NOISE & VIBRATION IMPACT ASSESSMENT FOR PLANNING

PROPOSED BROOMHILL RESIDENTIAL DEVELOPMENT

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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts associated with the proposed residential development at the Broomhill Industrial Estate, Tallaght, Dublin 24. The proposed development will comprise 242 no. residential units with internal and external communal amenity spaces and a creche. At ground floor level there will be provision of a public gym, office space and rentable studio space.

A baseline noise survey has been undertaken at the development site to determine the existing environment at the site.

Outward noise impact assessments have been undertaken for both construction and operational phases of the proposed development.

Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that at the nearest residential noise sensitive receivers, in this instance located at some 250m distance, noise from construction activities will be well below the threshold at which a likely significant impact will occur. Noise levels from construction activities at neighbouring commercial premises are predicted to be of a level corresponding to a moderate impact. Best practice construction methods have been presented within this report, the implementation of which will aid in the reduction of the impact of construction activities on nearby sensitive receptors.

Once operational, it is expected that noise emissions will be limited to plant noise emissions and noise from traffic moving to and from the proposed development. Regarding plant noise, suitable noise thresholds have been proposed based on the measured noise levels on the site. During detailed design stage plant and noise mitigation options shall be selected so that the noise emissions at units within the development and external nearby sensitive receptors do not exceed the recommended thresholds.

A review of environmental noise acting inwards on the proposed development has been carried out. Noise levels are such that provision of suitable glazing and ventilation will ensure the required internal noise levels are achieved in the residential units.

It is predicted that the majority of the amenity space will experience noise levels of ≤55dB $L_{Aeq,16hr}$ in line with the recommended noise level for these areas as set out in the ProPG Guidance Document.

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1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out an assessment in relation to the potential noise impacts associated with the proposed residential development at the Broomhill Industrial Estate, Tallaght, Dublin 24. The development site is located on the Broomhill Road, off the Airton Road. The surrounding area comprises commercial and warehousing premises.

Included within this report is an assessment of the outward noise impact of the construction and operational phases of the development. Inward noise incident on the proposed development from the surrounding environment is also assessed.

Figure 1 presents the outline of the proposed development site and the surrounding area.

Figure 1 Location of proposed development

Appendix A presents a glossary of acoustic terminology that is used throughout this report.

2.0 DESIGN CRITERIA

2.1 Outward Noise Assessment – Construction Phase

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. South Dublin City Council (SDCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

2.1.2 British Standard BS 5228 – 1: 2009+A1:2014

British Standard BS 5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise (hereinafter referred to as BS 5228-1:2009+A1:2014) contains appropriate criteria relating to permissible construction noise threshold levels for developments of this scale. 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 that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities, depending on context.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 1 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 (23:00to 07:00hrs)	45	50	55

Table 1 *Example Threshold of 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.

As a conservative exercise, Category A values are applied to residential receptors. If the construction noise exceeds this category value, then a significant effect is deemed to occur.

Review of the areas surrounding the proposed development is that it is a mix of commercial and industrial uses. The nearest residential noise sensitive location is

situated some 250m to the north west at Mayberry Park, 330m north at Redwood View and some 605m to the southeast at Bancroft Avenue. The contribution of construction noise associated with the proposed development will be negligible at such large distances. Therefore, the noise impact assessment will focus on the potential impact on nearby non-residential receptors.

Fixed Limits

When considering non-residential receptors, reference is made to BS 5228-1:2009+A1:2014, which gives several examples of acceptable limits for construction noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states:

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state:

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed: -*
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
>
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

Proposed Threshold Noise Levels

Taking into account the proposed documents outlined above and making reference to the baseline noise environment monitored around the development site (see Section 13.3), BS 5228-1:2009+A1:2014 has been used to inform the assessment approach for construction noise.

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

- For commercial NSLs it is considered appropriate to adopt the 75 dB(A) CNT, given the urban environment in which the closest commercial properties reside, in line with BS 5228-1:2009+A1:2014.
- For education buildings, namely TU Tallaght, it is considered appropriate to adopt the 70 dB(A) CNT.

Interpretation of the CNT

In order to assist with interpretation of CNTs, Table 2 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of *DMRB: Noise and Vibration*.

Guidelines for Noise Impact Assessment Significance (DMRB)	CNT per Period	Determination
Negligible	Below or equal to baseline noise level	Depending on CNT, duration & baseline noise level
Minor	Above baseline noise level and below or equal to CNT	
Moderate	Above CNT and below or equal to CNT +5 dB	
Major	Above CNT +5 to +15 dB	
	Above CNT +15 dB	

Table 2 Construction Noise Significance Ratings

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely impacts during the construction stages.

2.1.3 Construction Phase – Traffic Noise

In order to assist with the interpretation of construction traffic noise, Table 3 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This is taken from Table 3.17 of the *DMRB Noise and Vibration* (UKHA 2020).

Magnitude of Impact	Increase in Traffic Noise Level (dB)
Negligible	Less than 1.0
Minor	Greater than or equal to 1.0 and less than 3.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Major	Greater than or equal to 5.0

Table 3 Likely Effect Associated with Change in Traffic Noise Level – Construction Phase

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

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

2.2 Outward Vibration Assessment – Construction Phase

2.2.1 Building Damage

With respect to vibration, British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration 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 component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this lower value. Taking the above into consideration the vibration criteria in Table 3 are recommended.

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**
12 mm/s	20 mm/s	50 mm/s

Table 4 Recommended Vibration Criteria During Construction Phase

Expected vibration levels from the construction works will be discussed further in Section 4.4.

2.2.2 Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. There are no current standards which provide guidance on typical ranges of human response to vibration in terms of PPV for continuous or intermittent vibration sources.

BS5228-2:2009+A1:2014, provides a useful guide relating to the assessment of human response to vibration in terms of the PPV. Whilst the guide values are used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources.

Table 4 below summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.140mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3mm/s	Vibration might be just perceptible in residential environments.
1mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Table 5 Guidance on Effects of Human Response to PPV Magnitudes

Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin and or the duration of vibration is known. For example, ground breaking can typically be tolerated at vibration levels up to 2.5 mm/s if adequate public relations are in place and timeframes are known. These values refer to the day-time periods only.

During surface construction works (demolition and ground breaking etc.) the vibration limits set within would be perceptible to building occupants and have the potential to cause subjective effects. The level of effect is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication and information circulars relating to planned works, their duration and vibration monitoring can significantly reduce vibration effects to the neighbouring properties.

Interpretation of the Human Response to Vibration

In order to assist with interpretation of vibration thresholds, Table 5 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS5228-2:2009+A1:2014.

Criteria	Impact Magnitude	Significance Rating
≥10 mm/s PPV	Very High	Very Significant
≥1 mm/s PPV	High	Moderate to Significant
≥0.3 mm/s PPV	Medium	Slight to Moderate
≥0.14 mm/s PPV	Low	Not significant to Slight
Less than 0.14 mm/s PPV	Very Low	Imperceptible to Not significant

Table 6 Human Response Vibration Significance Ratings

2.3 Outward Noise Assessment – Operational Phase

During the operational phase of the proposed development the primary sources of noise are expected to be mechanical plant items serving the development and noise break out from amenity spaces.

It is anticipated that external mechanical plant items will operate continuously in order to serve the development. These will be selected and located so as not to impact surrounding noise sensitive receivers.

2.3.1 Mechanical Services Plant

Guidance from SDCC on noise emissions from mechanical plant items makes reference to the British Standard BS 4142: 2014: *Methods for Rating and Assessing Industrial and Commercial Sound*. This document is the industry standard method for analysing building services plant noise emissions to residential receptors and is the document used by DCC in their standard planning conditions and in complaint investigations.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 assessment it is necessary to compare the measured external background noise level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 recommends the application of a 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

The following definitions as discussed in BS 4142 as summarised below:

"ambient noise level, $L_{Aeq,T}$" is the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].

"residual noise level, $L_{Aeq,T}$" is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound

	pressure level over the reference time interval [T].
"specific noise level, $L_{Aeq,\ T}$"	is the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"rating level, $L_{Ar,T}$"	is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);
"background noise level, $L_{A90,T}$"	is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

2.3.2 Entertainment Noise

As part of the proposed development, a public gym and rentable studio space is proposed. These functions present the potential for noise impacts by way of entertainment noise.

There is no Irish Standard or legislative guidance regarding the assessment of noise nuisance from entertainment source, e.g. music. However, it is good practice to specify a noise criterion relative to the existing noise levels and ensure that the proposed development has no significant impact on the nearest sensitive locations.

The UK Institute of Acoustics (IOA) document *Good Practice Guide on the Control of Noise from Pubs and Clubs* (March 2003) contains recommendations for acoustic design criteria. This document however does not contain any objective assessment methods for music noise but defines what is considered to be inaudible music breakout as follows:

> *'Noise is considered to be inaudible when it is at low enough level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question.'*

Whilst a subjective assessment of audibility will identify the likelihood of a noise nuisance, it is considered prudent to assess any noise complaint on an objective basis with respect to noise.

In order to apply an objective criterion to permit a structured analysis, we propose that the following criterion is adopted for the assessment of the entertainment noise from the proposed development:

The $L_{Aeq,5min}$ level measured at the nearest noise sensitive location, with entertainment taking place, shall show no increase when compared with the representative $L_{Aeq,5min}$ level measured from the same position, under the same conditions and during a comparable period with no entertainment taking place; and
The $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands at the nearest noise sensitive location, with entertainment taking place, should show no increase when compared with the representative $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands measured from the same position, under the same conditions and during a comparable period with no entertainment taking place.

This criterion is based on the guidance contained within the Draft IOA *Code of Practice Guide on the Control of Noise from Pubs and Clubs* (November 1999) which is guidance for the control of music noise breakout.

2.3.3 Noise due to Additional Traffic Serving the Development

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 7 is taken from DMRB Design Manual for Roads and Bridges (DMRB), Highways England Company Limited, Transport Scotland, The Welsh Government and The Department for Regional Development Northern Ireland, (2020).

Change in Sound Level (dB)	Subjective Reaction	Magnitude of Impact
10+	Over a doubling of loudness	Major
5 – 9.9	Up to a doubling of loudness	Moderate
3 – 4.9	Perceptible	Minor
0.1 – 2.9	Imperceptible	Negligible
0	None	No Change

Table 7 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.

2.4 Outward Vibration Assessment – Operational Phase

The proposed development is residential in nature, therefore it is not anticipated that there will be any generation of vibration associated with operational phase.

2.5 Inward Noise Assessment

2.5.1 South Dublin County Council Development Plan (2016 – 2022)

Section 11.6.3 of the South Dublin County Council Development Plan (2016-2022) provides the following discussion in relation to *Environmental Hazard Management*:

(ii) Noise

The Planning Authority will have regard to the Dublin Agglomeration Environmental Noise Action Plan 2013 – 2018, Dublin Local Authorities

(2013) when assessing development proposals along major road and rail transport corridors, with a view to reducing noise from new sources and to identify and protect areas of low sound levels.

The guidance calls for developments to have a good level of sound insulation in accordance with best Irish practice. There is no Irish standard guidance that is directly applicable to this scenario, hence it is proposed to make reference to best practice international guidance (i.e. BS8233:2014, for example) for the purposes of arriving at appropriate design goals.

The NAP quoted above has been superseded by the Dublin Agglomeration Noise Action Plan 2018 – 2023 Volume 4: South Dublin County Council Public Consultation Document which is discussed in Section 2.2 below.

2.5.2 Dublin Agglomeration Environmental Noise Action Plan

Here, consideration has been given to the content of the Dublin Agglomeration Noise Action Plan 2018 – 2023 Volume 4: South Dublin County Council Public Consultation Document (NAP) was published in December 2018. The NAP states the following with respect to assessing the noise impact on new residential development:

"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 addition, the following is provided

"In advance of any national guidance relating to noise in the planning process, the following actions relating to planning and development will be considered for implementation:

a. *To review existing guidelines and policy relating to Noise in the County Development Plan and to ensure noise is a consideration in Local Area Plans and Part 8's and enhanced in the next County Development Plan.*
b. *To develop guidance note on Noise considerations in the planning process that can be issued to developers at pre-planning stage.*
c. *To require developers to produce a sound impact assessment and mitigation plans, where necessary, for any new development where the Planning Authority considers that any new development will impact negatively on pre-existing environmental noise levels within their Council area.*
d. *To ensure that future developments are designed and constructed in accordance best Irish practice to minimise noise disturbances through good acoustic design and take into account the multifunction uses of street (e.g. movement, recreation) and to ensure central areas of large mixed used developments area quiet."*

As per the NAP reference has also been made to guidance note *ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise.*

2.5.3 ProPG: Planning & Noise

The *Professional Guidance on Planning & Noise*: New Residential Development (ProPG) and associated supplementary documents[1] were 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 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.

[1] PropG Supplementary Document 1 (May 2017) on Planning and Noise Policy and Guidance and PropG Supplementary Document 2 (May 2017) on Good Acoustic Design for Residential Development

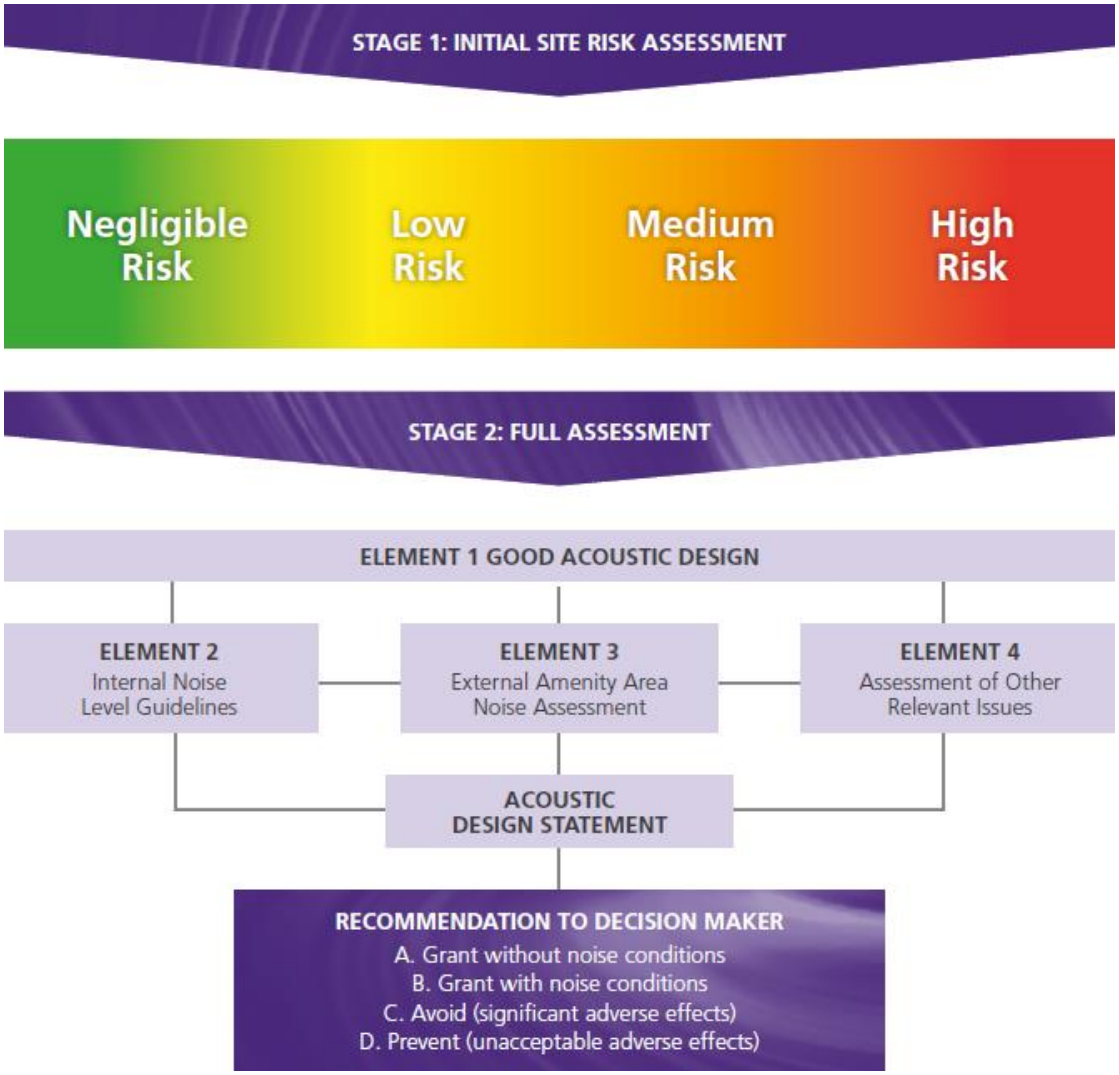

Figure 2 ProPG Approach (Source: ProPG)

2.5.4 British Standard BS 8233:2014

Internal Noise

There are no statutory guidelines or specific local guidelines relating to appropriate internal noise levels in dwellings. In this instance, reference is made to BS 8233: 2014: *Guidance on sound insulation and noise reduction for buildings.*

BS 8233 sets out recommended internal noise levels for several different building types from external noise sources such as traffic. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended indoor ambient noise levels for residential dwellings and other spaces are set out in Table 8.

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	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30
Commercial	Open plan office	40	-

Table 8 Indoor Ambient Noise Levels for Dwellings from BS8233: 2014

BS 8233 also provides some guidance on individual noise events, it states:

> *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax}, depending on the character and number of events per night. Sporadic noise events could require separate values."*

Typically, a 45 dB L_{AFmax} criterion is applied to individual noise events within bedrooms at night. This criterion is generally considered a noise level that should not typically be exceeded.

External Noise

BS 8233 also provides desirable noise levels for external amenity areas such as gardens, patios and balconies. It states:

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

3.0 Baseline Noise Survey

Environmental noise surveys have been conducted in order to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Environmental Noise Levels*. Specific details are set out in the following sections.

3.1 Methodology

The baseline noise survey comprised attended and unattended measurements. The attended measurements were made on a cyclical basis and were 15 minutes in duration. The unattended survey comprised an installed monitor continuously logging over a 6-day period.

The noise survey was conducted in general accordance with ISO 1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Sound Pressure Levels*.

Noise survey locations are indicated in Figure 3 and described below.

Figure 3 Noise Monitoring Locations

Attended survey positions

N1 Located to the north of the site opposite Fireseal Limited.
N2 Located to the west of the site
N3 Located to the south-west of the site outside Zoetis Tallaght

Unattended survey positions

N4 Located inside the site boundary

3.2 Survey Periods and Personnel

Surveys were undertaken by AWN Consulting during the periods detailed in Table 8.

Aspect	Survey Position	Survey Period
Noise	N1	10.45hrs to 15.00hrs on 16 June 2021
	N2	
	N3	
	N4 (unattended)	15.36hrs on 16 June to 13.51hrs on 21 June 2021

Table 9 Survey Periods

3.3 Instrumentation

The surveys were performed using the equipment listed in Table 2 below.

Measurement	Manufacturer	Equipment Model	Serial Number	Calibration date
Sound Level Meter	Rion	NL-52	186670	5 May 2020
Calibrator	Brüel & Kjær	Type 4231	2394086	23 March 2021

Table 10 Noise Monitoring Equipment Details

3.4 Measurement Parameters

The noise survey results are presented in terms of the following three 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_{Amax} is the instantaneous maximum sound level measured during 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.

The "A" suffix 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.

3.5 Baseline Noise Survey Results

3.5.1 Survey Position N1

Period	Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Daytime	10:45	52	73	48
	12:15	53	68	44
	13:45	51	72	45

Table 11 Summary of Measured Noise Levels at N1 (dB re. $2x10^{-5}$ Pa)

During the daytime at this location the primary noise sources were observed to be traffic noise from the Broomhill Road. Vehicles passing on Broomhill Terrace and running engines in the existing yard to the north of the site and power washer noise also contributed to measured noise levels. Ambient noise levels were in the range of 51 to 53 dB L_{Aeq}. Maximum levels ranged from 68 to 73 dB L_{Amax}. Background noise levels were in the range of 44 to 48 dB L_{A90}.

3.5.2 Survey Position N2

Period	Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Daytime	11:15	60	83	46
	12:45	60	75	47
	14:15	60	73	48

Table 12 Summary of Measured Noise Levels at N2 (dB re. $2x10^{-5}$ Pa)

During the daytime at this location the primary noise sources were observed to be traffic noise on the Broomhill Road. Traffic noise from the Airton Road also contributed to measured noise levels. Birdsong and some wind generated foliage noise was also observed. Ambient noise levels were of the order of 60 dB L_{Aeq}. Maximum levels ranged from 73 to 83 dB L_{Amax}. Background noise levels were in the range of 46 to 48 dB L_{A90}.

3.5.3 Survey Position N3

Period	Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
Daytime	11:45	60	82	49
	13:15	61	78	50
	14:45	62	79	49

Table 13 Summary of Measured Noise Levels at N3 (dB re. $2x10^{-5}$ Pa)

During the daytime at this location the primary noise source was noted to be traffic noise on the Broomhill Road and on the Airton Road. Several HGV's were observed manoeuvring close to the measurement position. A steady humming noise was audible but the source of the noise was not identified. Ambient noise levels were in the range of 60 to 62 dB L_{Aeq}. Maximum levels ranged from 79 to 82 dB L_{Amax}. Background noise levels were in the range of 49 to 50 dB L_{A90}.

3.5.4 Survey Position N4

The unattended measurements collected over the survey period are summarised below.

Date	Period	Measured Noise Levels (dB re. 2x10^{-5} Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
16 June	Day	54	88	53
	Night	52	71	51
17 June	Day	54	87	52
	Night	52	72	51
18 June	Day	56	86	51
	Night	52	65	51
19 June	Day	54	77	53
	Night	52	73	51
20 June	Day	58	96	51
	Night	51	73	50
21 June	Day	54	82	52
Average	Day	56	77 – 96	52
	Night	52	65 – 73	51

Table 14 Summary of Measured Noise Levels at N4 (dB re. 2x10^{-5} Pa)

Average daytime ambient noise levels ranged from 54 to 58 dB L_{Aeq} with an average of 56 dB L_{Aeq}. Daytime background noise levels ranged from 51 to 53 dB L_{A90} with an average of 52 dB L_{A90}.

Night-time ambient noise levels ranged from 51 to 52 dB L_{Aeq} with an average of 52 dB L_{Aeq}. Night-time background noise levels ranged from 50 to 51 dB L_{A90} with an average of 51 dB L_{A90}.

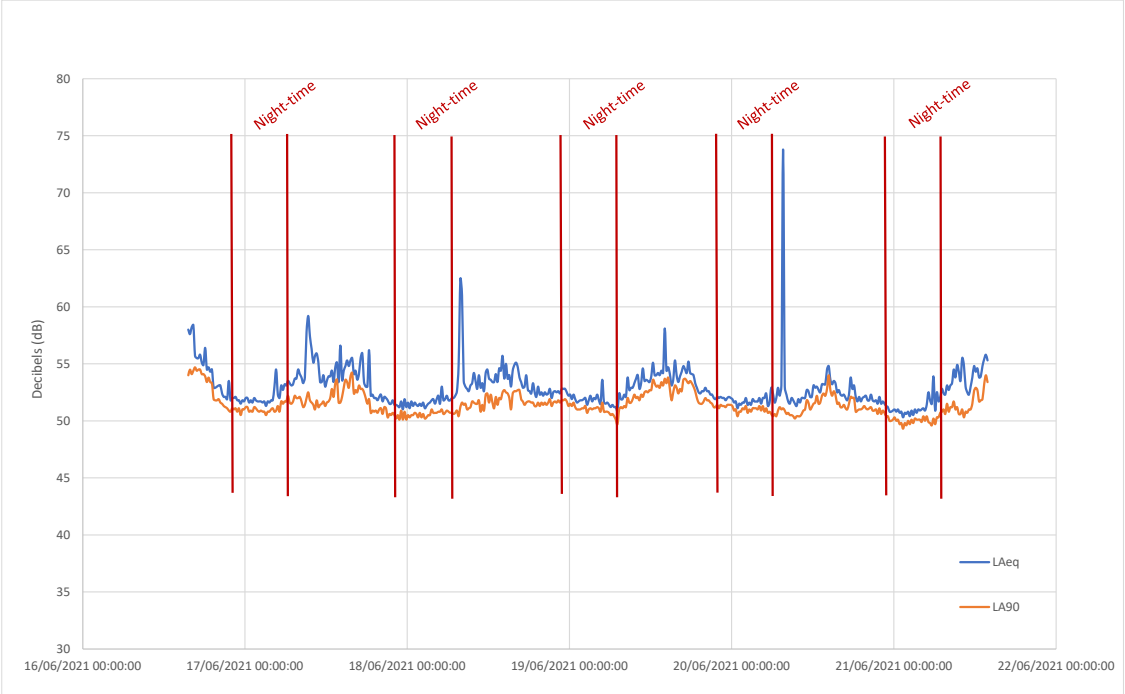

Figure 4 *Time history plot of L_{Aeq} and L_{A90} at N4*

In addition, the L_{AFmax} values were measured over 15-minute intervals over the duration of the unattended monitoring survey.

Figure 5 presents the number of measured L_{AFmax} events for each decibel level during the night period measured at Location N4. On review of the maximum noise levels the value of 67 dB L_{AFmax} is not regularly exceeded on a given night (less than 10 events).

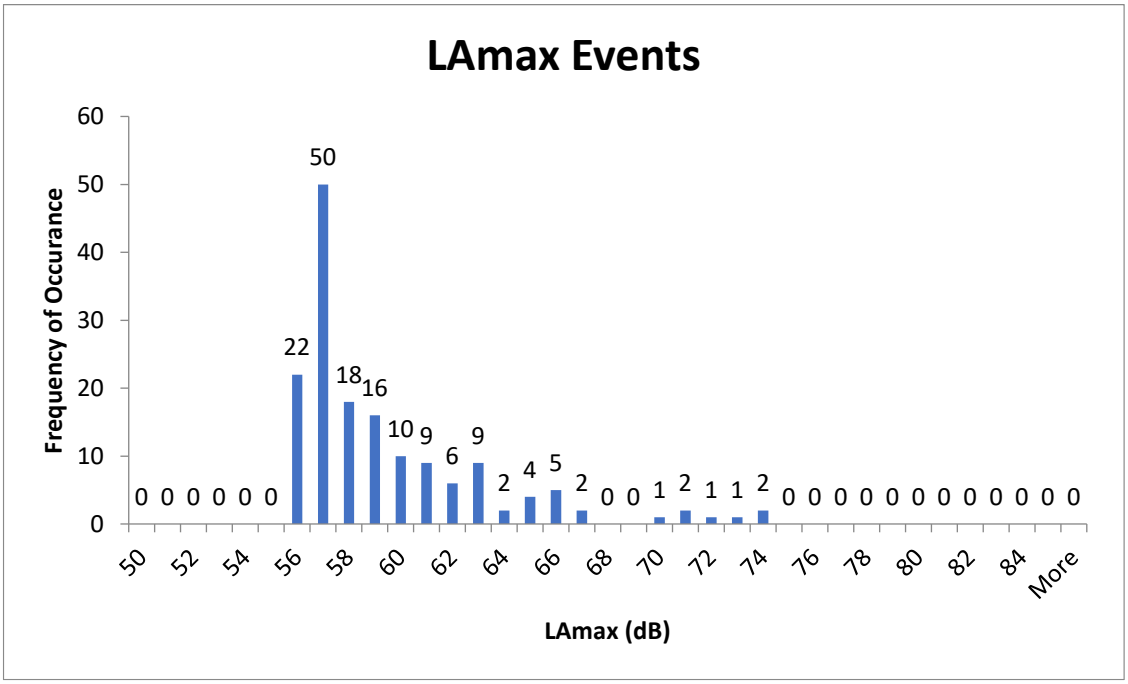

Figure 5 Distribution of L_{Amax} events – Night-time

3.6 Comment on Commercial Noise Environment

The development lands have been zoned REGEN under the South Dublin County Council Development Plan 2016 – 2022, i.e. zoned for enterprise / residential-led development.

As discussed in the sections above, during the attended noise survey, the noise environment surrounding the proposed development site comprised traffic on Broomhill road, Broomhill Terrace and Airton Road. HGV traffic was also noted and observed maneuvering near monitoring location N3. Other noise sources included loading of equipment, a power washer in use and birdsong.

With reference to Figure 4, night-time background noise levels at N4, measured in L_{A90}, were steady and individual intervals varied by some 3 dB throughout the unattended monitoring period. This indicates that in the absence of daytime commercial activity, that noise levels at the development site are steady and subject to vary slightly under the influence of weather conditions.

4.0 OUTWARD NOISE ASSESSMENT – CONSTRUCTION PHASE

4.1 Construction Phase Overview

A variety of items of plant will be in use for the purposes of site clearance/groundworks, demolition and construction. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

During the construction phase, it is anticipated that there will be a number of HGV's moving to/from site. Excavators will be employed to excavate and for foundation work, and breakers will be used in demolition and removal of existing structures and paved areas. Following this standard construction tools and methods will be employed for general construction and landscaping.

Review of aerial imagery and baseline noise surveys have identified the closest noise sensitive locations (NSLs), typically commercial premises and at greater distance, residential properties. The nearest NSLs are commercial units adjacent to the eastern and northern site boundaries. These identified NSLs are illustrated in Figure 6 below.

Figure 6 Noise Sensitive Locations

4.2 Construction Criteria

4.2.1 Noise

The closest sensitive residential receptor locations have been assigned the value 65 dB $L_{Aeq,1hr,}$ while commercial receptors have been assigned the value 75 dB $L_{Aeq,1hr}$. A value of 70 dB $L_{Aeq,1hr}$ is assigned at the educational buildings at TU Tallaght. These are the values for construction noise at a sensitive receiver that, above which, a significant impact is likely to occur.

4.2.2 Vibration

As set out in Section 2.2.2 recommended vibration limits have been set in order to avoid damage to existing buildings in proximity to areas of major construction works within the proposed development.

4.3 Predicted Construction Noise

4.3.1 General Construction

It is possible to predict indicative noise levels using guidance set out in BS 5228-1:2009+A1:2014 for the main phases of the proposed construction works. The noise levels relating to site clearance, ground excavation and loading lorries (dozers, tracked excavators and wheeled loaders) are typically in the range of 76 to 82 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 $L_{w(A)}$.

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. A combined construction noise level of 86 dB at 10 m also allows for 5 items of plant with an operational noise level of 78 dB each operating simultaneously along the closest works boundary, which is associated with typical construction mobile plant items, cranes etc., all of which will occur on the site.

Guidance on the approximate attenuation achieved by barriers surrounding the site is also provided in BS 5228-1 (BSI 2014a). 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.

The latter scenario can be assumed in this case due to the proximity of the noise-sensitive locations, i.e. a barrier height will be chosen so as to fully screen the sources. Table 15 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 $L_{Aeq,T}$)				
		10m	20m	30m	40m	50m
3 no. items each with SPL of 81 dB at 10 m operating simultaneously	114	76	70	66	62	56

Table 15 Potential Construction Noise Levels at Varying Distances Assuming Attenuation of 10 dB from Site Hoarding

With respect to residential receptors, noise levels at locations greater than 35m from areas of construction works are predicated to be within the construction noise criteria. The nearest identified residential receptors are some 250m and greater from the proposed development and therefore the impact is determined to be negligible.

With respect to neighbouring commercial receptors, premises located at 10m from major construction works will be marginally in excess (+1 dB) of the construction noise criteria, i.e. 75 dB $L_{Aeq,1hr}$. With reference to Table 1 and the Construction Noise Threshold for commercial premises, it is determined that a moderated impact is likely at these nearest commercial receptors.

The calculations set out above are based on assumed site activity and a combination of plant items operating simultaneously, as such they are typically worst-case scenarios. The use of best practice construction methods will be employed during the construction phase with a view to minimising noise impacts.

4.3.2 Construction Traffic

During the construction phase of the proposed development there will be additional construction traffic on local roads. The proposed route for construction traffic to and from the proposed development will be along the R113/R189 and Airton Road. Considering that 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 phase will not result in a significant noise impact.

4.4 Predicted Construction Vibration

The main potential source of vibration during the construction phase is associated with ground-breaking activities.

During demolition and ground breaking in the excavation phase, there is also potential for vibration to propagate through the ground. Empirical data for this activity is not provided in the BS 5228- 2:2009+A1:2014 standard, however the likely levels of vibration from this activity is expected to be significantly below the vibration criteria for building damage on experience from other sites. AWN Consulting have previously conducted vibration measurements under controlled conditions, during trial construction works, on a sample site where concrete slab breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- 3 tonne hydraulic breaker on small CAT tracked excavator
- 6 tonne hydraulic breaker on large Liebherr tracked excavator

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 to 0.25 PPV (mm/s) at distances of 10 to 50 m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.49 to 0.24 PPV (mm/s) at distances of 10 to 50 m respectively.

The range of values recorded provides some context in relation to typical ranges of vibration generated by construction breaking activity likely required on the proposed site. The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings noted in Figure 6 are likely to be below the limits set out in Table 4 to avoid any cosmetic damage to buildings.

Based on the vibration levels outlined above, when breaking works are taking place close to the eastern site boundary, it is likely that vibration levels will be perceptible to occupants of the nearest buildings.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 4 during all activities.

4.5 Best Practice Construction Noise Control

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites* Parts 1 and 2. Whist construction noise and vibration impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive buildings, the contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimised.

Referring to the potential noise generating sources for the works under consideration, the following best practice migration measures should be considered:

- Use of a standard site hoarding, typically 2.4m height will be erected around the perimeter of the construction site for the duration of works;
- The lifting of bulky items, dropping and loading of materials will be restricted to normal working hours.
- Mobile plant should be switched off when not in use and not left idling.
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site as necessary.
- 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.
- Maintaining site access roads even so as to mitigate the potential for vibration from lorries;
- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of barriers as necessary around items such as generators or high duty compressors;
- Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary
- Establishing channels of communication between the contractor/developer, Local Authority and residents, and;
- Appointing a site representative responsible for matters relating to noise and vibration.

5.0 OUTWARD NOISE ASSESSMENT – OPERATIONAL PHASE

5.1 Plant Noise

Once operational there will be building services plant items required to serve the residential aspect, the creche, the gym and office space. These will typically be limited to heating and cooling plant and extract units, depending on the building design and user requirements.

Several technologies under consideration for the scheme. It is expected that plant items will be housed internally in basement plant rooms or within the apartments themselves. For some proposals roof mounted units may be required.

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, it is best practice to set appropriate noise limits that will inform the detailed design during the selection and layout of building services for inside the development.

Plant items will be selected, designed and located so that there is no negative impact on the sensitive receivers within the development itself. The cumulative operational noise level from building services plant at the nearest development apartments will be designed/attenuated to meet the relevant BS 4142 criteria for day and night-time periods as set out in this assessment. Based on the baseline noise data collected, which include contributions from existing commercial sources, it is considered that an appropriate design criterion is of the order of 40 dB $L_{Aeq,15min}$. This limit is set in order to achieve acceptable internal noise levels within the residential spaces based on prevailing noise levels in the area.

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 Entertainment Noise

The following are examples of areas within the development may generate noise levels internally which will have the potential to generate an external impact:

- Public gym.
- Rentable studio space.

The development building envelope will comprise a combination of solid elements, i.e. masonry and cladding, and inset glazed windows and louvres. The solid wall elements will offer high levels of sound insulation, however, the windows will be weakest element.

To ensure that any music noise is inaudible, mitigation measures outlined below will be incorporated at the detailed design stage.

Appropriate Linings

Proposed constructions (e.g. external walls) should be reviewed in order to determine whether additional measures are required in order to control noise emissions from the highlighted areas. These measures would typically consist of independent wall linings where appropriate.

Glazing

Where glazing is proposed in the design the installed elements should offer an appropriate sound insulation performance in order to minimise noise break out.

Doors

Access to noisy internal areas from external locations may require acoustic lobbies with double doors separated by an appropriate distance.

Ventilation

Ventilation should be supplied by suitably attenuated mechanical means. Once details of the proposed building services installation are known, consideration should be given to the potential for entertainment noise breakout to atmosphere via ductwork; the potential for services noise transfer to both external and internal areas.

Audio System

Audio systems should feature a distributed array of loudspeakers arranged such that the coverage zones are tightly controlled and all patrons are within the “near field” of one or more loudspeakers. This will limit the amount of sound energy incident upon the external walls and in turn help to control the amount of noise transfer and break-out.

Noise Level

Once the measures outlined above are implemented it would be recommended that a maximum permissible noise level be set for each space (i.e. a noise level that should not be exceeded in order to ensure that noise emissions are kept to an acceptable level).

5.3 Additional Traffic on Surrounding Roads

During the operational phase of the proposed development, there will be an increase in vehicular traffic associated with the site on some surrounding roads. A traffic impact assessment relating to the proposed development has been prepared by NRB Engineering consulting engineers, as part of this EIAR. Using this information, the related noise impacts along the relevant road links has been assessed.

Table 16 and Table 17 overleaf present the predicted change in noise level at different road links around the site for the year of opening and the design year using the Annual Average Daily Traffic (AADT) flows along the road links under consideration.

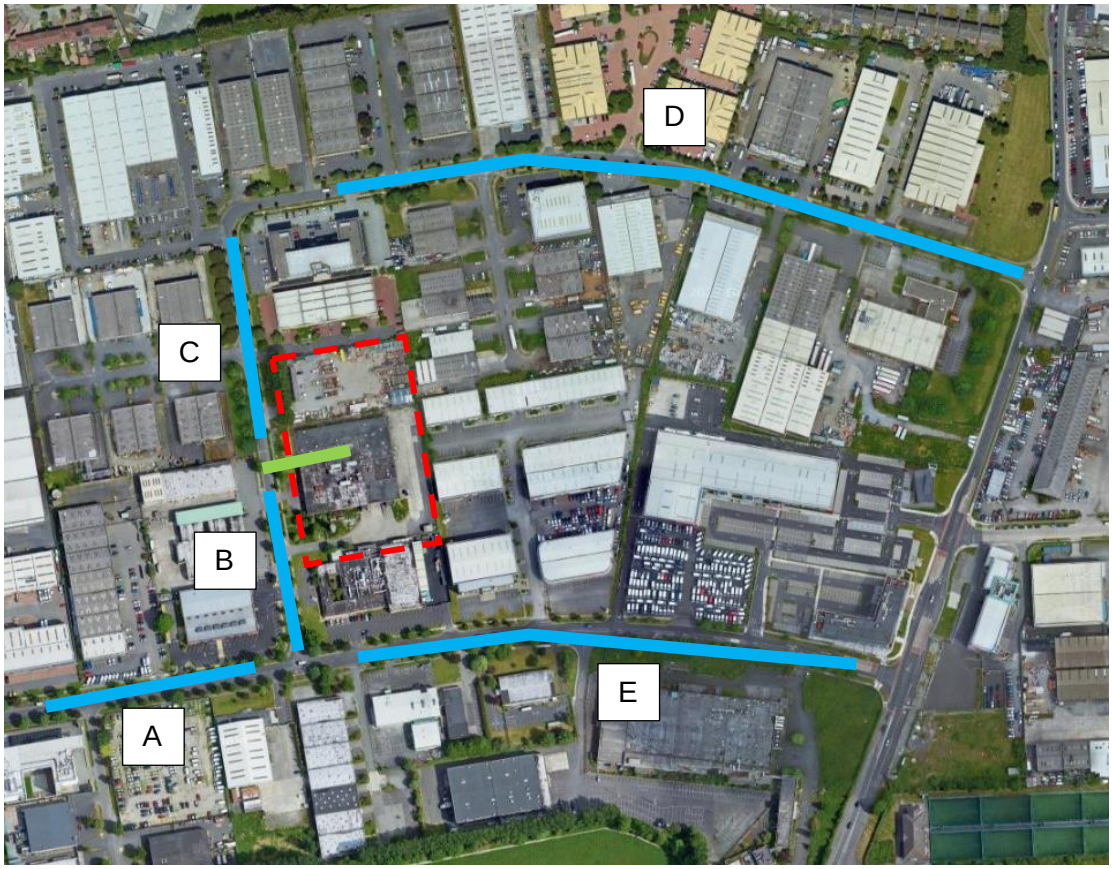

Figure 7 Surrounding Road Network

Road Link	Opening Year (2023)		
	Do Nothing – AADT Without Development	Do Something – AADT With Development	Change in Noise Level (dB)
A – Airton Road (west)	9359	9674	+0.1
B – Broomhill Road (i)	3376	4179	+0.9
C – Broomhill Road (ii)	3139	3354	+0.3
D – Broomhill Road (iii)	2293	2509	+0.4
E – Airton Road (east)	6567	6655	+0.1

Table 16 Predicted Change in Noise Level associated with Vehicular Traffic – 2023

With reference to Table 7, for the Opening Year 2023 the predicted change in noise level associated with additional traffic on surrounding road network is of negligible impact.

Road Link	Design Year (2038)		
	Do Nothing – AADT Without Development	Do Something – AADT With Development	Change in Noise Level (dB)
A – Airton Road (west)	10903	11218	+0.1
B – Broomhill Road (i)	4399	4802	+0.4
C – Broomhill Road (ii)	3657	3872	+0.2
D – Broomhill Road (iii)	2672	2887	+0.3
E – Airton Road (east)	7651	7739	0.0

Table 17 Predicted Change in Noise Level associated with Vehicular Traffic – 2038

With reference to Table 7, for the Design Year 2038 the predicted change in noise level associated with additional traffic on surrounding road network is of negligible impact.

6.0 INWARD NOISE IMPACT ASSESSMENT

6.1 Stage 1 – Noise Risk Assessment

6.1.1 Methodology

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 8 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.

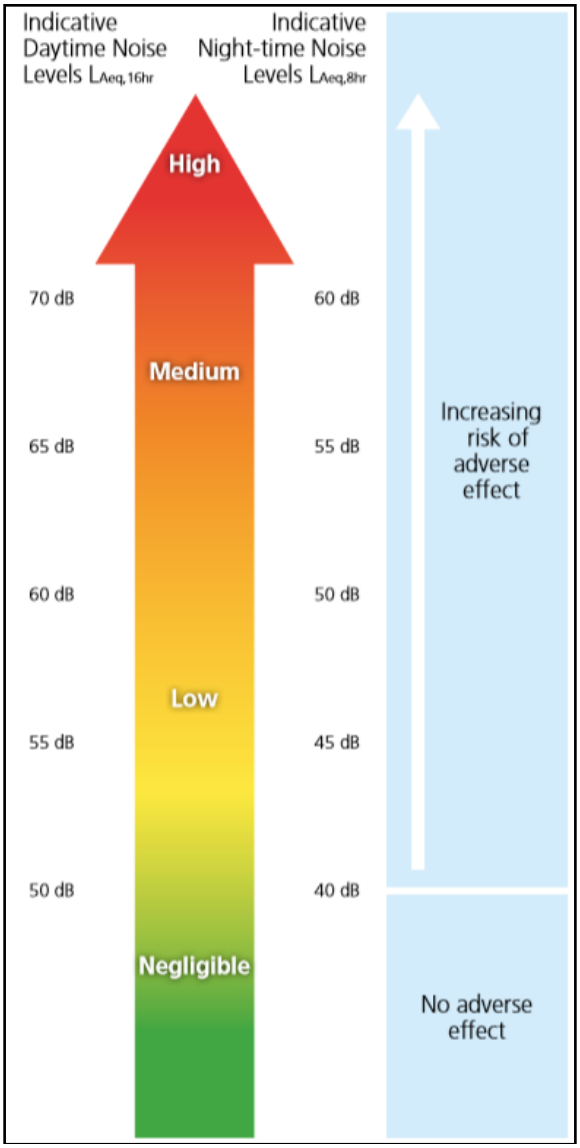

Figure 8 ProPG Stage 1 - Initial Noise Risk Assessment

It should be noted that a site should not be considered a negligible risk if more than 10 no. 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."*

6.1.2 Noise Risk Assessment Conclusion

With reference to the measured noise levels presented in Section 3.0 and the Noise Risk Assessment outlined in ProPG the noise levels for relevant periods have been derived in order to classify the proposed development site. Table 18 summarises the predicted noise levels at the most exposed proposed building facades, as per the proposed site layout.

Façade Location	Period	Measured/Predicted Noise Level (dB, $L_{Aeq,T}$)	"Risk Category"
Broomhill Terrace	Daytime	51 – 53	Low
Broomhill Road	Daytime	60 – 62	Low
	Night-time	55	Low - Medium

Table 18 Categorising Proposed Site

Giving consideration to the baseline noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk on the site can be classified as a 'low' to 'medium' noise risk.

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the L_{AFmax} noise levels. The results indicate that the L_{AFmax} noise levels are not projected to exceed 67 dB more than 20 times per night, and therefore does not exceed the threshold whereby ProPG recommends that the site is considered as high risk, with respect to this aspect.

ProPG states the following with respect to low and medium noise risk:

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.*

Given the above it can be concluded that the development site may be categorised as *Low* to *Medium Noise 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. This Acoustic Design Strategy is set out in Section 6.2.

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."*

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium 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.

6.2 Stage 2 – Full Acoustic Assessment

6.2.1 Element 1 – Good Acoustic Design (GAD) Process

ProPG Guidance

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. It is important to note that ProPG specifically states that good acoustic design 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 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 have been addressed in the following subsections.

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

Review of the site layout shows that at ground floor level, less sensitive non-residential spaces, i.e. amenity space, have been located facing onto the Broomhill Road. Further, the external communal amenity space is located to the rear of the development buildings, and are screened an set back from the influence of traffic noise.

Select Construction Types for meeting Building Regulations

Masonry constructions will be used in constructing the external walls of the development. The masonry construction type offers high levels of sound insulation performance. However, as is typically the case the glazed elements and any required ventilation paths will be the weakest elements in the façade in terms of sound insulation performance.

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 and vents open, 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:

> "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*."

It is important to note that it is impractical to achieve the good internal noise levels with windows open across the vast majority of development sites in urban or suburban locations. Such sites would need to be classified as having a negligible risk in accordance with the ProPG noise risk assessment approach. For this reason, there are no guidance documents either at a local level or an international level that AWN is aware of which would support the approach of achieving the ideal internal noise levels only in the open window scenario. It is therefore considered entirely correct and justifiable to provide building facades with a moderate degree of sound insulation such that with windows closed and vents open a good internal acoustic environment is achieved.

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

The good acoustic design measures that have been implemented on site, e.g. locating properties away from the road, placing outdoor space on the quiet side of buildings, are considered to be cost neutral and do not have any significant impact on other design aspects.

Assess Viability of Alternative Solutions

This will be explored at detailed design stage to assess the acoustic benefit of any alternative solutions.

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 $L_{Aeq,16hr}$."*

Noise levels across amenity areas is addressed in Section 6.2.3 below.

6.2.2 Element 2 – Internal Noise Levels

Internal Noise Criteria

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 8 and are based on annual average data.

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

Façade Noise Levels

Noise levels have been predicted across the development site during day and night-time periods. Table 19 presents the assigned noise levels for the various facades of the buildings on site.

Façade Ref	Period	$L_{Aeq,\ T}$ dB
ORANGE	Day	60 - 65
	Night	50 - 55
YELLOW	Day	50 - 60
	Night	45 - 50

Table 19 Summary of Assigned Façade Noise Levels

Figure 9 Predicted Façade Noise Levels

Recommend Façade Treatment

The British Standard BS EN 12354-3: 2017: *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 principals outlined in BS EN 12354-3 are also referred to in BS8233 and Annex G of BS8233 provide 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 typically the weakest element from a sound insulation perspective. In this instance the facades will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 20.

Glazing Specification	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
All Facades	19	27	34	39	35	40	31

Table 20 Sound Insulation Performance Requirements for Glazing, SRI (dB)

The above specification is representative of a double glazed 6/12/6 glazing system.

The overall R_w value outlined above 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 20 or greater.

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.

It is advised that the window supplier provides laboratory tests confirming the sound insulation performance. It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system when installed on site.

Wall Construction

In general, all wall constructions (i.e. block work or concrete and spandrel elements) 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 attenuation across all ventilators will be required to offer a minimum performance of **33 dB $D_{n,e,w}$.**

Internal Noise Levels

Taking into account the external façade levels and the specified acoustic performance to the building envelope, the internal noise levels have been calculated.

All locations are predicted to achieve good internal noise levels with windows closed.

Amenity Space

Indoor amenity space for use by residents is proposed, which by its nature is shielded from external noise.

Outdoor amenity space is also provided. This space is located to the rear of the development screened by development buildings, set back and further from the influence of traffic noise.

Summary

Considering the constraints of the site, in so far as possible and without limiting the extent of the development area, the principles of Good Acoustic Design 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. This will be developed further as the design progresses.

6.2.3 Element 3 – External Amenity Areas

For this development the good acoustic design principals employed have ensured that the majority of private external spaces are positioned set back to decrease the impact of traffic noise and to benefit from the screening effect of the development buildings. With respect to the current layout the vast majority of the private outdoor amenity space is predicted to achieve a noise level ≤55 dB $L_{Aeq,16hr}$.

6.2.4 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 vs unintended adverse consequences
- 4(v) acoustic design vs wider planning objectives

Each is discussed in turn below.

Compliance with Relevant National and Local Policy

There are no national policy documents relating to the acoustic design of residential dwellings. Locally the Dublin Noise Action Plan specifies that the guidance contained within ProPG should be used in assessing the noise impact on new residential developments.

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

Magnitude and Extent of Compliance with ProPG

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

- All dwellings as part of the development have been designed to achieve the good level of internal noise levels specified within ProPG.
- All external amenity areas have been shown to have an external noise level that complies with the recommended criterion set out in ProPG.

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

Likely Occupants of the Development

This element is not considered relevant here as the future occupants are unknown. It is included within ProPG to allow for some discussion on how the acoustic conditions may change depending on the likely occupants.

Acoustic Design v Unintended Adverse Consequences

Design aspects such as roadside barriers that remove views or prevent crossing roads, sealed facades that affect personal control over the internal environment etc., have been avoided through implementation of Good Acoustic Design principles.

Acoustic Design v Wider Planning Objectives

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

7.0 CONCLUSION

Planning Permission is being sought for a proposed residential development at Broomhill Road, Dublin 24. The development will comprise 242 no. residential units with internal and external communal amenity spaces and a creche. At ground floor level there will be provision of a public gym, office space and rentable studio space.

A baseline noise survey has been undertaken at the development site to determine the existing environment.

The noise and vibration impact of the construction phase and operational phase of the proposed development has been assessed.

Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that at the nearest residential noise sensitive receivers, noise from construction activities will be well below the threshold at which a likely significant impact will occur. Noise levels from construction activities at neighbouring commercial premises are predicted to be of a level corresponding to a moderate impact. Best practice construction methods have been presented within this report, the implementation of which will aid in the reduction of the impact of construction activities on nearby sensitive receptors.

Once operational, it is expected that noise emissions will be limited to plant noise emissions and noise from traffic moving to and from the proposed development. Regarding plant noise, suitable noise thresholds have been proposed based on the measured noise levels on the site. During detailed design stage plant and noise mitigation options should be selected so that the noise emissions at units within the development and external nearby sensitive receptors do not exceed the recommended thresholds

An inward noise assessment has been undertaken based on the results of the noise survey as recommended in the *ProPG: Planning & Noise* guidance document.

The measured noise levels on the site have been used to calculate noise levels at specific facades of proposed residential units and to predict the internal noise levels within bedroom spaces, taking account of the proposed building envelope and conditions in the receiving rooms (e.g. volumes and room acoustic characteristics). Based on these noise levels appropriate acoustic glazing and ventilators have been recommended to facades of the development buildings.

Based on the implementation of the measures outlined in this assessment the predicted noise levels conform to the criteria taken from BS8233:2014 for acceptable internal noise levels. It should be noted that the predicted internal noise levels detailed above assume that windows and doors will be closed.

It is predicted that the majority of the amenity space will experience noise levels of ≤55dB $L_{Aeq,16hr}$ in line with the recommended noise level for these areas.

APPENDIX A
GLOSSARY OF ACOUSTIC 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.

$D_{n,e,w}$ — Weighted element-normalized level difference. This is the value of sound insulation performance of a ventilator measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature for acoustic ventilators typically presents sound insulation data in terms of the $D_{n,e,w}$ parameter.

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.

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.

PPV Peak Particle Velocity (PPV) is defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is measured in mm/s.

R_w Weighted Sound Reduction Index – This is the value of the sound insulation performance of a partition or element measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature typically presents sound insulation data in terms of the R_w parameter.

R'_w Weighted Apparent Sound Reduction Index – This is similar to R_w but is used to express *in-situ* sound insulation performance, where issues such as flanking issue noise transfer may affect the measured level. As stated previously, technical literature typically uses the R_w parameter. In order to reflect the likely *in-situ* performance of an element an appropriate correction should be applied for the expected reduction in performance. Note that in instances where significant flanking issues are present the *in-situ* performance may be further reduced.

VDV Vibration Dose Value (VDV). This is an assessment of the effect of building vibration on the people within. The VDV is the fourth root of the integral of the fourth power of acceleration after it has been frequency-weighted (as defined in BS6472: 2008). The frequency-weighted acceleration is measured in m/s^2 and the time period over which the VDV is measured is in seconds. This yields VDVs in $m/s^{1.75}$.