishoge Community School to the west of site 5a and to the south of site 5b. This NSL is approximately 30m from the closest site construction works at site 5a and 40m from the construction works at site 5b.	30m – 40m
6	NSL6 is the group of residential NSLs situated to the south west of the site 5 development. These NSLs are approximately 100m from the site 5a construction works and 160m from the site 5b construction works.	100 – 160m

Table 9.19: Description of NSLs Closest to Development

Figure 9.13: Identified NSLs during Construction

The construction noise threshold is determined by referring to Table 9.1 (BS 5228-1) and the baseline ambient noise levels (as referred to in Section 9.3), as outlined in the assessment criteria section.

Working hours for the three sites are set out below and in their respective Construction and Environmental Management Planss (CEMPs). Sunday or Bank Holiday work will only take place periodically and with the agreement of South Dublin County Council. Similarly, any other out of hours working will be only permitted by arrangement with site management and South Dublin County Council.

On occasions, it may prove necessary to carry out noisy activities outside of normal working hours. In such instances, prior consultation will be carried out with South Dublin County Council and local residents, outlining the nature and reason for the works and their likely duration.

Based on the prevailing noise environment measured, the construction noise thresholds are defined from Category A for all residential receptors within the vicinity of the development sites as defined within Table 9.1.

Category A sets the following construction noise thresholds:

- Monday to Friday (07:00 – 19:00hrs) 65dB $L_{Aeq,T}$
- Saturdays (07:00 – 13:00hrs) 65dB $L_{Aeq,T}$
- Evening and Saturday (13:00 – 23:00hrs) 55 dB $L_{Aeq,T}$
- Night-time (23:00 – 07:00hrs) weekdays 45 dB $L_{Aeq,T}$

9.5.1.2 Source Noise Levels

Since the construction programme has been established in outline form, construction noise associated with activities on site during each construction phase is reviewed for the purposes of determining the likely significant effects. Indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228-1. This standard sets out sound power and sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels.

Given that the construction stage is highly transient in nature and involves a number of various stages which will encompass a range of different activities on a day to day and week to week basis, it is not possible to calculate with a high degree of accuracy the specific levels of noise associated with each stage. The construction stage will be undertaken over a number of stages from site preparation through to building construction and internal fit out. Expected typical levels of noise associated with the key stages of work are discussed below.

Site Clearance and Ground Preparation Works

For site clearance, building construction works, road works and landscaping works, typical plant items will include excavators, loaders, dozers, concreting works, mobile cranes and generators. Noise source levels are quoted in the range of 70 to 80 dB L_{Aeq} at distances of 10 m within BS 5228-1. For the purposes of this assessment, a combined sound pressure level of 85 dB $L_{Aeq,T}$ at 10m has been used for construction noise calculations. This would include, for example, 2 no. items of construction plant with a sound pressure level of 80 dB L_{Aeq} at 10 m and 3 no. items of plant with a sound pressure level of 75 dB L_{Aeq} at 10 m, resulting in a total noise level of 85 dB L_{Aeq} at 10m along the closest works boundary.

Given the nature of the proposed works, which will include standard house and apartment building techniques across the site, a cumulative construction noise level of 85 dB L_{Aeq} at 10m represents a conservative noise level used to assess construction activities associated with the earlier stages of construction when site clearance, excavation, and foundation work will be employed. This worst-case scenario is a robust assumption made for developments of this size, on the basis that it is unlikely that more than 5 no. items of such plant/equipment would be operating simultaneously in such close proximity to each other at any given time. In reality, items of construction plant and machinery will be operating at varying distances from any one NSL.

General Construction

Once the ground preparation and foundation works have been completed, a large portion of the work will involve manual labour and cranes with lower overall noise levels. For the purpose of this assessment, a combined sound pressure level of 78 dB $L_{Aeq,T}$ at 10m has been used for construction noise calculations during ongoing site works and compounds, once site clearance and excavation works are completed. This would include, for example, one item of plant at 75 dB L_{Aeq} and three items of plant at 70 dB L_{Aeq} operating simultaneously within a work area, resulting in a total noise level of 78 dB L_{Aeq} along the closest works boundary.

9.5.1.3 Construction Noise Calculations

Construction noise levels have been calculated at the closest NSLs associated with the proposed development, assuming the construction noise levels discussed above. For the purposes of the assessment, partial site screening (5 dB) has been assumed from the use of a standard site hoarding of 2.4 m high for noise sensitive boundaries. The calculations also assume that the equipment will operate for 66% of the working time over a construction working day. Table 9.20 summarises the result of this assessment.

Construction Activity	**Cumulative Sound Pressure dB $L_{Aeq,T}$ at 10m**	**Calculated Noise Levels at Varying Distances, dB $L_{Aeq,T}$**					
		20m	**40m**	**60m**	**80m**	**100m**	**200m**
Site Clearance and Ground Preparation Works	85	72	66	62	60	58	51
General Construction	78	65	59	55	53	51	44

Table 9.20: Indicative Construction Noise Levels at NSLs

Site 3 Construction Noise

The construction noise levels detailed in Table 9.20 indicate that construction activities can operate within the adopted CNT of 65 dB $L_{Aeq,T}$ at distances beyond 40m from construction works, with higher noise emissions associated with the site clearance and ground preparation works.

The closest NSLs are NSL1 to the north and west of the development site. The closest dwellings in this development are at distances of 20m extending out to greater than 500m from the construction works. The impact to the closest properties approximately 20m from the site clearance works is determined to be short term, negative and significant to very significant This will reduce to moderate to significant at NSLs between 20 to 40m from the site clearance works, and slight to moderate beyond 40m, where the construction noise levels associated with the site clearance and ground works will fall to within or below the adopted CNT of 65 dB $L_{Aeq,T.}$

During general construction works associated with houses and apartments, façade and fit out works, construction activities can operate within the adopted CNT of 65 dB $L_{Aeq,T}$ at distances of ≥20m. Reference to Table 9.2 determines the construction noise effect associated with general site works is short term, negative and slight to moderate.

Other existing NSLs are NSLs 2,3 and 4 and are at varying distances of approximately 80m to 200m from the site 3 residential development construction works. At these distances, construction noise levels are below the significance threshold 65 dB $L_{Aeq,T}$. Reference to Table 9.2 determines the construction noise effect associated with both stages of construction is short term, negative and not significant at these remaining NSLs.

Site 4 Construction Noise

During the site 4 construction the closest NSLs are NSL1 approximately 80m north of the nearest site 4 construction works and NSL2 approximately 290m to the east of the site 4 development site. The closest dwellings in this development are at distances of 80m from the construction works. At these distances, construction noise levels are below the significance threshold 65 dB $L_{Aeq,T}$ during both the site clearance and general construction stages of construction. The nearest commercial receptors are approximately 130m from the construction works where construction noise levels will also fall below the adopted CNT of 75 dB $L_{Aeq,T.}$ Reference to Table 9.2 determines the construction noise effect for site 4 for both stages of construction is short term, negative and not significant at all identified NSLs.

Site 5 Construction Noise

The construction noise levels detailed in Table 9.20 indicate that construction activities can operate within the adopted CNT of 65 dB $L_{Aeq,T}$ at distances beyond 40m from construction works, with higher noise emissions associated with the site clearance and ground preparation works.

The closest NSLs to the site 5 development works are NSL4 to the north of the 5b development site and NSL5 to the east of the 5a development. The closest NSLs to the site 5 development are at distances of 20m from the nearest construction works. The impact to the closest NSLs approximately 20m from the site clearance works is determined to be short term, negative and significant to very significant This will reduce to moderate to significant at NSLs between 20 to 40m from the site clearance works, and slight to moderate at distances beyond 40m, where the construction noise levels associated with the site clearance and ground works will fall to within or below the adopted CNT of 65 dB $L_{Aeq,T.}$

During general construction works associated with houses and apartments, façade and fit out works, construction activities can operate within the adopted CNT of 65 dB $L_{Aeq,T}$ at distances of ≥20m. Reference to Table 9.2 determines the construction noise effect associated with general site works is short term, negative and slight to moderate.

All other NSLs within the vicinity of the site 5 works are at distances beyond 40m. At these distances, construction noise levels are below the significance threshold 65 dB $L_{Aeq,T}$. Reference to Table 9.2 determines the construction noise effect associated with both stages of construction is short term, negative and not significant at all remaining NSLs.

Comment on Cumulative Construction Noise

In the event that construction activities on the three sites associated with the proposed development occur concurrently, there is potential for cumulative noise impacts to occur. Due to the nature of the construction works associated with the proposed development, noise levels will dominate the noise environment when occurring in proximity to the NSLs along its immediate boundary. The noise contribution from other construction sites would need be equal to those associated with the proposed development to result in any cumulative effect.

In the event of the construction phases of the proposed development overlapping, predicted construction noise levels within Table 9.20 may rise by the order of +3 dB.

9.5.1.4 Construction Phase – Vibration

The main potential source of vibration during the construction of any residential development is associated with piling and any initial groundbreaking or demolition activities. It is not anticipated that groundbreaking or piling will be undertaken in relation to any of the sites associated with the proposed development based on site investigation works. Due to the standard construction techniques anticipated to be incorporated for the proposed development, the anticipated effect in relation to construction vibration will be brief to temporary, negative and not significant at all NSLs.

9.5.1.5 Construction Phase – Traffic

During the construction phase, traffic associated with the proposed development would consist of a mix of Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) travelling to and from the site.

In terms of the additional construction traffic on local roads that will be generated as a result of the proposed development, the following comment is presented: As stated in the DMRB Noise and Vibration (UKHE 2020), Volume 11, Section 3, Part 7, in order to increase traffic noise levels by 1 dB traffic volumes would need to increase by the order of 25%. It is considered that additional traffic introduced onto the local road network due to the construction stage of the development will introduce a level of traffic that will not result in a significant noise impact. However, a series of mitigation measures within section 9.6.1 will be implemented to ensure that noise from vehicle movements during construction is reduced to a minimum.

9.5.2 Operational Phase

9.5.2.1 Operational Phase – Mechanical Plant and Services

There are no sources of mechanical or electrical plant associated with the building types across the proposed development with potential to emit significant audible noise levels beyond the buildings themselves. (i.e. individual heat recovery systems serving the residential units where proposed). Any plant rooms required to serve the apartment blocks will likely be enclosed at basement level or at roof level. Any required plant items serving development buildings will be designed and located so that there is no negative impact on sensitive receivers within the proposed development itself (e.g. within apartments above plant rooms etc.)

In this instance, best practice is to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for the proposed development. The operational noise level from any building services plant at the nearest residences within the proposed development will be designed/attenuated to not exceed the internal noise levels discussed in section 9.2.2.1, to ensure no negative noise impacts occur within the proposed residential units.

Once noise emissions from operational plant are designed to not exceeded the internal noise criteria at the new residential units within the proposed development, the related noise impact to existing NSLs offsite will be imperceptible. The overall outward noise impact of mechanical and electrical services on site to existing surrounding NSLs is determined to be Neutral, Imperceptible and Long-Term.

9.5.2.2 Operational Phase – Additional Traffic on Public Roads

For the purposes of assessing the potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the proposed development, given that traffic from the development will make use of the existing road network.

A traffic impact assessment relating to the proposed development has been prepared as part of this EIAR: refer to Chapter 13 Material Assets (Transportation) for further information.

Traffic flows along the surrounding road network in terms of Annual Average Daily Traffic (AADT) for the Do Nothing and Do Something scenarios have been reviewed to calculate the change in traffic noise.

All operational traffic calculations are based on the completion of three development sites related to the proposed development and are considered a worst-case scenario in relation to noise. The assessment years are based on the forecast opening year of 2027 and the design year of 2042. The junctions used for the assessment are highlighted below in Figure 9.14.

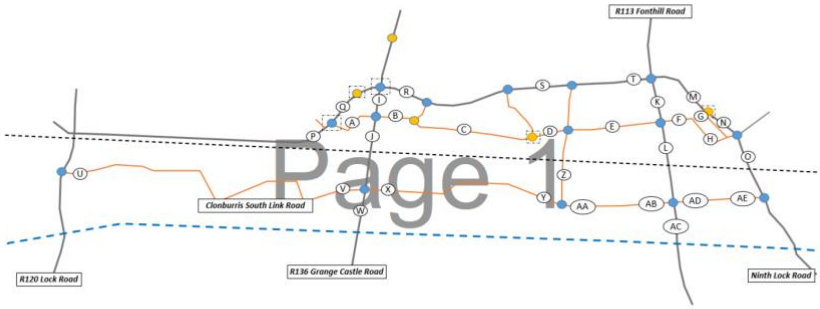

Figure 9.14: Traffic Assessment Junctions

The calculated changes in noise levels between the Do Nothing and Do Something for the opening year of 2027 are summarised below in Table 9.21.

Road Link	Total Vehicle AADT (2027 Do Nothing)	HGV% (2027 Do Nothing)	Total Vehicle AADT (2027 Do Something)	HGV% (2027 Do Something)	Calculated Change in Noise Levels, dB	Significance
A	3499	2.50%	6448	1%	2.0	Not Significant
B	5924	5.30%	6234	5%	0.1	Not Significant
C	6505	0.20%	6815	0%	0.2	Not Significant
D	6943	0.10%	7253	0%	0.2	Not Significant
E	5990	6.70%	6300	6%	0.1	Not Significant
F	5603	6.40%	5727	6%	0.1	Not Significant
G	2641	13.30%	2765	13%	0.1	Not Significant

Road Link	Total Vehicle AADT (2027 Do Nothing)	HGV% (2027 Do Nothing)	Total Vehicle AADT (2027 Do Something)	HGV% (2027 Do Something)	Calculated Change in Noise Levels, dB	Significance
H	698	0.00%	698	0%	0.0	Not Significant
I	18951	8.80%	19315	9%	0.1	Not Significant
J	19543	10.50%	21654	10%	0.2	Not Significant
K	18237	1.60%	18361	2%	0.0	Imperceptible
L	21348	0.90%	21410	1%	0.0	Imperceptible
M	7828	4.90%	7952	5%	0.0	Imperceptible
N	7192	1.00%	7385	1%	0.1	Not Significant
O	13127	1.10%	13320	1%	0.0	Imperceptible
P	13586	1.50%	14206	1%	0.1	Not Significant
Q	11743	1.00%	12053	1%	0.1	Not Significant
R	15646	3.90%	15956	4%	0.0	Imperceptible
S	14909	6.10%	15219	6%	0.1	Not Significant
T	14655	6.80%	14965	7%	0.0	Imperceptible
U	2602	2.50%	2602	3%	0.0	Imperceptible
V	4933	1.50%	4955	2%	0.0	Imperceptible
W	21401	12.00%	25096	10%	0.2	Not Significant
X	6231	8.10%	6380	8%	0.0	Imperceptible
Y	6976	7.00%	7074	7%	0.0	Imperceptible
Z	5702	8.60%	5708	9%	0.0	Imperceptible
AA	6865	0.50%	6963	1%	0.1	Not Significant
AB	7308	0.50%	7406	1%	0.1	Not Significant
AC	21245	0.90%	21354	1%	0.0	Imperceptible
AD	5343	1.00%	5348	1%	0.0	Imperceptible
AE	5603	0.90%	5609	1%	0.0	Imperceptible

Table 9.21: Potential Impact in relation to Operational Phase Traffic Do Nothing v Do Something 2027

The calculated changes in noise levels between the Do Nothing and Do Something for the design year of 2042 are summarised in Table 9.22.

Road Link	Total Vehicle AADT (2027 Do Nothing)	HGV% (2027 Do Nothing)	Total Vehicle AADT (2027 Do Something)	HGV% (2027 Do Something)	Calculated Change in Noise Levels, dB	Significance
A	7100	1.30%	10049	1%	1.2	Not Significant
B	7065	4.40%	7375	4%	0.1	Not Significant
C	5023	0.30%	5333	0%	0.3	Not Significant
D	5134	0.10%	5444	0%	0.3	Not Significant
E	3447	11.60%	3757	11%	0.1	Not Significant
F	5436	6.60%	5560	7%	0.1	Not Significant
G	4223	8.30%	4347	8%	0.1	Not Significant
H	864	0.00%	864	0%	0.0	Imperceptible
I	18247	9.20%	18611	9%	0.0	Imperceptible
J	21582	9.50%	23693	9%	0.2	Not Significant
K	10587	2.70%	10711	3%	0.1	Not Significant
L	13213	1.40%	13275	1%	0.0	Imperceptible
M	5854	6.60%	5978	6%	0.0	Imperceptible
N	4713	1.50%	4906	1%	0.1	Not Significant
O	7718	1.80%	7911	2%	0.1	Not Significant
P	16057	1.30%	16677	1%	0.1	Not Significant
Q	10177	1.10%	10487	1%	0.1	Not Significant
R	11665	5.20%	11975	5%	0.1	Not Significant
S	13665	6.70%	13975	7%	0.0	Imperceptible
T	15475	6.40%	15785	6%	0.0	Imperceptible
U	2958	2.20%	2958	2%	0.0	Imperceptible
V	5199	1.40%	5213	1%	0.0	Imperceptible

Road Link	Total Vehicle AADT (2027 Do Nothing)	HGV% (2027 Do Nothing)	Total Vehicle AADT (2027 Do Something)	HGV% (2027 Do Something)	Calculated Change in Noise Levels, dB	Significance
W	25177	10.20%	27538	9%	0.1	Not Significant
X	7200	7.00%	7298	7%	0.0	Imperceptible
Y	6992	7.00%	7090	7%	0.0	Imperceptible
Z	6391	7.70%	6397	8%	0.0	Imperceptible
AA	6822	0.50%	6920	1%	0.1	Not Significant
AB	7033	0.50%	7131	1%	0.1	Not Significant
AC	16380	1.20%	16449	1%	0.0	Imperceptible
AD	4483	1.20%	4489	1%	0.0	Imperceptible
AE	3041	1.70%	3047	2%	0.0	Imperceptible

Table 9.22: Potential Impact in relation to Operational Phase Traffic Do Nothing v Do Something 2042

The resultant change in noise level in relation to operational traffic of the development is calculated to vary across the various road links within the study area. However, across all links the worst case expected increase in noise level is less than 2.0 dB(A). With reference to Table 9.7, the resulting impact of operational traffic is determined to be long term, negative and imperceptible to not significant.

9.5.2.3 Operational Phase – Outward Noise from Retail and Creche

The proposed development includes retail and creche units as part of its design across the three sites. In relation to potential noise generated by these aspects of the development, the following comment is provided.

Section 9.2.2.1 derives appropriate external levels so as to achieve the required internal noise levels in line with the guidance of BS 8233. The introduction of retail spaces will introduce noise in the vicinity of existing NSLs. Likely sources of noise will be in the form of mechanical plant and human interactions that occur in external areas of these spaces. Any introduction of mechanical plant will need to comply with the criteria set within Section 9.2.2.1. Due to the distance between the retail units and the nearest NSLs within the development and the likely operating times, noise relating to humans is negligible. The operational impact of the retail units within the development is deemed to be negative, not significant and long term.

Measurement of noise levels generated by children playing outdoors at several crèches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,1hr}$ at distance of 5 metres. The nearest noise sensitive areas are located within the development at ground floor level, approximately 35m from the creche. Considering the usage of the creche area (e.g. external areas are only expected to be in use for a portion of the 16 hour daytime period) and the expected standard noise insulation of the façade, it is predicted that the internal criteria within Table 9.6 will be met in all residential units and the resultant noise impact due to the creche is negative, not significant and long term.

9.5.3 Operational Phase – Inward Impact Assessment

The development lands associated with the three sites of the proposed development are in close proximity to existing road networks and rail networks. The noise environment is described fully within Section 9.3. Noise from these existing sources has the potential to impact the residential developments proposed, particularly the residential dwellings in closest proximity to existing roads and rail.

The existing noise climate within the development lands was surveyed and the results summarised in Section 9.3.2 above.

To calculate the inward noise impact of the existing road network, a noise model was created and calibrated against the measured noise levels. Once agreement was achieved between the calibrated noise model and the measured survey results, the road noise model was developed to calculate the future noise levels at the existing developments, taking into account future traffic flows on the road network and the future link roads that will be constructed within and in the vicinity of the sites. The future noise model also takes into account the proposed removal of the wall that borders Thomas Omer Way.

9.5.3.1 Noise Model Validation

Noise levels recorded during both the attended and unattended surveys, along with traffic data received from the design team, were used to calibrate the noise model to within 1 dB of the measured values. The resultant noise levels output from the model differ slightly; however, strong agreement is noted across the various measurement positions. This is regarded as a very strong correlation in respect of predicted noise levels. Table 9.23 outlines the measured noise levels against the calculated noise levels within the noise model.

Location	Time Period	Measured Noise Level (dB)	Calculated Noise Level (dB)
UN3	Daytime	64	65
	Night	58	57
AT5	Daytime	70	70
	Night	61	62
AT4	Daytime	52	53
	Night	N/A	45

Table 9.23: Calculated v Measured Noise Levels at Development Sites

Figure 9.15 and Figure 9.16 display the calculated noise contours across the development sites for the day and night time periods at a height of 4m above ground level, i.e. the typical height of a first floor window.

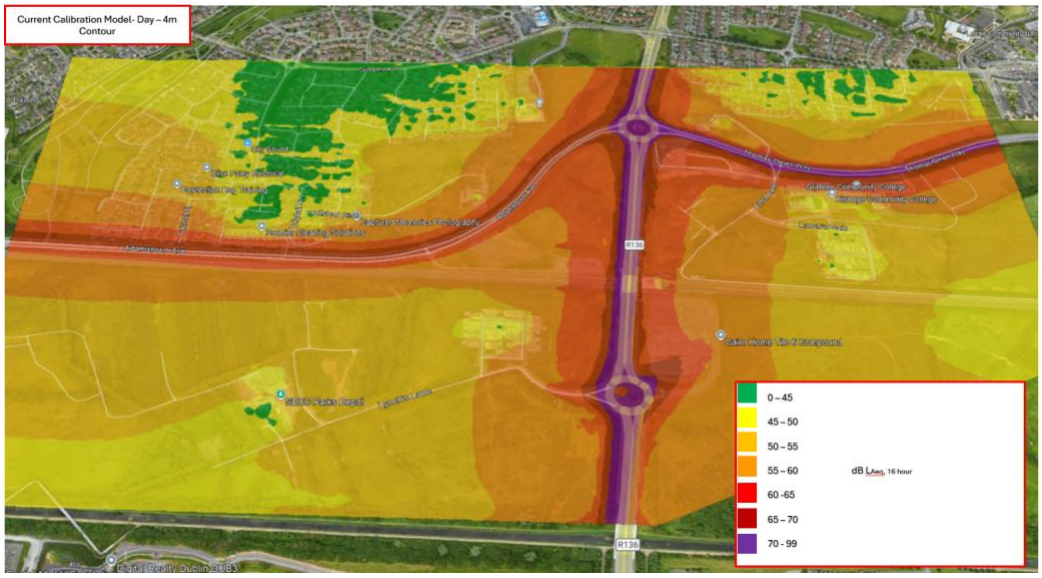

Figure 9.15: Noise Calibration Model Daytime dB $L_{Aeq,16hr}$

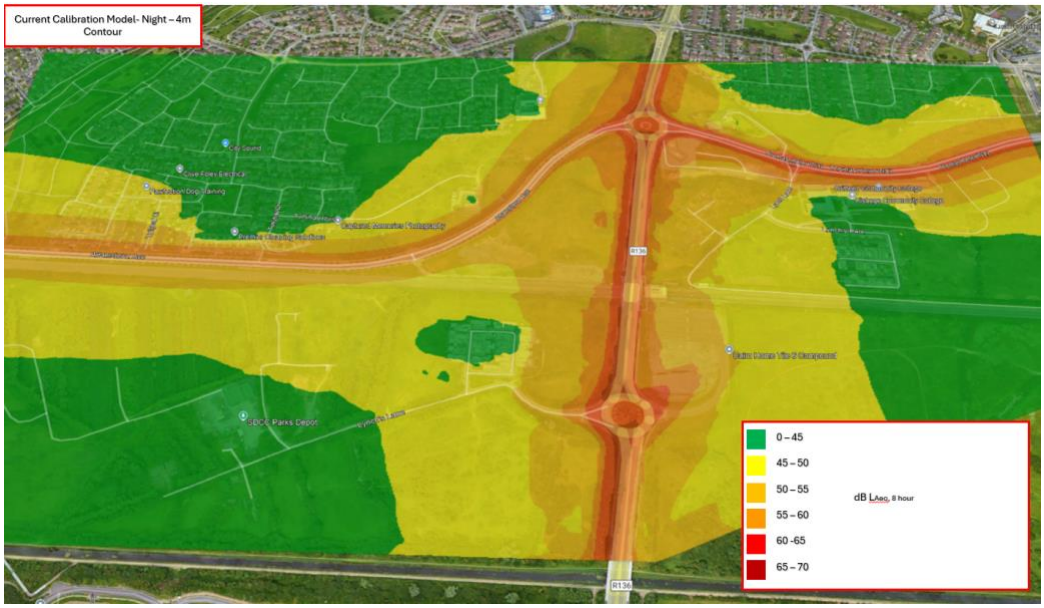

Figure 9.16: Noise Calibration Model Nighttime dB $L_{Aeq,8hr}$

The results of the modelling exercise demonstrate that highest noise levels are experienced along the boundaries of the existing roads in proximity to the road edges and reduce by varying degrees at distances further from the road edges across the three sites, in the absence of any development buildings.

9.5.3.2 Future Noise Climate

The future noise climate will change due to the number of roads and link roads to be built and upgraded within the Clonburris SDZ. These changes will also, in some cases, result in a change of speed along local road networks. To account for the potential change in noise levels across the three sites, the noise model of the proposed sites was updated to include the proposed developments and road designs for the future year of 2042. The information used was provided by the design team in

terms of site drawings that illustrate the future road networks associated with the sites and future traffic flows.

The future noise climate is also likely to be increased further due to the proposed Dart+ Southwest Railway expansion. Reference to Chapter 14 (Noise and Vibration) of this application, in particular Table 14.63, indicates that noise levels at the nearest NSLs at Adamstown Avenue (representative of site 3) and NSLs at Kishoge Road (representative of site 4) fall 3dB below the predicted road noise levels at NSLs along Adamstown Avenue and are equal to the night-time levels predicted at NSLs within site 4. With reference to this, the road noise levels will be used to assess the risk classification across the three sites, with a 3dB tolerance applied to the noise levels at site 4 and the southern buildings within site 3B facing on to the rail to account for a worst-case scenario. This is considered a robust and worst case assessment across the sites within the proposed development.

Figure 9.17 and Figure 9.18 display the calculated future noise contours across the development sites for the day and night time periods at a height of 4m above ground level taking into account the future development and future road networks proposed.

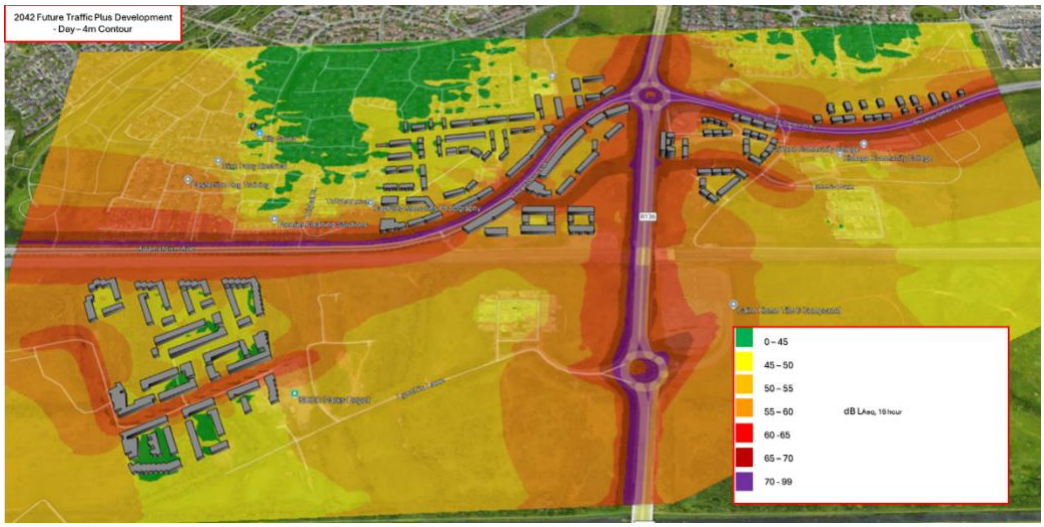

Figure 9.17: Future Noise Environment Across Site dB $L_{Aeq,16hr}$ Day time

Figure 9.18: Future Noise Environment Across Site dB $L_{Aeq,8hr}$ Nighttime

Figure 9.17 presents the daytime 16 hour calculated traffic noise levels across the development sites. The ranges of noise levels for the three sites are discussed below.

Site 3 Future Noise

The daytime future noise at site 3, along either side of Adamstown Avenue, is within the 65 to 70 dB $L_{Aeq,16hr}$ noise contour, reducing to between 55 and 60 dB $L_{Aeq,16hr}$ beyond the first line of development buildings that border the road edge. In site 3A, the noise levels reduce further to within the 50 to 55 dB $L_{Aeq,16hr}$ noise contour. In site 3B, where there is a proposed link road connecting the R136 and Adamstown Avenue, noise levels largely remain higher within the 55 to 60 dB $L_{Aeq,16hr}$ noise contour.

During the night-time period, future traffic noise levels are in the range of 55 to 60 dB $L_{Aeq,8hr}$ noise contour, reducing to between 50 and 55 dB $L_{Aeq,8hr}$ beyond the first line of development buildings that border the road edge. In site 3A, the noise levels reduce further to within the 40 to 45 dB $L_{Aeq,8hr}$ noise contour. In site 3B, where there is a proposed link road connecting the R136 and Adamstown Avenue, noise levels remain higher within the 55 to 60 dB $L_{Aeq,8hr}$ noise contour, with the exception of facades that are sufficiently screened from the road networks.

Site 4 Future Noise

The daytime future noise at site 4, along the northern boundary facing the rail line and Adamstown Avenue, is within the 60 to 65 dB $L_{Aeq,16hr}$ noise contour. These noise levels, however, are likely to rise by approximately +3 dB with the introduction of the Dart+ Southwest railway expansion. The noise levels then reduce to between 55 and 60 dB $L_{Aeq,16hr}$ beyond the first line of development buildings that border the rail and further reduce to within the 45 to 50 dB $L_{Aeq,16hr}$ deeper into the site. At development buildings that border the road edge of the proposed Clonburris South Link Road, noise levels are elevated to within the 60 to 65 dB $L_{Aeq,16hr}$ noise contour.

During the night-time period, future traffic noise levels along the northern boundary facing the rail line and Adamstown Avenue are within the 50 to 55 dB $L_{Aeq,8hr}$ noise contour. These noise levels, however, are likely to rise by approximately +3 dB with the introduction of the Dart+ Southwest railway expansion. The noise levels then reduce to between 45 and 50 dB $L_{Aeq,8hr}$ beyond the first line of development buildings that border the rail, and further reduce to within the 40 to 45 dB $L_{Aeq,8hr}$ deeper into the site. At development buildings that border the road edge of the proposed Clonburris South Link Road, noise levels are elevated to within the 55 to 60 dB $L_{Aeq,8hr}$ noise contour.

Site 5 Future Noise

The daytime future noise at site 5, along the boundaries facing the R136, Thomas Omer Way, and the proposed link road through the development site, is within the 65 to 70 dB $L_{Aeq,16hr}$ noise contour. The noise levels then reduce to between 60 and 65 dB $L_{Aeq,16hr}$ beyond the first line of development buildings that border the road networks. Within site 5A, the noise levels remain largely within the 55 to 60 dB $L_{Aeq,16hr}$ for the remainder of the site due to being bounded on all sides by road networks. Within site 5B, the noise levels reduce further into the site, decreasing to within the 50 to 55 dB $L_{Aeq,16hr}$ noise contour further north within the site.

During the night-time period, future traffic noise levels along the boundaries facing the R136, Thomas Omer Way, and the proposed link road through the development site, are within the 60 to 65 dB $L_{Aeq,8hr}$ noise contour. The noise levels then reduce to between 55 and 60 dB $L_{Aeq,8hr}$ beyond the first line of development buildings that border the road networks. Within site 5A, the noise levels remain largely within the 50 to 55 dB $L_{Aeq,8hr}$ for the remainder of the site due to being bounded on all sides by road networks. Within site 5B, the noise levels reduce further into the site, decreasing to within the 45 to 50 dB $L_{Aeq,8hr}$ noise contour further north within the site.

The information outlined above has been used to categorise the noise risk classification of the site.

9.5.3.3 Stage 1: Noise Risk Classification of the Sites

Noise levels across the proposed development have been categorised for both the 16 hour daytime (07:00 to 23:00hrs) $L_{Aeq,16hr}$ and the 8 hour night-time period (23:00 to 07:00hrs), $L_{Aeq,8hr.}$ Giving consideration to the measured and calculated noise levels presented in the previous sections for a

future scenario with the updated road layouts and increased traffic flows on both road networks and rail networks during the year 2042, the initial site noise risk assessment has concluded that the level of risk across all three sites falls into the Medium to High noise risk categories.

The ProPG document states the following with respect to medium and high risks areas:

Medium Risk As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrates that a significant adverse noise impact will be avoided in the finished development.

High Risk High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Given the above, it can be concluded that the development sites within the proposed development can be categorised as Medium to High Noise Risk and as such the Acoustic Design Statement (following here and also in subsequent sections) is required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that adverse noise impacts will be avoided in the final development.

It should be noted that the ProPG document states the following with regard to how the initial site noise risk is to be used:

"It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as a negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design"

Following the guidance contained in the ProPG document, residential development on sites that are identified as having medium or high noise levels is not precluded. The document merely recommends that a more considered approach will be required to ensure that developments on higher risk sites are suitably designed to mitigate the noise levels. The primary goal of the approach outlined in the ProPG document is to ensure that the best possible acoustic outcome is achieved for a particular site.

9.5.3.4 Stage 2: Noise Assessment

Façade Noise Levels

As demonstrated in the previous section, current or potential future road noise across the three sites is categorised as low to medium noise risk.

The future noise contours modelled and illustrated within Figure 9.17 and Figure 9.18 present the calculated noised levels at the various facades within the proposed development. The calculated contours relate to 4m above the ground.

Element 1 – Good Acoustic Design Process

In practice, good acoustic design should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life of occupants or compromising other sustainable design objectives. Section 2.23 of the ProPG document outlines the following checklist for Good Acoustic Design:

- Check the feasibility of relocating or reducing noise levels from relevant sources;
- Consider options for planning the site or building layout;

- Consider the orientation of proposed building(s);
- Select construction types and methods for meeting building performance requirements;
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
- Assess the viability of alternative solutions; and
- Assess external amenity area noise.

In the context of the proposed development, each of the considerations listed above has been addressed in the following subsections.

Relocation or Reduction of Noise from Source

Noise sources incident upon the development site have been determined to be medium to high risk. The control of noise at source from road traffic or rail noise is outside of the site boundary and hence is outside of the scope of the proposed development.

Planning, Layout and Orientation

As part of the project design, the majority of residential buildings within the proposed development across the three sites are set back from the road boundary and where possible screened from noise sources by other buildings within the development's design. The closest properties to the road and rail will experience highest potential noise levels, with reduced noise levels further into the sites.

Select Construction Types for meeting Building Regulations

The design of all buildings is required to meet with all relevant parts of the Building Regulations. The specific detail will be completed at detailed design stage. In terms of the building sound insulation, the glazed elements and any required ventilation paths to achieve compliance with Part F of the Building Regulations will be the weakest elements in the façade.

Consideration will therefore be given to the provision of sound insulation performance for glazing and ventilation systems, where required to achieve suitable internal noise levels within the development. This is specified within Table 9.26 and the figures below. Achievement of acceptable internal ambient noise levels does not form part of building regulation requirements. However, this will be incorporated into the building design in line with best practice and compliance with the guidance set out in the ProPG document.

Impact of noise control measures on fire, health and safety

The good acoustic design measures that have been implemented on site, e.g. locating properties away from the road, are considered to be cost neutral and do not have any significant impact on other issues.

Assess External Amenity Area Noise

The ProPG document provides the following advice with regard to external noise levels for amenity areas in the development:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

Figure 9.19 presents the calculated day time noise levels across the sites with the development buildings in place. The contours are calculated for a height of 1.5m.

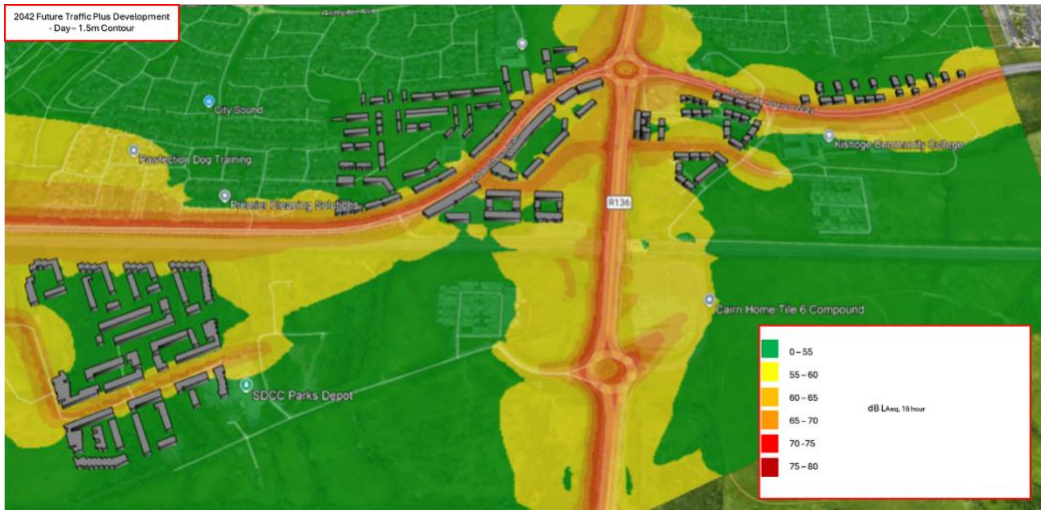

Figure 9.19: External Amenity Areas at 1.5m Height dB $L_{Aeq,16hr}$ Daytime

External noise levels within the majority of communal open spaces across the development sites are within the recommended range of noise levels from the ProPG document of between 50 – 55 dB $L_{Aeq,16hr}$

Outdoor space within site 5a will experience higher noise levels due to proximity to local roads. However, this is offset somewhat by the desirability of proximity to urban surroundings and proximity and accessibility of public transport and local amenities. There is also provision of a large amenity space within site 5b that falls within the desirable noise range of between 50 – 55 dB $L_{Aeq,16\ hr.}$

Summary

Considering the constraints of the site, insofar as possible and without limiting the extent of the development area, the principles of Good Acoustic Design have been applied to the development.

Element 2 – Internal Noise Levels

To determine the inward noise impact for noise sensitive properties proposed as part of the development, it is necessary to determine the internal noise levels within the proposed buildings. These can then be compared against appropriate internal noise criteria from BS 8233, as summarised in Table 9.6.

In addition to these absolute internal noise levels, the ProPG document provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions

Discussion on Open/Closed Windows

The typical level of sound reduction offered by a partially open window falls in the region of 10 to 15 dB. Considering the design goals outlined in Table 9.9, and a sound reduction across an open window of 15 dB, the free-field noise levels required to ensure internal noise levels do not exceed good or reasonable internal noise levels for daytime or night time periods are summarised in Table 9.25.

Level Desired	Daytime External Noise Level Ranges (07:00 – 23:00hrs)	Nighttime External Noise Level Ranges (07:00 – 23:00hrs)
Good (i.e., at or below the internal noise levels)	50 – 55 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,8hour}$

Level Desired	Daytime External Noise Level Ranges (07:00 – 23:00hrs)	Nighttime External Noise Level Ranges (07:00 – 23:00hrs)
Reasonable (i.e., 5 dB above the internal noise levels)	55 – 60 dB $L_{Aeq,16hour}$	50 dB $L_{Aeq,8hour}$

Table 9.24: External noise levels required to achieve suitable internal noise levels

Daytime and nighttime noise levels calculated across the three proposed development sites are largely above that which would be considered good or reasonable with windows open; hence appropriate acoustic specifications will be provided to ensure residential rooms can achieve good internal noise levels.

Façade Specification

The British Standard BS EN 12354-3: 2000: Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound, provides a calculation methodology for determining the sound insulation performance of the external envelope of a building. The method is based on an elemental analysis of the building envelope and can take into account both the direct and flanking transmission paths. The Standard allows the acoustic performance of the building to be assessed taking into account the following:

- Construction type of each element (i.e, windows, walls, etc.);
- Area of each element;
- Shape of the façade; and
- Characteristics of the receiving room.

The principles outlined in BS EN 12354-3 are also referred to in BS 8233, and Annex G of BS 8233 provides a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS 8233 has been adopted here to determine the required performance of the building façades.

Glazing

As is the case in most buildings, the windows, or glazed elements, of the building envelope are typically the weakest element from a sound insulation perspective. BS 8233 is the relevant standard that applies to indoor ambient noise levels. The guidance provided in this standard is summarised in Table 9.6 of this report. In this instance, the facades along the boundaries indicated in red within Figure 9.20 to Figure 9.22 will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 9.26. Table 9.26 also sets out a minimum sound insulation performance requirement for the remainder of the facades within the proposed development sites.

The overall Rw outlined in this section are provided for information purposes only. The over-riding requirement is the Octave Band sound insulation performance values, which may also be achieved using alternative glazing configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 9.26.

The details of any performance requirements of façade elements including ventilation will be further examined and interrogated during the detailed design of the proposed development for all three sites due to the multiple noise sources and complex nature of the surrounding noise environment.

SRI	Octave Band Centre Frequency (Hz)						Total dB R_w
	125	250	500	1kHz	2kHz	4kHz	
Red Marked Facades	26	27	34	40	38	46	37
All other Facades	24	20	25	35	38	35	31

Table 9.25: Sound Insulation performance requirements for facades.

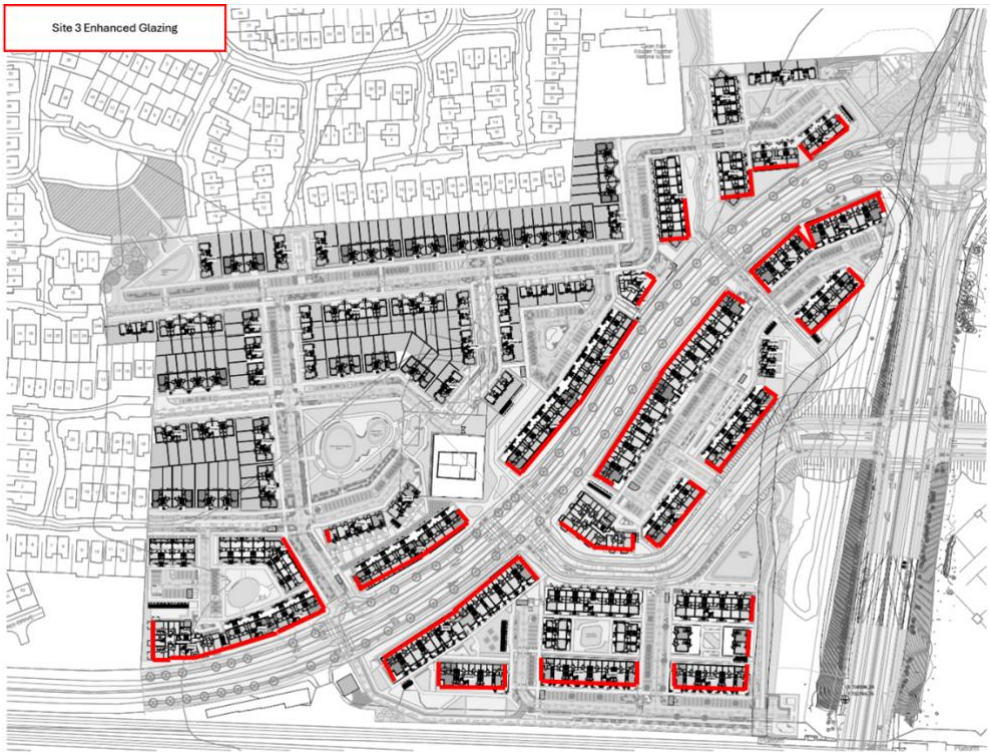

Figure 9.20: Site 3 Enhanced Glazing Locations

Figure 9.21: Site 4 Enhanced Glazing Locations

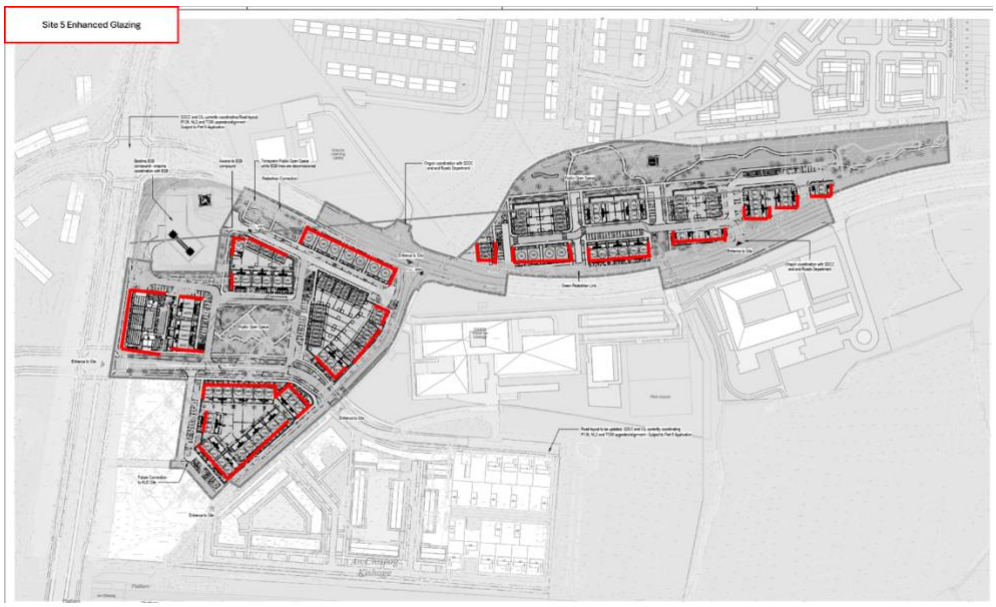

Figure 9.22: Site 5 Enhanced Glazing Locations

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the "glazing system" is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

As part of the detailed design of all residential blocks, the specifics in terms of octave band SRI performances will be reanalysed to take account of the finalised room layouts, room volumes and glazing dimensions, as well as any additional road layouts within the SDZ.

Element 3 – External Amenity Areas

External noise levels within the public open spaces and private gardens across the three development sites are predicted to be within the ProPG recommended range of noise levels of between 50 and 55 dB $L_{Aeq,16hr}$. It is considered that the objective of achieving suitable external noise levels is largely achieved within the overall site in areas screened from noise sources. In areas that are exposed to roads and rail, the external noise levels are likely to exceed the ProPG recommended range for external noise. However, this could be offset due to the desirability of proximity to urban surroundings and of proximity and accessibility to public transport and local amenities.

Comment on Inward Noise Impact of Aircraft – Casement Aerodrome

The closest site within the proposed development is approximately 3km from the Casement Aerodrome, which operates military aircraft. The aerodrome, due to its military nature, is in operation 24 hours a day, 365 days a year, subject to operational requirements. Aircraft types range from rotary light aircraft, to heavy and fixed wing and heavy weight aircraft.

Detailed information on the current operation of Casement Aerodrome was not available at the time of this assessment. However, based on historical information in the public domain obtained by AWN in 2019, it is understood that over 21,000 movements are recorded annually. AWN understand that typically 10-15% of aircraft movements took place during the more sensitive nighttime period (23:00hrs to 07:00hrs), which amounts to numbers of the order of 9 aircraft movements per night.

During the attended daytime noise surveys, aircraft movement were observed but were not noted as being a primary noise source. Where aircraft movements were noted they were faintly audible and not the dominant noise source at the time. It is likely that other aircraft movements occurred during the duration of the survey but were not readily discernible.

As such, it is considered that standard building constructions would provide adequate sound insulation to the intrusion of any aircraft noise, without the need for mitigation measures.

9.5.4 Operational Phase – Vibration

The VDV value has been calculated for the day and night-time periods at a position representative of the closest building façades. The calculation accounts for the number of future train pass-bys per day, considering the Dart+ Southwest rail expansion and assuming the maximum VDV value per train pass-by. The calculated values presented in Table 9.18 are below a threshold where a low probability of adverse comment would be expected within a building, as defined in BS 6472-1 (2008).

In addition, reference has been made to Table 14.68 of Chapter 14 within the Dart+ Southwest application. The likely levels of operational vibration indicated in this table are well below the orders of magnitude where a significant effect will occur at properties 10m from the track. Properties within the proposed development are set back at distances beyond 10m; therefore, it can be concluded that the resultant impact of operational vibration is deemed to be negative, not significant, and long-term.

9.6 MITIGATION MEASURES (AMELIORATIVE, REMEDIAL OR REDUCTIVE MEASURES)

9.6.1 Construction Phase

The assessment detailed in Section 9.5.1.3 has determined that construction activities can largely operate within the adopted construction noise threshold levels at the closest off-site NSLs for the majority of the construction phase, due to the distance from the works and the construction activities

involved. At the closest NSLs, the CNT values have the potential to be exceeded at NSLs adjacent to site 3 during the site clearance and ground preparation works.

Vibration levels at the closest neighbouring buildings are expected to be orders of magnitude below the limits set out in section 9.2.1.5 to avoid any cosmetic damage to buildings.

Best practice noise and vibration control measures will be employed by the contractor during the construction phase in order to avoid exceedance of the adopted construction noise threshold values at the nearest NSLs. The best practice measures set out in BS 5228 (2009 +A1 2014) Parts 1 and 2 will be complied with. This includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- Selection of quiet plant;
- Noise control at source;
- Screening; and
- Liaison with the Public.

Further comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, hours of work, and noise monitoring, where required.

9.6.1.1 Selection of Quiet Plant

The potential for any item of plant to result in exceedance of construction noise thresholds will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever practicable (e.g. plant items with sound attenuation incorporated). Should a particular item of plant already on the site be found to exceed the construction noise thresholds, the first action will be to identify whether the item can be replaced with a quieter alternative.

The appointed contractor will evaluate the choice of excavation, breaking, piling or other working method taking into account various ground conditions and site constraints. Where alternative lower noise generating equipment are available that will provide equivalent structural / excavation results, these will be selected to control noise within the relevant thresholds, where it is practicable to do so.

9.6.1.2 Noise Control at Source

The following measures will be implemented, if required, by the appointed contractor to control noise at source. These measures relate to specific site considerations:

- For mobile plant items such as dump trucks, cranes, excavators and loaders, the installation of an acoustic exhaust, utilising an acoustic canopy to replace the normal engine cover and / or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant will be switched off when not in use and not left idling.
- For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker “tool” and ensuring any leaks in the air lines are sealed.
- Where compressors, generators and pumps are located in proximity to NSLs and have the potential to exceed the construction noise thresholds, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- Resonance effects in panel work or cover plates can be reduced through stiffening or the application of damping compounds, while other noise nuisance can be controlled by fixing resilient materials in between the surfaces in contact.
- For all materials handling, ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.

9.6.1.3 Screening

Screening is an effective method of reducing CNLs at a receiver locations and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver. Standard construction site hoarding (2.4 m in height) with a mass per unit of surface area greater than 7 kg/m2 can provide adequate sound insulation. This is recommended as a minimum around the northern site boundaries of the proposed development site.

Erection of localised demountable enclosures or screens will be used around piling rigs, breakers or drill bits, as required, when in operation in proximity to NSLs with the potential to exceed the construction noise thresholds. Annex B of BS 5228–1 (Figures B1, B2 and B3) provides typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on-site from standard materials. A well placed and designed mobile temporary screen around a pile, breaker or excavation can effectively reduce noise emissions by 10 dB(A).

In addition, careful planning of the construction site layout will also be considered. The placement of site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening.

9.6.1.4 Hours of Work

Working hours for the three sites are set out below and in their respective CEMPs. Sunday, Bank Holiday work or out of hours work will only take place periodically by agreement with South Dublin County Council.

9.6.1.5 Liaison with the Public

A designated Community Liaison Officer (CLO) will be appointed to site during construction works. Any noise complaints will be logged and followed up in a prompt fashion by the CLO. In addition, prior to particularly noisy construction activity, the CLO will inform the nearest NSLs of the time and expected duration of the noisy works.

9.6.1.6 Monitoring

During the construction phase the contractor will carry out noise monitoring at representative NSLs to evaluate and inform the requirement and / or implementation of noise management measures. Noise monitoring will be conducted in accordance with ISO 1996–1 (ISO 2016) and ISO 1996–2 (ISO 2017).

9.6.1.7 Vibration Control

The likely vibration levels associated with construction activities associated with the proposed development are not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or cosmetic damage to buildings.

Vibration from construction activities will be limited to the values set out in Table 9.4 to avoid any form of potential cosmetic damage to buildings and structures. Monitoring will be undertaken at identified sensitive buildings, where proposed works have the potential to be at or exceed the vibration limit values in Table 9.4.

9.6.2 Operational Phase

9.6.2.1 Traffic Along Surrounding Road Network

Changes to traffic flows will result in a not significant increase in noise level in the surrounding environment. Therefore, no mitigation measures are necessary in this case.

9.6.2.2 Mechanical Plant and Services

With consideration at the detailed design stage, the selection and location of plant items within the proposed development and associated buildings will ensure that noise emissions from any mechanical and electrical building services plant do not exceed the relevant noise criteria within Section 9.2.2.1; therefore no further mitigation is required. In addition, noise emissions should be broadband in nature and should not contain any tonal or impulsive elements.

Once operational noise emissions are controlled within the development site, there will be no perceptible noise impact at sensitive receivers off-site.

9.6.2.3 Retail and Creche Noise

As outlined within Section 9.5.2.3, noise related to the proposed plaza and creche will result in a not significant effect. Notwithstanding this, the operation of both the creche and plaza will be limited to within daytime hours and shall not cause noise nuisance that exceeds the internal noise criteria presented within Section 9.2.2.1.

9.6.2.4 Inward Impact

Mitigation is listed by the way of minimum sound insulation requirements within Table 9.26. Notwithstanding this, as part of the detailed design of all residential blocks, the specifics in terms of octave band SRI performances will be reanalysed to take account of the finalised room layouts, room volumes and glazing dimensions, as well as any additional road layouts within the SDZ.

9.7 RESIDUAL IMPACT OF THE PROPOSED DEVELOPMENT

9.7.1 Construction Phase

The use of best practice noise control measures, hours of operation, scheduling of works within appropriate time periods, and noise monitoring during this phase will be implemented. With the inclusion of the various noise and vibration control measures on site discussed in Section 9.6.1, it is expected that calculated noise levels in Table 9.20 can be reduced by 5 dB.

After the implementation of mitigation measures, there is likely to be residual construction noise levels slightly above the CNT of 65 dB $L_{Aeq,T}$ ¬during the site clearance phase at NSLs adjacent to site 3. Referring to Table 12, there is therefore potential for a residual short term, negative and moderate to significant impact at these NSLs during the site clearance and ground preparation phase of the works.

The majority of residual construction noise impacts at NSLs during the remaining work phases at all sites are expected to be controlled to within the CNT, thus resulting in a temporary to short-term, negative and not significant effect.

The residual effect of construction vibration is short term, negative, and not significant.

9.7.2 Operational Phase

Noise levels from any building services plant within the development site will be controlled to not exceed the internal noise levels within Section 9.2.2.1 for residential dwellings within the proposed development.

Once operational noise emissions are controlled within the development site, noise emissions outside the site will be imperceptible. The residual noise effect is neutral, imperceptible and long-term.

Traffic along the surrounding road network will not lead to a change in noise level that would pose any significant effect. The resultant impact is long-term, negative and not significant.

9.7.3 Inward Impact

Noise levels inwards on the proposed development have been measured, calculated and assessed. Mitigation measures in the way of higher enhanced glazing have been specified to ensure that good or reasonable internal noise levels are achieved across the proposed development. The resultant residual noise impact at residents within the development will be negative, not significant and long term.

9.7.4 Cumulative Impact

A full list of developments that are currently permitted or under construction within the surrounding area is contained in the project description chapter. The largest infrastructure project within the vicinity of the proposed development is the Dart+ Southwest project. This has been taken into account within the assessment when considering future rail noise and vibration impacts upon the proposed development.

In the event that construction activities at nearby sites are taking place concurrently with the construction of the proposed development, there is potential for cumulative noise impacts to occur. Due to the nature of construction works associated with each site of the proposed development, noise levels from this site will dominate the noise environment when occurring in proximity to the closest noise sensitive locations along its immediate boundary. The noise contribution from other construction sites would need be equal to those associated with the closest site in order to result in any cumulative effect.

The operational noise limits set for on-site buildings are designed to avoid any significant increase in the prevailing background noise environment external to the site. Operational noise limits included in this report refer to cumulative noise from all fixed installations on site. The design of plant and other fixed installations will be progressed during the design stage to ensure the noise limits at off-site noise sensitive locations are not exceeded.

Traffic volumes assessed take account of the additional traffic from other permitted developments and therefore the traffic noise assessment presented is already assessing the cumulative impact. This assessment has concluded there will be no significant noise impact due to operational traffic.

In conclusion, there is potential for a temporary increase in cumulative construction noise if construction works on the three sites within the development take place concurrently, or other developments occur at the same time. Residual cumulative effects related to the construction phase, post-mitigation, are likely to be not significant. This is also true for the operational phase, provided that the operational noise levels outlined in Section 9.2.2.1 are adhered to during the detailed design, and the mitigation measures specified in Section 9.6 are followed.

9.8 MONITORING

9.8.1 Construction Phase

During the construction phase, the contractor for each site will carry out noise monitoring at representative NSLs to evaluate and inform the requirement and / or implementation of noise management measures. Noise monitoring will be conducted in accordance with ISO 1996–1 (ISO 2016) and ISO 1996–2 (ISO 2017).

9.8.2 Operational Phase

There are no proposed monitoring requirements associated with the operational phase of the proposed Development.

9.9 DIFFICULTIES ENCOUNTERED

There were no significant difficulties encountered in compiling this chapter.