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PROPOSED RESIDENTIAL DEVELOPMENT ON LANDS AT THE FORMER BLAKES CROSS AND ESMONDE MOTORS SITES

NOISE & VIBRATION IMPACT ASSESSMENT

Technical Report Prepared For

Cairn Homes Properties Ltd
7 Grand Canal
Grand Canal Street Lower
Dublin 2

Technical Report Prepared By

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Our Reference

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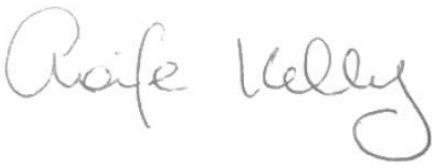
Signature		
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EXECUTIVE SUMMARY

Planning Permission is currently being sought from An Bord Pleanála for the construction of a mixed use development comprising BTR residential development, restaurant/cafe, community sports hall, creche, office space and open space at the former Blakes and Esmonde Motors sites, Stillorgan Road, Co. Dublin.

This report, prepared by AWN Consulting Limited (AWN), discusses the potential noise and vibration impacts of the proposed development works in the context of current relevant standards and guidance.

The existing noise climate has been surveyed during both daytime and night-time periods and have been found to be dominated by traffic on surrounding roads and other urban noise sources within this suburban area.

The assessment has considered the impact of noise during both the construction and operational phases of the proposed development. A review has been undertaken of the most appropriate guidance and standards relating to both phases and appropriate criteria set for each.

The potential noise impact during the construction phase has been assessed at the nearest residential noise sensitive locations (NSLs) with reference to BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*. The report has set out a range of predicted indicative construction noise levels associated with the varying construction phases in addition to best practice noise control measures to minimise the impact from this phase.

During the operational phase, potential sources of noise are considered to be limited to building services plant and additional traffic on surrounding roads, along with a slight potential for noise impact from delivery activity. In respect of building services, plant selection at detailed design stage will ensure that the noise criteria set out in this report are met. Mitigation measures are not expected to be required for development-generated traffic.

The site has been identified as having a range of noise levels associated with a ‘Medium to High Risk’ of noise impacts due to the surrounding roads. Based on façade treatments presented in this report, the proposed development can be designed to function in compliance with the requirements of ProPG once appropriate consideration is given at the detailed design stage to the sound insulation mitigation measures and principles outlined in this report.

CONTENTS

1.0 INTRODUCTION

This document has been prepared by AWN Consulting Ltd. (AWN) to assess the potential noise and vibration impacts of the proposed development in the context of current relevant standards and guidance.

This assessment has been prepared by Mike Simms BE MEngSc MIOA MIET, Senior Acoustic Consultant at AWN, who has worked in the field of acoustics for 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, energy, industrial, commercial and residential.

This report presents information on the assessment of noise and vibration impacts on the surrounding environment during both the construction and operational phases. The principal objectives of the Noise and Vibration assessment will be to specify appropriate limit values and mitigation measures to ensure that the impact on the environment is minimised and complied with acceptable standards and guidelines.

2.0 PROPOSED DEVELOPMENT

The development will consist of the construction of a mixed use scheme of 377 no. “Built to Rent” BTR apartments, Community Sports Hall (933 sq. m), along with 5 no. restaurant/cafés (c. 841.2 sq.m), creche (c. 215 sq. m), office hub (195.3 sq. m) and ancillary residents’ support facilities/services (1,016 sq. m) laid out in 6 no. blocks ranging in height from 3-9 storeys (over basement) comprising 21 no. studio apartments, 189 no. 1 bedroom apartments, 159 no. 2 bedroom apartments & 8 no. 3 bedroom apartments, and public realm upgrades on a site of c. 1.41 hectares.

Building 1 (Part 3 - 6 & 7 storeys) consists of 77 no. apartments comprising 13 no. studio apartments, 30 no. 1 bedroom apartments, 33 no. 2 bedroom apartments, 1 no. 3 bedroom apartment.

Building 2 (Part 3 – 5, 7 & 8 storeys) consists of 95 no. apartments comprising 7 no. studio apartments, 57 no. 1 bedroom apartments, 24 no. 2 bedroom apartments, 7 no. 3 bedroom apartments.

Building 3 (9 storeys) consists of 54 no. apartments comprising 18 no. 1 bedroom apartments and 24 no. 2 bedroom apartments.

Building 4 (7 storeys) consists of 60 no. apartments comprising 42 no. 1 bedroom apartments & 18 no. 2 bedroom apartments.

Building 5 (7 storeys, with lower ground floor to the west) consists of 62 no. units comprising 1 no. studio apartment, 26 no. 1 bedroom apartments, & 35 no. 2 bedroom apartments.

Building 6 (5 & 6 storeys, with lower ground floor to the south) consists of 29 no. units comprising 16 no. 1 bedroom apartments and 13 no. 2 bedroom apartments.

The development also includes: c. 841 sq.m. retail / restaurant / café floorspace (5 no. units at ground floor/lower ground floor/plaza levels), a (double height part) community sports hall including ancillary areas (c. 906 sq. m), and a creche of c. 215 sq. m: Residential amenity floorspace (c. 1,257 sq. m).

Public open space, communal open space for resident access only;

Basement car parking spaces (119 no.) and 1 no. set down surface car parking space as well as 771 no. cycle spaces and vehicular access to the site will be from 'The Hill'.

3.0 METHODOLOGY

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 Phase and
- Operational Phase.

The construction phase will involve site clearing and excavations, services installations, construction of building frame and envelope and landscaping. This phase will generate the highest potential noise impact due to the works involved, however, the phase is short term and expected to be completed within 24 months.

The primary potential sources of outward noise in the operational context are long term and will comprise traffic movements to site using the existing road network and building services plant noise. These issues are discussed in detailed in this report.

The assessment of impacts has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this report. In addition to specific guidance documents for the assessment of noise and vibration impacts which are discussed further in the relevant sections, the following guidelines were considered and consulted for the purposes of this report:

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports Draft August 2017, and;
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

The study has been undertaken using the following methodology:

- An environmental noise survey has been undertaken in the vicinity of the subject site in order to characterise the existing baseline noise environment;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations will be performed during the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations will be performed to assess the potential impacts associated with the operational of the development at the most sensitive locations surrounding the development site; and
- A schedule of mitigation measures will be proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

3.1 Construction Phase Assessment Criteria

3.1.1 Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local Authorities typically control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise.*

The approach adopted here calls for the designation of an NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a sensitive receptor during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values recommended by BS5228-1 are set out in Table 1.

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Daytime (08:00 – 19:00) and Saturdays (08:00 – 14:00)	65	70	75
Evenings and weekends [D]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

Table 1 Example Threshold of Significant Effect at Dwellings

Notes
A. Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D. 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for assessing construction noise impact at residential properties.

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.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5 dB. Based on review of existing noise levels obtained from the noise survey, relevant BS5228-1 threshold values at the various assessment locations are presented in Table 2. If the construction noise level exceeds the appropriate category value, then a potential significant effect is deemed to occur.

Period	Construction Noise Threshold Value $L_{Aeq,1hr}$ (dB)	Baseline Noise Category
Daytime (07:00 – 19:00) and Saturdays(07:00 – 13:00)	65	A
Evening(19:00 to 23:00hrs)	55	A
Night time (23:00 to 07:00hrs)	45	A

Table 2 Rounded Baseline Noise Levels and Associated Categories

Guidance on the degree of significance is presented the UK document Design Manual for Roads and Bridges (2020) *LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2.* The approach is as follows:

- to determine the threshold value for construction noise according to the method from BS5228 described above and
- to compare the predicted construction noise level with the existing noise levels and the threshold value according to the criteria in the table below.

Potentially this procedure is to be followed separately for each NSL, however in this instance as the existing noise levels at all survey locations correspond to Category A according to table above, all NSLs are considered together.

Similarly, for this proposed development the vast majority of construction works will take place within the 'Daytime' period, i.e. 07:00 – 19:00 on Mondays to Fridays and 07:00 – 13:00 on Saturdays.

The magnitude of the construction noise impact according the DMRB is mapped to the EPA significance terms as detailed in Table 3.

Construction Noise Level	Magnitude of Impact (DMRB)	EPA Significance of Effect
Below or equal Baseline Noise Level	Negligible	Not Significant
Above Baseline and below or equal to threshold	Minor	Slight – Moderate
Above threshold and below or equal to threshold + 5dB	Moderate	Moderate – Significant
Above threshold + 5dB	Major	Significant – Very Significant

Table *3* Description of Construction Noise Impacts based on DMRB

3.1.2 Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. For the purpose of this development, vibration values levels used for the purposes of evaluating building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Building Damage

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS 7385: *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993); and

- BS 5228: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.*

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above.

BS 5228-2 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

Suggested levels of allowable vibration (in terms of peak particle velocity) at the closest part of a sensitive property to the source of vibration are summarized in Table 4.

Line (see Figure 1)	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings.	50 mm/s at 4Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial building types.	15 mm/s at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

Table 4 Transient Vibration Guide Values for Cosmetic Building Damage

Note 1 Values referred to are at the base of the building.
Note 2 For Line 2, at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded.

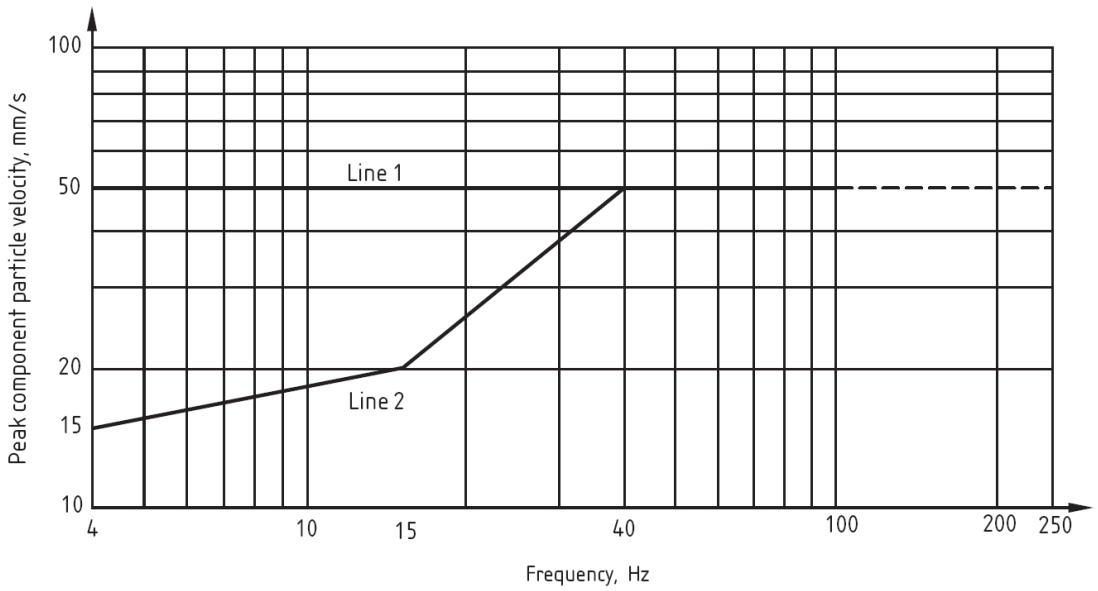

Figure 1 Transient Vibration Guide Values for Cosmetic Damage

The guide values contained in Table 4 relate to predominantly transient vibration which does not give rise to resonant responses in structures, and to low rise buildings.

Human Perception

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of traffic, vibration is perceptible at around 0.5 mm/s and may become disturbing or annoying at higher magnitudes. Higher levels of vibration, however, are typically tolerated for single events or events of short duration. For example, during piling, one of the primary sources of vibration during construction, vibration levels may typically be tolerated at up to 2.5 mm/s. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant to such activities during the night-time (or if they are trying to sleep during the daytime).

BS 5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of the peak particle velocity (PPV). Table 5 below summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1 mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.
10 mm/s	Vibration is likely to be intolerable for any more than a brief exposure to this level
Table 9.5 Guidance on effects of human response to PPV magnitudes	

Table 5 Guidance on effects of human response to PPV magnitudes

Expected vibration levels from the construction works will be discussed further in Section 5.1.

3.2 Operational Phase Assessment Criteria

3.2.1 Building Services Plant Noise

The most appropriate standard used to assess the impact of a new continuous source (i.e. plant items) to a residential environment which is often applied by Dublin City Council is BS 4142 *Methods for rating and assessing industrial and commercial sound (*2014). 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*. This level has been determined with reference to manufacturers information for specific plant items.

- "*Rating level*" $L_{Ar,Tr}$ is the specific noise level plus adjustments for the character features of the sound (if any), and;

- *"Background noise level"* is the sound 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 L_{A90} parameter. These levels were measured as part of the baseline survey.

The assessment procedure in BS4142: 2014 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 specific noise level in order 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 a 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.

3.2.2 Additional traffic on surrounding roads

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. In order to assist with the interpretation of the noise associated with additional vehicular traffic on public roads, Table 6, taken from Design Manual for Roads and Bridges (DMRB) *Sustainability & Environment Appraisal LA 111 Noise and Vibration* Revision 2 (UK Highways Agency, 2020) offers guidance as to the likely degree of impact associated with any long-term change in traffic noise level.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact	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	Significant
10+	Doubling of loudness and above	Major	Very significant

Table 6 Significance in Change of Noise Level

The guidance outlined in Table 6 will be used to assess the predicted increases in traffic levels on public roads associated with the proposed development and comment on the likely long-term impacts during the operational phase.

3.2.4 Vibration

The development is a residential and commercial in nature, therefore it is not anticipated that there will be any outward impact associated with vibration for the operational phase.

3.3 Inward Noise Impact Criteria

3.3.1 Dún Laoghaire Rathdown County Council Noise Action Plan

The Dún Laoghaire Rathdown County Council Noise Action Plan (NAP) 2018 – 2023 is of relevance here. The NAP indicates that guidance within the ProPG *Planning and Noise: Professional Practice Guidance on Planning and Noise* document should be referred to:

"In the scenario where new residential development or other noise sensitive development is proposed in an area with an existing climate of environmental noise, there is currently no clear national guidance on appropriate noise exposure levels. The EPA has suggested that in the interim that Action Planning Authorities should examine the planning policy guidance notes issued in England titled, 'ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise'. This has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England."

In accordance with this NAP policy, the following Acoustic Report has been prepared to comply with the requirements of this policy.

In addition to ProPG, the Dún Laoghaire Rathdown County Council Noise Action Plan 2018 – 2023 has been published in order to address the requirements of the European Noise Directive 2002/49/EC. This NAP produced noise maps in order to determine the population exposure to undesirably high noise levels and also to identify areas with desirably low noise that should be preserved into the future. The NAP defines the following ranges for these descriptions:

- Undesirably high external noise levels are defined as being above 55dB at night and/or above 70dB during the day, and;
- Desirably low external noise levels are defined as being below 50dB at night and/or below 55dB during the day.

It is important to note that the NAP does not recommend that residential development be restricted within areas identified as having undesirably high noise levels. Rather it recommends a range of noise mitigation measures be required for new residential developments within these areas.

3.3.2 ProPG: Planning & Noise

The *Professional Practice Guidance on Planning & 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 it's 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 outlines a systematic risk based 2 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:

- Element 1 - Good Acoustic Design Process;
- Element 2 - Noise Level Guidelines;
- Element 3 - External Amenity Area Noise Assessment
- Element 4 - Other Relevant Issues

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

A. Planning consent may be granted without any need for noise conditions;
B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or,
D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

Section 3.0 of the ProPG provides a more detailed guide on decision making to aid local authority planners on how to interpret the findings of an accompanying Acoustic Design Statement (ADS).

A summary of the ProPG approach is illustrated in Figure 2.

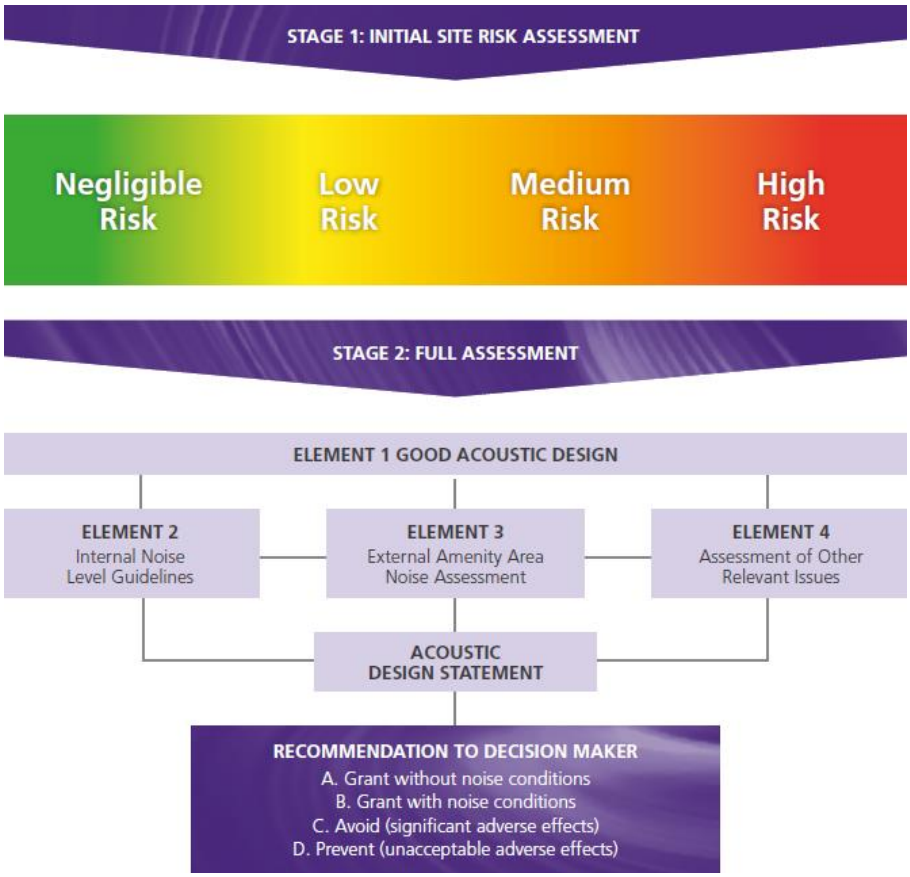

Figure 2 ProPG Approach (Source: ProPG)

3.3.3 ProPG Stage 1 - Noise Risk Assessment Methodology

Stage 1 of the ProPG approach is the Noise Risk Assessment. This 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 3 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.

Paragraph 2.9 of ProPG states that,

> *"The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."*

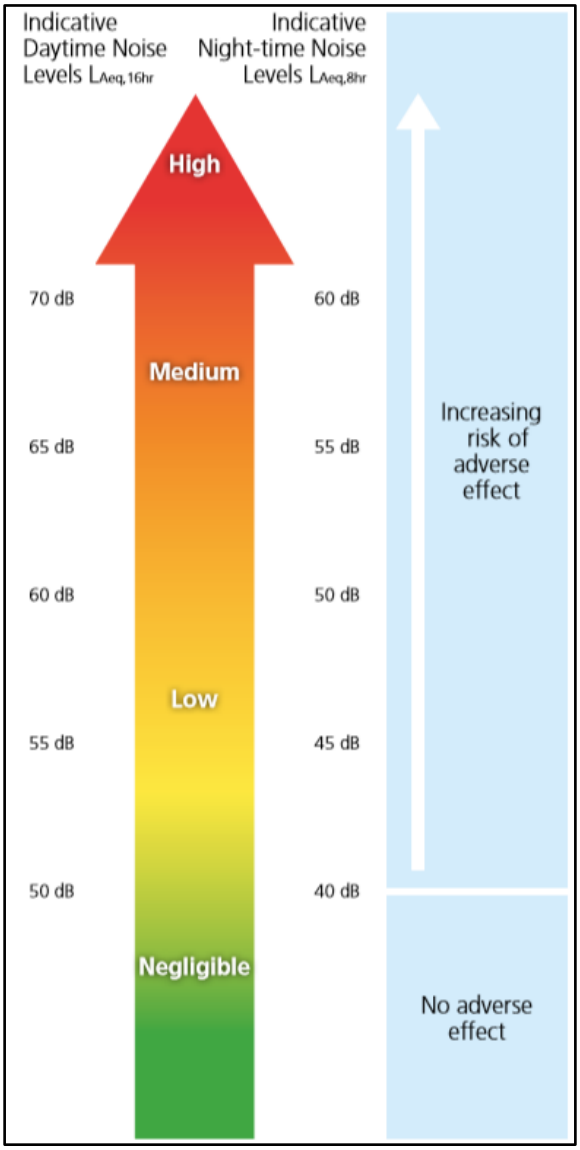

Figure 3 ProPG Stage 1 - Initial Noise Risk Assessment

3.3.4 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 and WHO's *Community Noise Guidelines*. The recommended indoor ambient noise levels are set out in Table 7 and are based on annual average data, that is to say they omit occasional events such as New Year's Eve.

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

Table 7 ProPG Internal Noise Levels

*Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded no more than 10 times per night without a significant impact occurring.

In addition to these absolute internal noise levels ProPG 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 WHO 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

In the first instance, it is important to note 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 7 and a sound reduction across an open window of 15 dB, the free-field noise levels that would be required to ensure that internal noise levels do not exceed good (i.e. at or below the internal noise levels) or reasonable internal noise levels (i.e. 5 dB above the internal noise levels) have been summarised in Table 8.

Level Desired	Day 07:00 to 23:00hrs	Night 23:00 to 07:00hrs
Good (i.e. at or below the internal noise levels)	50 – 55 dB $L_{Aeq,16hour}$	45 dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels)	55 – 6 0dB $L_{Aeq,16hour}$	50 dB $L_{Aeq,8hour}$

Table 8 External Noise Levels Required to Achieve Internal Noise Levels

In this instance the external noise levels are such that there are façades where it will not be possible to achieve the desired good internal noise levels with windows open, therefore appropriate acoustic specifications to windows and passive vents will be provided to ensure the rooms are adequately ventilated and achieve the good internal noise levels detailed here.

4.0 EXISTING RECEIVING ENVIRONMENT

The proposed development is located on a brownfield site at the junction of Stillorgan Road and Lower Kilmacud Road.

4.1 Baseline Noise Survey Locations

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: *Acoustics – Description, measurement and assessment of environmental noise*.

The noise measurement locations were selected to represent the noise environment at the NSLs surrounding the proposed development.

The monitoring locations are discussed below and shown in Figure 4:

Location UN1 Unattended measurement location intended to capture the noise levels representative of the most exposed façades.

Location AT1 Attended measurement location to capture the noise level at the NSLs at houses to the north.

Location AT2 Attended measurement location to capture the noise level at the NSLs at houses to the southwest.

Location AT3 Attended measurement location to capture the noise level at the NSLs at houses at a location more screened from Lindon Lea Park to the southwest.

Figure 4 Baseline noise measurement locations

4.2 Survey Periods

Unattended noise measurements were conducted between 11:20hrs on 15 February and 10:30hrs on 22 February 2021. Attended measurements were carried out between 11:30 and 14:20 on 15 February 2021.

The weather during the survey period was mainly dry with varying cloud cover. Wind speeds were moderate; however they were not considered to have had a detrimental effect on the noise measurements.

4.3 Personnel and Instrumentation

AWN installed and collected the noise monitoring equipment. The following instrumentation was used in conducting the noise and surveys:

Equipment	Type	Serial Number	Calibration Date
Sound Level Meter	Bruel and Kjaer 2250-L	3008402	Nov 2019
Sound Level Meter	Rion NL-52	186669	May 2020

Table 9 Instrumentation Details

4.4 Noise Measurement Parameters

The noise survey results are presented in terms of the following 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.

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.

L_{AFmax} is the instantaneous maximum sound level measured during the sample period using the 'F' time weighting.

The "A" suffix for the noise parameters denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

4.5 Survey Results

4.5.1 Unattended Noise Measurements

Table 10 presents a summary of noise levels measured during the noise survey at location UN1 during day and night-time periods.

Start Time	Period	Overall $L_{Aeq, T}$ dB	Overall $L_{Aeq, T}$ dB
Monday 15 February	Day	68	56
Monday 15 February to Tuesday 16 February	Night	66	50
Tuesday 16 February	Day	70	57
Tuesday 16 February to Wednesday 17 February	Night	66	49
Wednesday 17 February	Day	71	57
Wednesday 17 February to Thursday 18 February	Night	66	49
Thursday 18 February	Day	70	58

Thursday 18 February to Friday 19 February	Night	64	47
Friday 19 February	Day	71	59
Friday 19 February to Saturday 20 February	Night	64	40
Saturday 20 February	Day	71	59
Saturday 20 February to Sunday 21 February	Night	65	49
Sunday 21 February	Day	69	53
Sunday 21 February to Monday 22 February	Night	65	39
Highest Day		71	--
Highest Night		66	--

Table 10 Summary of Measured Noise Levels at location UN1

At Location UN1, daytime noise levels were in the range 69 to 71 dB $L_{Aeq,16hr}$ and night-time noise levels were in the range 64 to 66 dB $L_{Aeq,8hr}$.

L_{Aeq} and L_{AFMax} values were measured at 15-minute intervals over the duration of the survey. Figures 5 and 6 present the number of measured L_{Aeq} and L_{AFMax} events for each decibel level during the day and night periods. It is noted from Figure 6 the noise level of 85 dB L_{Amax} is not normally exceeded.

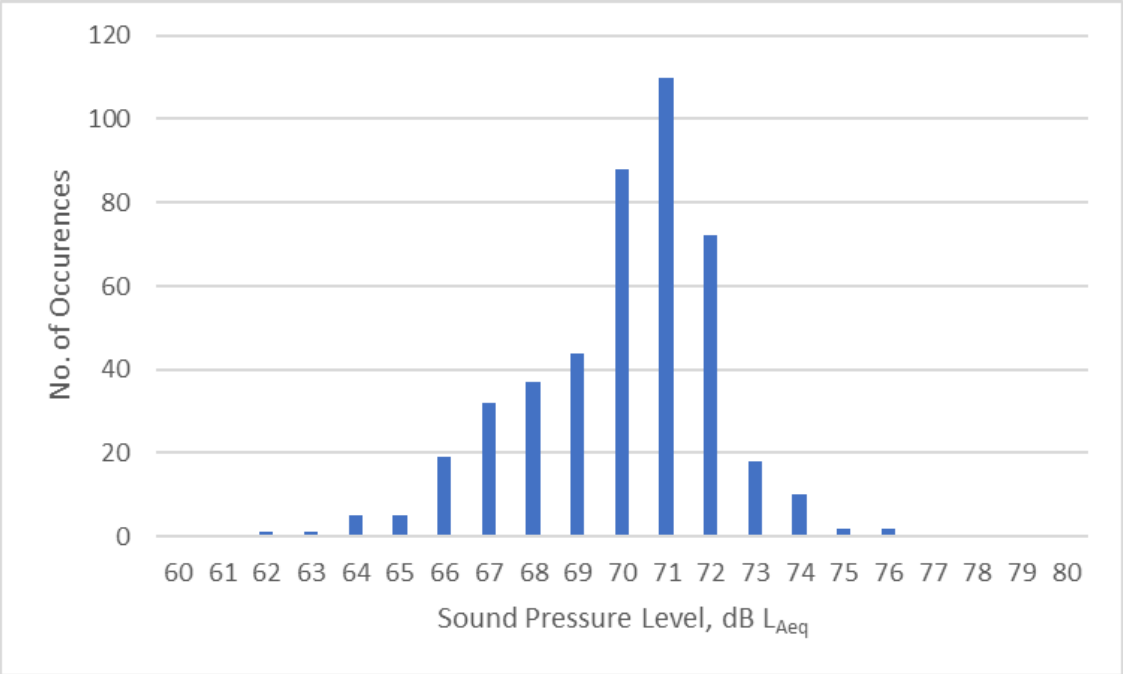

Figure 5 Number of Events at UN1 at Each Decibel Level – Day

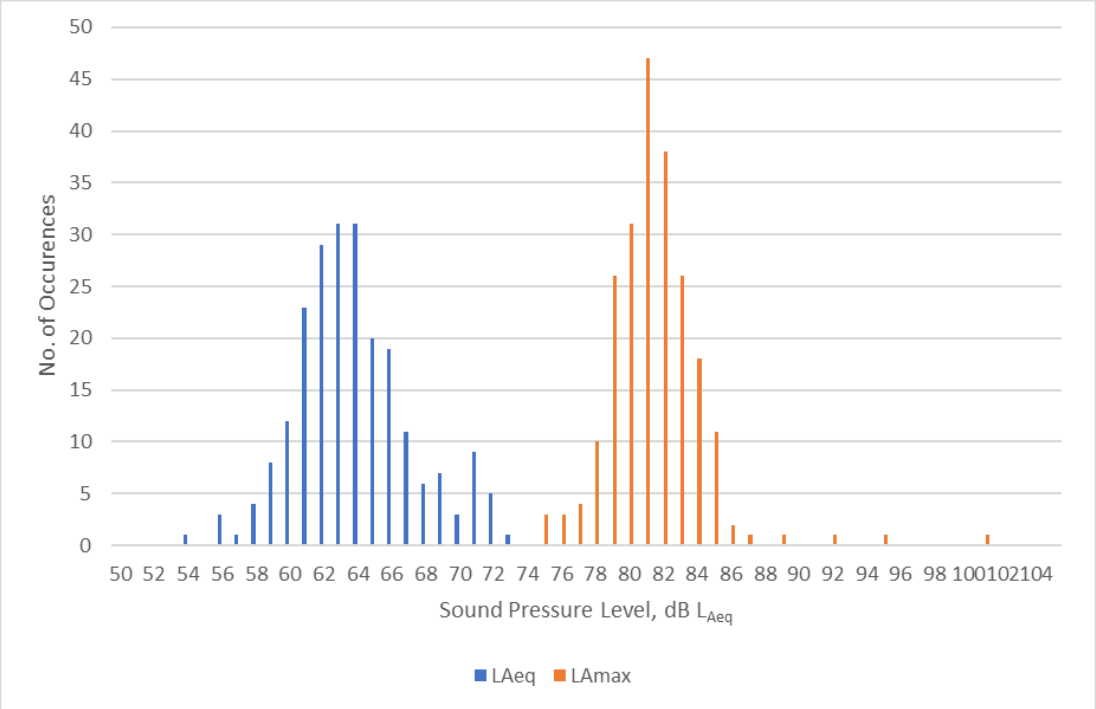

Figure 6 Number of Events at UN1 at Each Decibel Level – Night

4.5.2 Attended Noise Measurements

The survey results for the attended monitoring are given in Table 11.

Location	Start Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
		$L_{Aeq,15min}$	L_{A90}
AT1	13:02	65	54
	13:25	64	54
	13:25	64	55
AT2	11:33	65	47
	12:08	66	51
	12:42	66	51
AT3	11.50	63	51
	12:25	63	51
	14:05	63	50

Table 11 Summary of Attended Results

Noise levels were in the range 63 to 65 dB $L_{Aeq,15min}$ and 47 to 55 dB $L_{A90,15min}$. Traffic on R825 Stillorgan Road and Kilmacud Road were the dominant noise sources, with birdsong and pedestrian activity and conversation also audible.

4.6 Round 3 Road Noise Maps

Transport Infrastructure Ireland (TII) have produced noise maps for major roads in Dublin City and County. Figures 7 and 8 presents the mapped noise levels across the development site for road traffic in terms of L_{den} and L_{night}. The measured L_{day} of 68 to 71 dB $L_{Aeq16hr}$ at UN1 compares favourably with the TII noise map which indicates noise levels of the order of 70 dB L_{den} for the same point on the site, considering that traffic flows are likely to have been reduced due to movement restrictions for COVID-19.

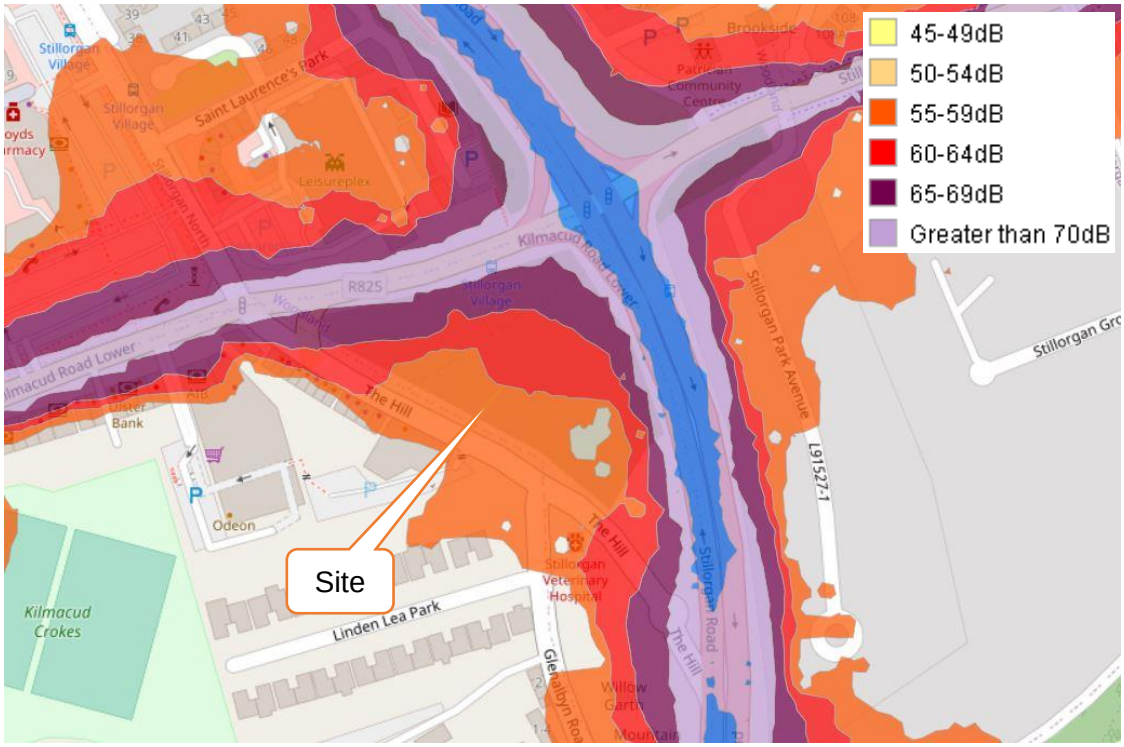

Figure 7 EPA Round 3 Road Traffic Noise Map of L_{den}

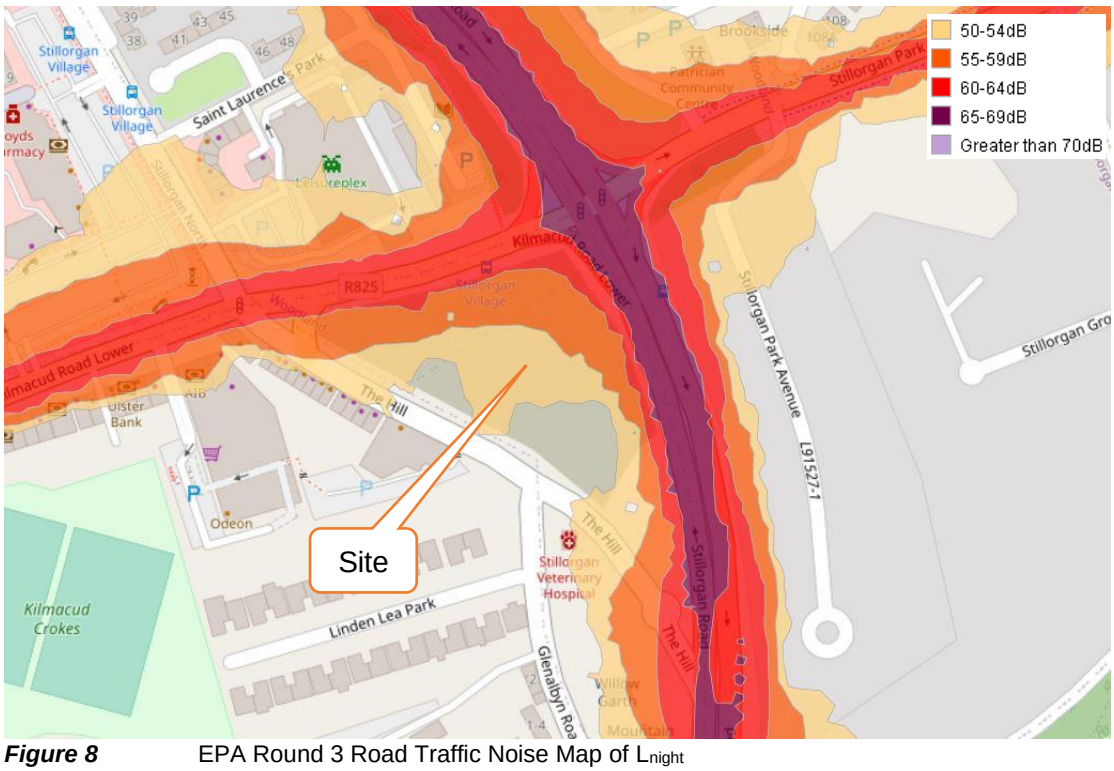

Figure 8 EPA Round 3 Road Traffic Noise Map of L_{night}

4.7 Public Health Restrictions

The baseline noise survey was undertaken during Phase 1 of the Irish Government's Roadmap for re-opening (May 2020) the country during the Covid-19 pandemic. During this survey period, traffic flows along the immediate and surrounding road network were potentially lower than those experienced during 'normal' pre-Covid-19 conditions.

In order to review and validate the survey results and to undertake a robust assessment to ensure that appropriate mitigation is specified (where necessary), a

review has been carried out of available noise mapping of the development site and surroundings.

Review of the measured noise levels on site against EPA Noise Maps confirms that noise levels are in line with and slightly above those presented in the Noise Round 3 Road noise maps. Therefore, no further correction is proposed in this regard.

4.8 Summary of Assumed Façade Noise Levels on Developed Site

For the purposes of developing noise mitigation measures, the façades in the site are assigned in 'zones' based on the predicted noise level. Figure 9 place the façades into one of three zones, A, B or C. These zones will be referred to in Section 6.5.2 in the discussion of proposed façade treatments.

Based on a review of the measured noise levels, the following noise levels are assumed at the various noise zones of the development:

Zone	Daytime $L_{Aeq,16hr}$ (07:00 – 23:00hrs)	Night time $L_{Aeq,8hr}$ (23:00 to 07:00hrs)
A	71	66
B	68	61
C	66	59

Table 12 Assumed noise levels

Note that the noise levels encountered at the development site are typical of other urban development sites close to the road network. The dominant noise source is road traffic on the local road network and there is a significant reduction in noise from day to night periods.

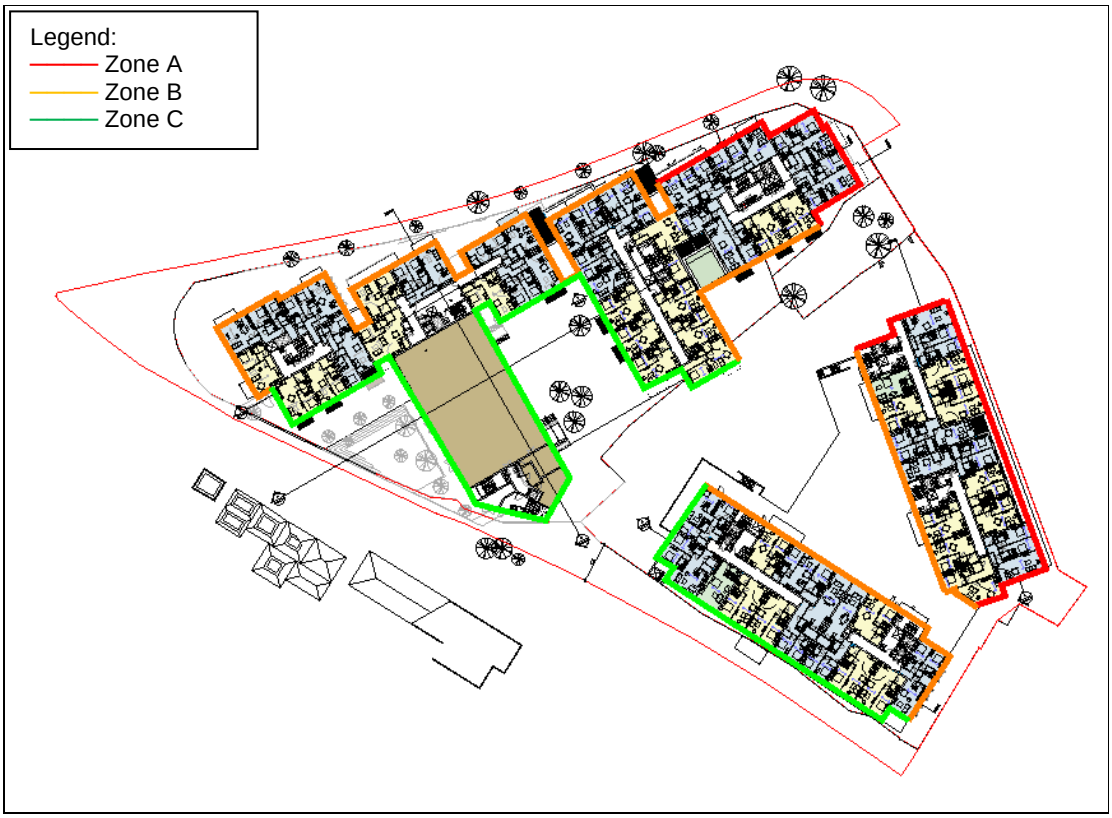

Figure 9 Residential Floor Plan showing Assumed Noise Levels for various facades

4.9 Noise Risk Assessment Conclusion

As stated in section 4.5.1, the average measured noise levels in the most noisy part of the site were of the order of 71 dB L_{Aeq} for daytime periods and 66 L_{Aeq} for night-time periods. Noise levels at location AT2 near the southwestern boundary of the site were slightly lower at 65 to 65 dB L_{Aeq} in the daytime period. With reference to Figure 3 (ProPG Stage 1 - Initial Noise Risk Assessment) it is considered that the level of noise risk across the site varies 'medium' to 'high': ProPG states the following with respect to negligible, low and medium risks:

Negligible Risk — *These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.*

Low Risk — *At low noise levels, the site is likely to be acceptable from a noise perspective provided that 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 in the finished development.*

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 demonstrate 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 site may be categorised as *Medium* to *High Risk* and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

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

> *"2.12 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 initial 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 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."

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or high-risk noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitable designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

5.0 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

The potential impacts of the proposed development are discussed for the short-term construction phase and long-term operational phase. These are set out in the following sections.

5.1 Construction Phase

The largest noise and vibration impact of the proposed development will occur during the construction phase due to the operation of various plant machinery and HGV movement to, from and around the site. However, the construction phase can be classed as a short-term phase (approximately two years in duration).

The closest residential noise-sensitive properties to the proposed development are adjacent to the southeast boundary of the site on The Hill and also at Lindon Lea Park to the southwest and at St Lawrence's Park to the north. Based on the results of the baseline noise surveys undertaken, the ambient daytime noise level at these properties was found to be between 63 and 65 dB $L_{Aeq,T}$.

Thresholds for significant noise from construction can be determined by referring to Table 1 and the baseline ambient noise levels, as outlined in the assessment criteria section. The daytime significance threshold for construction noise at the site is set at 65 dB $L_{Aeq,T}$. A night-time threshold is not included as construction work will not take place at night.

BS 5228-1 contains noise level data for various construction machinery. The noise levels relating to site clearance, ground excavation and loading lorries (dozers, tracked excavators and wheeled loaders) reach a maximum of 81 dB $L_{Aeq,T}$ at a distance of 10 m. For this assessment, a worst-case scenario is assumed of 3 no. such items with a sound pressure level (SPL) of 81 dB at 10 m operating simultaneously along the closest works boundary. This would result in a total noise level of 86 dB at 10 m and an equivalent combined sound power level of 114 dB L_{WA}. This worst-case scenario is the typical assumption made for developments of this size, on the basis that it is unlikely that more than 3 no. items of such plant/equipment would be operating simultaneously in such close proximity to each other.

Guidance on the approximate attenuation achieved by barriers surrounding the site is also provided in BS 5228-1. It states that when the top of the plant is just visible to the receiver over the noise barrier, an approximate attenuation of 5 dB can be assumed, while a 10 dB attenuation can be assumed when the noise screen completely hides the sources from the receiver.

This scenario can be assumed in this case due to the proximity of the NSLs, i.e. a barrier height will be chosen so as to completely hide the source. Table 13 shows the

potential noise levels calculated at various distances based on the assumed sound power level and attenuation provided by the barrier of 10 dB.

Description of Noise Source	Sound Power Level (dB Lw(A))	Calculated noise levels at varying distances (dB $L_{Aeq,T}$)				
		10	20	30	50	100
3 no. items each with SPL of 81 dB at 10 m operating simultaneously.	114	76	70	66	62	56

Table 13 *Potential construction noise levels at varying distances assuming attenuation of 10 dB from site barrier*

The calculated noise levels in Table 13 show that there is potential for the maximum permissible daytime noise level to be exceeded at distances up to 30 m from the works. This indicates that additional mitigation measures will be required to prevent likely significant impacts at residential properties. These measures are detailed in Section 7.1.

Construction Vibration

Potential for vibration impacts during the construction phase programme are likely to be limited given the ground breaking, piling and excavations required. There is potential for piling to be used for building and basement foundations for office and apartment buildings. For the purposes of this assessment the expected vibration levels during piling assuming augured or bored piles have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: Vibration, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54 mm/s at a distance of 5 m, for auguring;
- 0.22 mm/s at a distance of 5 m, for twisting in casing;
- 0.42 mm/s at a distance of 5 m, for spinning off, and;
- 0.43 mm/s at a distance of 5 m, for boring with rock auger.

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the nearest buildings are not expected to pose any significance in terms of cosmetic or structural damage. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of nearby buildings.

In this instance, taking account of the distance to the nearest sensitive off-site buildings, vibration levels at the closest neighbouring buildings are expected to be orders of magnitude below the limits set out in Table 4 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants, as set out in Table 5. The potential vibration impact during the construction phase if of short-term, neutral and imperceptible impact.

5.2 Operational Phase

The main potential source of outward noise from the proposed development will relate to traffic flows to and from the development site onto the public roads and mechanical and electrical services used to service development buildings. The relevant guidance documents in Section 3.2 will be used to assess potential operational noise impacts.

5.2.1 Building Services Plant

Once operational, there will be building services plant items required to serve the commercial and residential aspect of the development. These will typically be limited to heating and cooling plant and extract units, depending on the building design and user requirements. The plant items are mainly at basement level and at roof levels.

The exact layout or type of building services plant has not yet been established, therefore it is not possible to calculate noise levels to the surrounding environment. In this instance, is it best practice to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for the development. Plant items will be selected, designed and located so that there is no negative impact on sensitive receivers within the development itself. The cumulative operational noise level from building services plant at the nearest NSL within the development (e.g. apartments, etc.) will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods as set out in this assessment. Based on the baseline noise data collected for this assessment it is considered an appropriate design criterion is the order of 40 dB $L_{Aeq,15min}$. This limit is set in order to achieve acceptable internal noise levels within residential spaces based on prevailing noise levels in the area.

The main noise sources associated with the day to day operation of the site from a mechanical point of view relates to ventilation fans associated with basement carparks. Due to their location at ground level within the site, there is the potential for noise to affect residential units within the proposed development itself. Where required, additional attenuation will be incorporated into the design such that the noise level from the proposed fans does not exceed 40 dB(A) at 3m from the basement ventilation louvres in order to protect residential amenity of the spaces.

Taking into account that sensitive receivers within the development are much closer than off-site sensitive receivers, then once the relevant noise criteria is achieved within the development it is expected that there will be no negative impact at sensitive receivers off site.

5.2.2 Additional Traffic on surrounding roads

Traffic flows associated with the operational phase of the proposed development have been provided Waterman Moylan. Information on development related traffic onto the existing road network has been used to determine the predicted change in noise levels in the vicinity of a number of roads in the area surrounding the proposed development for the design year of 2039. The information is provided for both the Do Nothing scenario (i.e. the proposed development is not built) and the Do Something scenario which assumes the full development is constructed and operational, plus the additional traffic flows due to the Leisureplex development which is part of a separate application. Table 14 summarises the calculated change in noise levels along the assessed road links associated with the addition of development related traffic.

Link	Description	2039 Do Nothing	2039 Base Plus Development and Leisureplex	Calculated Change in Noise Levels, dB
		Total Vehicles (AADT)	Total Vehicles (AADT)	
Junction 1 Arm A	Stillorgan Park Road	11,953	12,066	0.0
Junction 1 Arm B	Stillorgan Road (N11)	29,793	29,848	0.0
Junction 1 Arm C	Lower Kilmacud Road	10,957	11,239	0.1
Junction 1 Arm D	Stillorgan Road (N11)	31,630	31,744	0.0
Junction 2 Arm A	Lower Kilmacud Road	10,824	11,106	0.1
Junction 2 Arm B	The Hill	5,606	6,737	0.8
Junction 2 Arm C	Lower Kilmacud Road	14,152	14,520	0.1
Junction 2 Arm D	Old Dublin Road	8,758	9,239	0.2

Table 14 Changes in traffic noise level due to additional vehicles on surrounding roads

The assessment has indicated that traffic volume increases are negligible when added to the existing road network. The calculated change in traffic noise of 1dB(A) or less along all link roads in the immediate vicinity of the development site. Reference to Table 6 confirms that a change in noise level of less than 1dB(A) is negligible and therefore not significant.

6.0 INWARD NOISE IMPACT

6.1 Element 1 – Good Acoustic Design Process

6.4.1 ProPG Guidance

In practice, good acoustic design (GAD) should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life or occupants or compromising other sustainable design objectives. It is important to note that ProPG specifically states that GAD is not equivalent to overdesign or "*gold plating"* of all new development but that it seeks to deliver the optimum acoustic environment for a given site.

Section 2.23 of the ProPG outlines the following checklist for GAD:

- 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 have been addressed in the following subsections.

6.4.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

The surrounding road network is located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

The layout of the site places a set of taller buildings along the southern boundary, with a roadway providing a degree of buffer distance between the façades and the M50 motorway. The screening effect of these larger buildings reduces noise levels in the open areas and private gardens in the centre of the site, and even in the northern part of the site, as can be seen by comparing Figures 7 & 9 and 8 & 10.

Select Construction Types for meeting Building Regulations

A mix of construction types could be considered for the building envelope including masonry and curtain wall elements. Masonry construction types offers high levels of sound insulation performance. However, as is typically the case 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 in terms of sound insulation performance.

Consideration will therefore be given to the provision of upgraded glazing and acoustic ventilators. Note that it will not be possible to achieve the desirable internal acoustic environments with windows open. Instead the proposal here will be to provide dwelling units with glazed elements and ventilators that have good acoustic insulation properties so that when the windows are closed the noise levels internally are good. Inhabitants will be able to open the windows if they wish, however, doing so will increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following (note emphasis has been added in bold),

> "2.22 *Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided;* ***occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open****. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents* "
>
> *Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded*
>
> 2.34 *Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed,* ***which may be the case in urban areas and at sites adjacent to transportation noise sources****, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded*."

Impact of noise control measures on fire, health and safety etc

The GAD measures that have been implemented on site, *e.g.* locating taller buildings at the sound end of the site, placing shared outdoor amenity space on the quiet side of buildings, are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

The option of introducing additional noise screening along the boundary of the site Roads was considered. In this instance it is not possible to place any acoustic screens close to the roadside edge where it would be most effective. This limits the effectiveness of any possible acoustic screen. In addition, the presence of a solid

boundary wall at this location would interfere significantly with the street. For these reasons it was not considered practicable to provide a noise screen to the boundary of the site with the any surrounding roads.

Assess External Amenity Area Noise

ProPG provides the following advice with regards 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 $L_{Aeq,16hr}$."*

The values are largely based on WHO guideline values.

Based on the measured noise levels, once the proposed development is constructed, all external spaces in the central area of the site expected to be or of the order of 55 dB $L_{Aeq,16hr}$ or, if in excess of this, below the DLRCC thresholds of undesirable noise levels, i.e. 70 dB L_{Aeq} by day and 55 dB L_{Aeq} by night as outlined in the Noise Action Plan.

6.4.3 Summary

Considering the constraints of the site, in so far as possible and without limiting the extent of the development area, the principles of GAD have been applied to the development.

In terms of viable alternatives to acoustic treatment of façade elements, currently it is not considered likely that there will be further options for mitigation outside of proprietary acoustic glazing and ventilation.

6.2 Element 2 – Internal Noise Guidelines

6.5.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 and WHO's *Community Noise Guidelines*. The recommended indoor ambient noise levels are set out in Section 3.3.4.

6.5.2 Proposed Façade Treatment

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 BS8233 and Annex G[1] of BS8233 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 BS8233 has been adopted here to determine the required performance of the building facades.

Glazing

As is the case in most buildings, the glazed elements of the building envelope are the weakest element from a sound insulation perspective. In this instance façades will be provided with glazing that, when closed, achieve the minimum sound insulation performance as set out in Table 15.

Zone (See Figure 9)	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
A	26	36	42	44	42	44	42
B	27	29	36	41	42	52	39
C	24	25	31	41	43	44	37

Table 15 Sound Insulation Performance Requirements for Glazing, SRI (dB)

The acoustic specifications listed in Table 15 can be achieved using a standard thermal double-glazed unit with slightly thicker glass.

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.

Wall Construction

In general, all wall constructions (i.e. block work or concrete) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50 dB R_w for this construction.

Ventilation

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations and will be finalised at the detail design stage. Options which will be considered to achieve compliance with background ventilation requirements will include adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively. If vents are used, the acoustic performance should be 44 dB $D_{n,e,W}$ in all areas.

[1] The methodology contained within Annex G of BS8233 is based on the assumption that the source is a line source (such as a road) and that the building facades are simple, i.e. do not have balconies. These assumptions are considered valid for the purposes of this assessment and have been adopted.

6.5.3 Internal Noise Levels

Taking into account the external façade levels and the specified building envelope the internal noise levels have been calculated. In all instances the good internal noise criteria are achieved for daytime and night-time periods.

6.3 Element 3 – External Amenity Area Noise Assessment

External noise levels within the proposed open amenity areas across the parts of development site expected to be, once the proposed development is constructed within the recommended range of noise levels from ProPG of between 50 – 55dB $L_{Aeq,16hr}$, being screened from the surrounding roads be the development buildings. It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site.

In areas where the predicted levels are in excess of 55dB $L_{Aeq,16hr}$ they nevertheless expected to be below the threshold set out in the Dún Laoghaire Rathdown County Council Noise Action Plan 2018 – 2023 where a daytime level above 70dB(A) is considered undesirably high.

6.4 Element 4 – Assessment of Other Relevant Issues

Element 4 gives consideration to other factors that *may* prove pertinent to the assessment, these are defined in the document as:

- 4(i) compliance with relevant national and local policy
- 4(ii) magnitude and extent of compliance with ProPG
- 4(iii) likely occupants of the development
- 4(iv) acoustic design v unintended adverse consequences
- 4(v) acoustic design v wider planning objectives

Each is discussed in turn below.

6.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally the Dún Laoghaire Rathdown County Council Noise Action Plan specifies desirably low external noise levels and also noise levels above which noise mitigation measures should be considered.

This Acoustic Design Statement has been prepared in compliance with the requirements of ProPG and therefore complies with the requirements of local policy.

6.4.2 Magnitude and Extent of Compliance with ProPG

As discussed within this report the following conclusions have been drawing with regards to the extent of compliance with ProPG:

- All dwellings within the development have been designed to achieve the good level of internal noise levels specified within ProPG.
- External amenity areas have been assessed and are determined to be within the target level for most of the site. In the amenity space at the northeast of the site, the external noise levels under are expected to be above the target levels set out in ProPG but are considered acceptable for the development in line with the DLRCC NAP.

Based on the preceding it is concluded that the proposed development is in full compliance with the requirements of ProPG.

6.4.3 Likely Occupants of the Development

This element is not considered relevant here as the proposed units are permanent residential dwellings.

6.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

6.4.5 Acoustic Design v Wider Planning Objectives

It is understood that wider planning objectives have been adhered to during the process of developing the design for the proposed development.

7.0 MITGATION MEASURES

In order to ameliorate the likely noise impacts, a schedule of noise control measures has been formulated for both construction and operational phases.

7.1 Construction Phase

With regard to construction activities, best practice control measures from construction sites within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2* will be used to control noise and vibration impacts. The contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential NSLs are not significant. This will be particularly important during demolition, foundation construction including piling works which are likely to be the activities to have the highest potential noise impact.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in BS 5228-1:2009+A1 2014. Part 1 – Noise;
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Establishing channels of communication between the contractor/developer, Dún Laoghaire Rathdown County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration;
- The Contractor appointing a Site Environmental Manager (SEM) responsible for matters relating to noise and vibration.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of good quality site hoarding to the site perimeters which will act as a noise barrier to general construction activity at ground level;
- Erection of barriers as necessary around items such as generators or high duty compressors; and

- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.

7.2 Operational Phase

In order to ensure that acceptable operational noise levels at the nearest NSLs are achieved, the following mitigation measures should be considered during the detailed design stage.

7.2.1 Building Services Plant

Noise emissions from the plant areas will be designed to ensure that noise levels at the façade of the NSLs both within the development and in the surrounding area do not exceed the criteria discussed at Section 3.2.1.

During the detailed design of the development, the selection and location of mechanical and electrical plant will be undertaken in order to ensure the noise emission limits set out above are not exceeded. In addition to selecting plant with suitable noise levels, the following best practice measures are recommended for all plant items in order to minimise potential noise disturbance for adjacent buildings:

- where ventilation is required for plant rooms, consideration will be given to acoustic louvers or attenuated acoustic vents, where required to reduce noise breakout;
- ventilation plant serving plant rooms and car parks will be fitted with effective acoustic attenuators to reduce noise emissions to the external environment;
- the use of perimeter plant screens will be used, where required, for roof top plant areas to screen noise sources;
- the use of attenuators or silencers will be installed on external air handling plant;
- all mechanical plant items e.g. fans, pumps etc. shall be regularly maintained to ensure that excessive noise generated any worn or rattling components is minimised;
- any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document, and;
- Installed plant will have no tonal or impulsive characteristics when in operation.

7.2.2 Additional Traffic on Surrounding Roads

During the operational phase of the development, noise mitigation measures with respect to the outward impact of traffic from the development are not deemed necessary.

8.0 CONCLUSION

A Build to Rent Residential development with community sports hall, creche, cafe/restaurant and office hub is proposed on a brownfield site of the former at Blakes and Esmonde Motors sites, Stillorgan Road, County Dublin. This report presents a summary of the aspects of the development pertinent to environmental noise and vibration.

The existing noise environment has been quantified by way of an environmental noise survey consisting of attended and unattended measurements. Existing noise levels have been found to be typical of a suburban area.

Suitable noise and vibration criteria have been identified for the assessment of construction noise. Similarly, appropriate noise criteria have been selected for the relevant operational elements of the development, i.e. building services and additional vehicular traffic on surrounding roads.

Applying the mitigation measures introduced in this document, there is no aspect of the constructed development that would be expected to cause a significant noise impact.

The inward noise impact assessment presented in this report has assessed the impact of traffic noise levels on the proposed development and has been prepared in accordance with the requirements of ProPG as required by the Dún Laoghaire Rathdown County Council NAP. The proposed development can be designed to function in compliance with the requirements of ProPG once appropriate consideration is given at the detailed design stage to the sound insulation mitigation measures and principles outlined in this report.

APPENDIX A

GLOSSARY OF NOISE/VIBRATION TERMINOLOGY

Ambient noise The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.

Background noise The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).

dB Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 µPa).

dB(A) An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Hertz (Hz) The unit of sound frequency in cycles per second.

$L_{Aeq,T}$ This 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 (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

L_{AFN} The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{AF90} Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

L_{AF10} Refers to those A-weighted noise levels in the upper 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting.

L_{AFmax} is the instantaneous fast time weighted maximum sound level measured during the sample period.

L_{AFmin} is the instantaneous fast time weighted minimum sound level measured during the sample period.

APPENDIX A
GLOSSARY OF NOISE/VIBRATION TERMINOLOGY

Octave band A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.