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# NOISE ASSESSMENT FOR A PROPOSED MIXED USE DEVELOPMENT AT No. 158A RICHMOND ROAD, DUBLIN 3, D03 YK12

Technical Report Prepared For

**Thornton O'Connor Town Planning**

Technical Report Prepared By

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## EXECUTIVE SUMMARY

Planning Permission is currently being sought from Dublin City Council for the construction of a mixed-use development, located at Richmond Road, Dublin 3.

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 urban 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 with reference to BS 5228 (2009 +A1 2014) - Part 1. 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 and vibration 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. Noise from deliveries will be managed by restricting deliveries to day time hours to keep noise impacts to a minimum. Mitigation measures are not expected to be required for development-generated traffic.

# 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 Alistair Maclaurin BSc, PgDip, MIOA, Senior Acoustic Consultant at AWN, who has worked in the field of acoustics since 2012. He has been the lead noise consultant across various sites on major infrastructure projects such as Crossrail and Thames Tideway Tunnel, specialising in construction noise assessment and control. Additionally, he has undertaken various environmental noise assessments for infrastructure developments and planning reports.

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.

Appendix A presents a glossary of the acoustic terminology used in this report.

## 2.0 PROPOSED DEVELOPMENT

Malkey Limited intend to apply for permission for development (Large-scale Residential Development (LRD)) at this c. 0.55 hectare site at the former Leydens Wholesalers & Distributors, No. 158A Richmond Road, Dublin 3, D03 YK12. The site is bounded to the north-east by Richmond Road, to the west/south-west by No. 146A and Nos. 148-148A Richmond Road (pending application ABP Reg. Ref. TA29N.312352), to the south/south-west by a residential and commercial development (Distillery Lofts) and to the east/south-east by the Former Distillery Warehouse (derelict brick and stone building). Improvement works to Richmond Road are also proposed including carriageway widening up to c. 6 metres in width, the addition of a c. 1.5 metre wide one-way cycle track/lane in both directions, the widening of the northern footpath on Richmond Road to a minimum of c. 1.8 metres and the widening of the southern footpath along the site frontage which varies from c. 2.2 metres to c. 7.87 metres, in addition to a new signal controlled pedestrian crossing facility, all on an area of c. 0.28 hectares. The development site area and road works area will provide a total application site area of c. 0.83 hectares.

The proposed development will principally consist of: a Large-scale Residential Development (LRD) comprising the demolition of existing industrial structures on site (c. 3,359 sq m) and the construction of a mixed-use development including artist studios (c. 749 sq m), a creche (c. 156 sq m), a retail unit (c. 335 sq m), and a gym (c. 262 sq m), and 133 No. residential units (65 No. one bed apartments and 68 No. two bed apartments). The development will be provided in 3 No. blocks ranging in height from part 1 No. to part 10 No. storeys as follows: Block A will be part 1 No. storey to part 4 No. storeys in height, Block B will be part 1 No. storeys to part 10 No. storeys in height (including podium) and Block C will be part 1 No. storeys to part 9 No. storeys in height (including podium). The proposed development has a gross floor area of c. 14,590 sq m and a gross floor space of c. 13,715 sq m.

The development also proposes the construction of: a new c. 204 No. metre long flood wall along the western, southern and south-eastern boundaries of the proposed development with a top of wall level of c. 6.4 metres AOD to c. 7.15 metres AOD

(typically c. 1.25 metres to c. 2.3 metres in height) if required; and new telecommunications infrastructure at roof level of Block B including shrouds, antennas and microwave link dishes (18 No. antennas enclosed in 9 No. shrouds and 6 No. transmission dishes, together with all associated equipment) if required. A flood wall and telecommunications infrastructure are also proposed in the adjoining Strategic Housing Development (SHD) application (pending decision ABP Reg. Ref. TA29N.312352) under the control of the Applicant. If that SHD application is granted and first implemented, no flood wall or telecommunications infrastructure will be required under this application for LRD permission (with soft landscaping provided instead of the flood wall). If the SHD application is refused permission or not first implemented, the proposed flood wall and telecommunications infrastructure in the LRD application will be constructed.

The proposed development also provides ancillary residential amenities and facilities; 25 No. car parking spaces including 13 No. electric vehicle parking spaces, 2 No. mobility impaired spaces and 3 No. car share spaces; 2 No. loading bays; bicycle parking spaces; motorcycle parking spaces; electric scooter storage; balconies and terraces facing all directions; public and communal open space; hard and soft landscaping; roof gardens; green roofs; boundary treatments; lighting; ESB substation; switchroom; meter room; comms rooms; generator; stores; plant; lift overruns; and all associated works above and below ground.

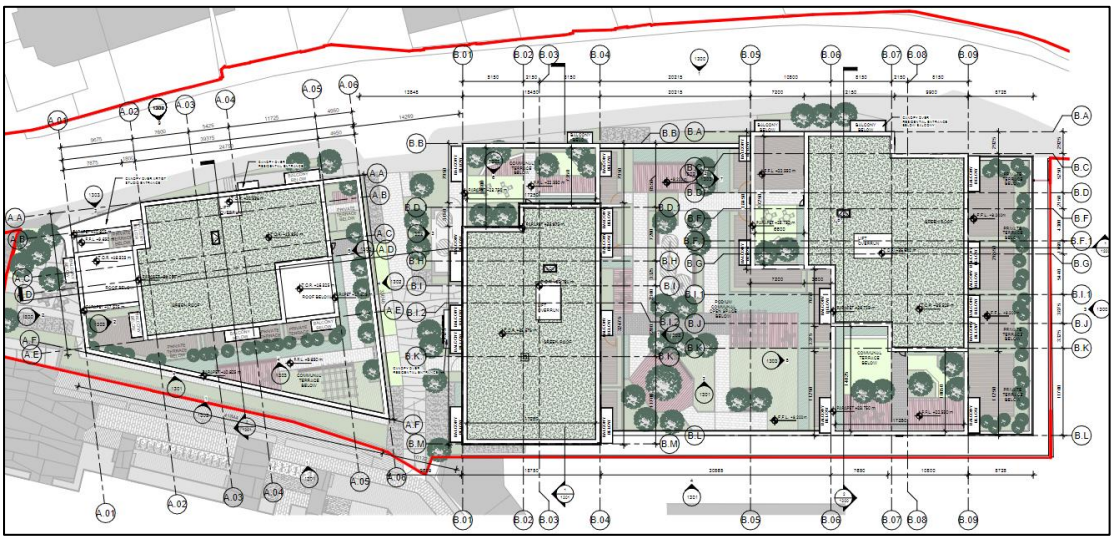

***Figure 1*** Site Location & Layout

## 3.0 METHODOLOGY AND CRITERIA

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, demolition 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, potential outward noise from commercial spaces 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:

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;
- Professional Practice Guidance on Planning & Noise (ProPG) Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH) (2017); 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 Dublin Agglomeration Noise Action Plan 2019 – 2023 (Volume 1 Dublin City Council)

The Dublin Agglomeration NAP states the following with respect to assessing the noise impact on new residential development:

*"Acoustic privacy is a measure of sound insulation between dwellings and between external and internal spaces. Development should have regard to the guidance on sound insulation and noise reduction for buildings contained in BS 8233:2014. The*

*following principles are recommended for minimising disruption from noise in dwellings:*

- *Utilise the site and building layout to maximise acoustic privacy by providing good building separation within the development and from neighbouring buildings and noise sources*
- *Arrange units within the development and the internal layout to minimise noise transmission by locating busy, noisy areas next to each other and quieter areas next to quiet areas*
- *Keep stairs, lifts, and service and circulation areas away from noise-sensitive rooms like bedrooms. Particular attention should be paid to the siting and acoustic isolation of the lift motor room. Proposals close to noisy places, such as busy streets may need a noise impact assessment and mitigation plan."*

## 3.2 ProPG: Planning & Noise

The Professional 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 UK or Irish government document, since its publication 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, and;
    - 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.

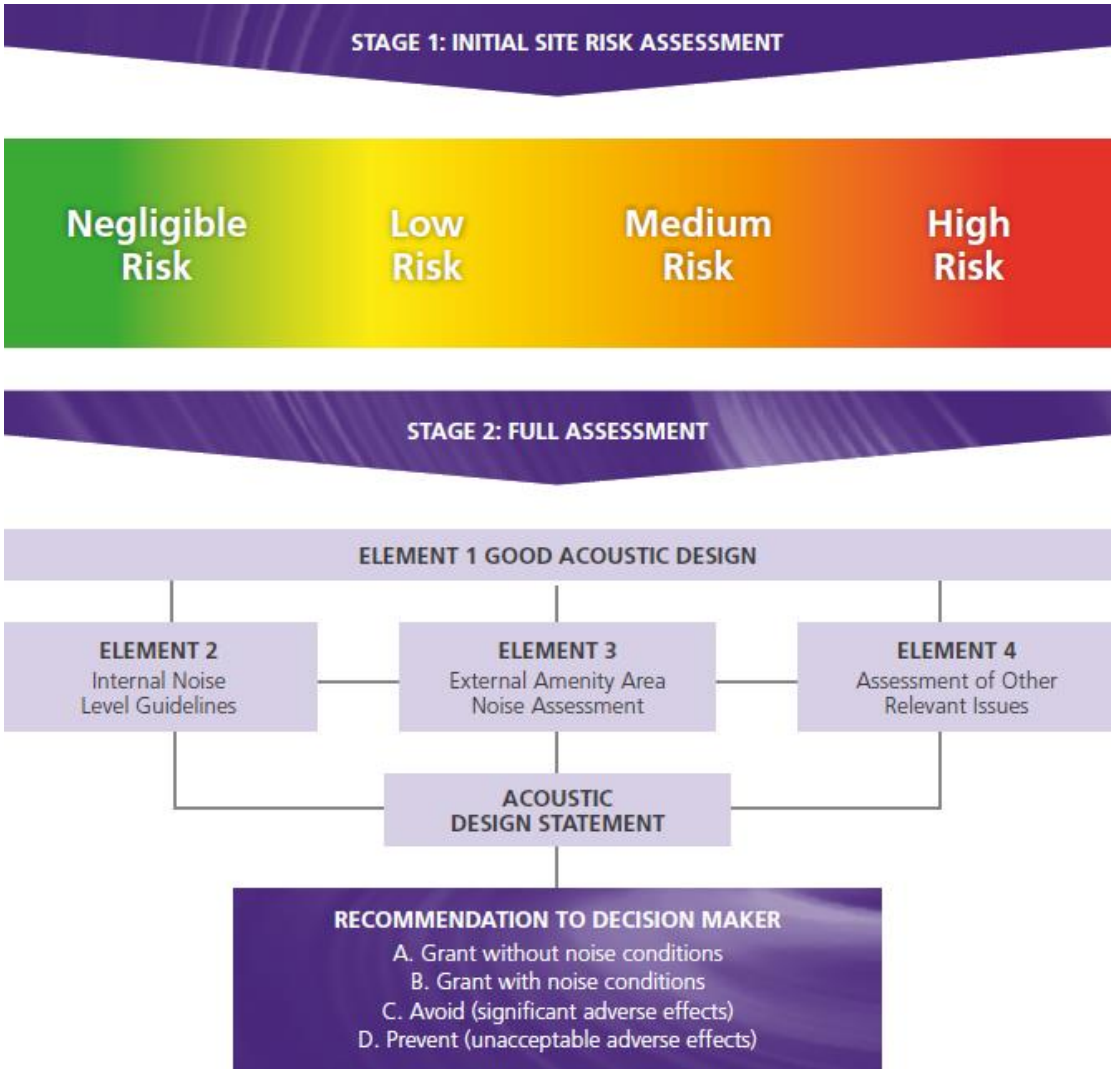


***Figure 2*** ***ProPG Approach (Source: ProPG)***

## 3.3 WHO Environmental Noise Guidelines for Europe

The World Health Organisation (WHO) have published in October 2018 *Environmental Noise Guidelines for the European Region*. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of $L_{den}$ and $L_{night}$ levels above which there is risk of adverse health risks.

However, it should be noted that the WHO guideline values referred to here are recommended to serve as the basis for a policy-making process to allow evidence-based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines,

*"The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices."*

It is therefore not intended to refer to the WHO guidelines in an absolute sense as part of this assessment and it will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits for use.

## 3.4 Internal Noise (BS 8233)

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 are set out in Table 1.

| 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 |

***Table 1*** 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.

## 3.5 Childcare Facility Criteria

BS 8233 also sets out recommended internal noise levels for several different non-domestic building types from external noise sources such as road and air traffic.

The recommended indoor ambient noise levels in non-domestic buildings are as follows:

| Objective | Typical Situations | Design range dB $L_{Aeq,T}$ |
|---|---|---|
| Typical noise levels for acoustic privacy in shared spaces | Restaurant | 40 – 55 |
| | Open plan office | 45 – 50 |
| | Night club, public house | 40 – 45 |
| | Ballroom, banqueting hall | 35 – 40 |
| | Living room | 35 – 40 |

***Table 2*** Indoor ambient noise levels in spaces when they are unoccupied, and privacy is important

| Activity | Location | Design range dB $L_{Aeq,T}$ |
|---|---|---|
| Speech or telephone communications | Department Store Cafeteria, canteen, kitchen | 50 – 55 |
| | Concourse Corridor, circulation space | 45 – 55 |
| Study and work requiring concentration | Library, gallery, museum | 40 – 50 |
| | Staff/meeting room, training room | 35 – 45 |
| | Executive office | 35 – 40 |
| Listening | Place of worship, counselling, meditation, relaxation | 30 – 35 |

***Table 3*** Typical Noise Levels in Non-DomesticBuildings from BS8233

Based on a review of the BS 8233 standard and considering the proposed usage of the proposed development a criterion for internal noise levels for the childcare facility been identified for each of the following rooms:

| Room | Activity | Design Criterion dB $L_{Aeq,T}$ |
|---|---|---|
| Quiet Rooms | Daytime Resting & Sleeping | 35 |
| Preschool Rooms | Study and Work requiring concentration | 40 |
| Offices | | 40 |

***Table 4*** Recommended design criteria for Childcare Facility

## 3.6 Offsite Noise Impacts

Once a development of this nature becomes fully operational, a variety of electrical and mechanical plant will be required to service the development. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (i.e. overnight). Noisy plant with a direct line-of-sight to noise sensitive properties would potentially have the greatest impact. Plant contained within plantrooms has the least potential for impact once consideration is given to appropriate design of the space.

In relation to plant noise levels at noise sensitive locations DCC would typically apply the following condition to the development of this nature:

> *"Noise levels from the proposed development should not be so loud, so continuous, so repeated, of such duration or pitch or occurring at such times as to give reasonable cause for annoyance to a person in any premises in the neighbourhood or to a person lawfully using any public space. In particular the rated noise levels from the proposed development shall not constitute reasonable grounds for complaint as provided for in B.S. 4142. Method for rating industrial noise affecting mixed residential and industrial area.*

*Reason: In order to ensure a satisfactory standard of development, in the interests of residential amenity."*

Guidance from DCC on noise emissions from mechanical plant items makes reference to the British Standard BS 4142: 2014+A1:2019: *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 also 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 2dB penalty for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB 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 +10dB 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 +5dB 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.

Based on previous noise surveys in the area it is considered that a plant noise criterion of the order of 40 dB(A) will be appropriate at the nearest noise sensitive locations at off-site locations. This will need to be confirmed through noise surveys which will be completed on site and/or in the vicinity of the noise sensitive locations in question. It is important to note that in protecting the amenity within the development (i.e. control noise levels from commercial/retail units at residential units within the proposed development) would result in acceptable noise levels at off-site noise sensitive locations that are removed at a further distance. In addition to the above absolute level, note that plant noise emissions should not contain tonal or impulsive characteristics.

### 3.7 Entertainment Noise

Entertainment sound shall be controlled so as its level at any adjacent noise sensitive location shall not cause the ambient noise level (measured in the absence of said entertainment sound) to increase, when assessed over 5 minute back to back periods. Similar criteria shall apply to the 63Hz & 125Hz octave band levels.

### 3.8 Building Regulation Requirements

It is noted that retail/commerical and gymnasium units are located below the residential portions of the development and that a party floor separates the spaces. Given the particular sensitivity of the residential spaces to potential for noise transmission through the floor from the retail units, some high-level advice is provided within this document to mitigate noise transmission through the floor to the residential units.

The sound insulation performance requirements for residential spaces as set out in *Part E* of the *Building Regulations 2014* are as follows:

> *Sound E1 Each wall and floor separating a dwelling from:*
>
> *a) another dwelling or dwellings,*
> *b) other parts of the same building, or*
> *c) adjoining buildings,*
>
> *shall be designed and constructed in such a way so as to provide reasonable resistance to sound.*

See the Regulations for further definitions and clarifications.

TGD E also states that:

> *"A higher standard of sound insulation may be required between spaces used for normal domestic purposes and communal or non-domestic purposes. In these situations the appropriate level of sound insulation will depend on the noise generated in the communal or non-domestic space. Specialist advice*

*may be needed to establish if a higher standard of sound insulation is required in order to achieve a reasonable resistance to sound."*

It is this passage that is most relevant to the considerations within this report. Considering the adjacency of the commercial/retail areas to the residential areas it is recommended that the airborne sound insulation value between these spaces is increased to accommodate the various uses that the communal space may entail that could result in higher than typical noise emissions.

## 3.9 Construction Noise Impacts (BS5228)

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 normally 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 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.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 2 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by BS 5228 – 1. These are cumulative levels, i.e. the sum of both ambient and construction noise levels.

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

***Table 2*** Example Threshold of Significant Effect at Dwellings

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

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

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

Note 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 residential properties.

This assessment process determines if a significant construction noise impact is likely. Notwithstanding the outcome of this assessment, the overall acceptable levels of construction noise set out in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*[1], which

1 *Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004*, Transport Infrastructure Ireland

should not be exceeded at noise sensitive locations during the construction phase of the development. Table 3 sets out these levels.

| Days and Times | Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq(1hr)}$ | $L_{Amax}$ |
| Monday to Friday 07:00 to 19:00hrs | 70 | 80 |
| Monday to Friday 19:00 to 22:00hrs | 60* | 65* |
| Saturdays 08:00 to 16:30hrs | 65 | 75 |
| Sundays & Bank Holidays 08:00 to 16:30hrs | 60* | 65* |

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

***Table 3*** Maximum Permissible Noise Levels at the Facade of Dwellings during Construction

In exceptional circumstances there may be a requirement that certain construction works are carried out during night-time periods. Therefore, based on the above the following construction noise criteria are proposed for the site subject to review of planned noise survey results being reviewed in the study area:

*70dB $L_{Aeq,1hr}$ at noise sensitive location*
*75dB $L_{Aeq,1hr}$ at commercial property*

## 3.10 Review of Vibration Guidance

Peak particle velocity (PPV) is commonly used to assess the structural response of buildings to vibration. Reference to the following documents has been made for the purposes of this assessment in order to discuss appropriate PPV limit values.

- British Standard BS7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;
- British Standard BS5228-2: 2009 + A1: 2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

BS5228-2 and BS7385 advise 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.

The recommended vibration limits in order to avoid cosmetic damage to buildings, as set out in both documents referred to above, are reproduced in Table 4. The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 4. Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in the Table. It should be noted that these values refer to the base of the building.

| Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of | | |
|---|---|---|
| 4 to 15 Hz | 15 to 40Hz | 40Hz and above |
| 15 mm/s | 20 mm/s | 50 mm/s |

***Table 4*** Transient Vibration Guide Values for Cosmetic Damage

Human response to vibration stimuli occurs at orders of magnitudes below those associated with any form of building damage, hence vibration levels lower than those indicated in Table 5 can lead to concern. BS5228-2 also provides a useful guide

relating to the assessment of human response to vibration in terms of PPV. Whilst the guide values are commonly 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 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. |

***Table 5*** Guidance on Effects of Human Response to PPV Magnitudes

The standards note that single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. Where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 might be more appropriate to determine whether time varying exposure is likely to give rise to any degree of adverse comment.

## 4.0 EXISTING RECEIVING ENVIRONMENT

### 4.1 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 noise sensitive locations surrounding the proposed development. The selected locations are shown in Figure 3 and described as below:

- UN1 – Unattended measurement location at south-western boundary
- UN2 – Unattended measurement location at the northern boundary of the site.
- AT1 – Attended location to capture a snapshot of the daytime noise environment at the recently constructed residential development to the northwest of the site along Richmond Road.
- AT2 – Attended location to capture a snapshot of the daytime noise environment along Richmond Road opposite the proposed development.
- AT3 – Attended location to capture a snapshot of the daytime noise environment in the commercial and office premises to the southeast of the site.


***Figure 3*** Noise Survey Locations

## 4.2 Survey Periods

Unattended noise measurements at UN1 were conducted between 10:45hrs on Tuesday 11 May and 14:15 Thursday 20 May 2021.

Further unattended measurements were undertaken at location UN2 between 14:15 on Thursday 10 November and 13:50 on Monday 14 November 2022.

Attended noise measurements were carried out on Tuesday 11 May 2021 between 11:00hrs and 14:10hrs.

The weather during the survey period was 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:

| Location | Type | Serial Number | Calibration Date |
|---|---|---|---|
| AN1 – 3 | Bruel and Kjaer 2250-L | 3008402 | Nov 2019 |
| UN1 | Rion NL-52 | 575782 | Nov 2020 |
| UN2 | Rion NL-52 | 998413 | Mar 2022 |

***Table 6*** 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.

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

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

**$L_{AFmax}$** 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 Location UN1

The results of the unattended monitoring survey at Location UN1 are summarised for daytime periods in Table 7 and for night-time periods in Table 8.

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq,16hr}$ | $L_{A90}$ |
| Tuesday 11 May | 57 | 48 |
| Wednesday 12 May | 58 | 48 |
| Thursday 13 May | 58 | 48 |
| Friday 14 May | 57 | 48 |
| Saturday 15 May | 56 | 47 |
| Sunday 16 May | 54 | 42 |
| Monday 17 May | 57 | 47 |
| Tuesday 18 May | 58 | 49 |
| Wednesday 19 May | 57 | 46 |

***Table 7*** Summary of Daytime Unattended Noise Measurements at UN1. $L_{Aeq}$ Averages refer to logarithmic averages and $L_{A90}$ averages refer to arithmetic averages.

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq}$ | $L_{A90}$ |
| Tuesday 11 May to Wednesday 12 May | 50 | 38 |

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq}$ | $L_{A90}$ |
| Wednesday 12 May to Thursday 13 May | 51 | 37 |
| Thursday 13 May to Friday 14 May | 50 | 41 |
| Friday 14 May to Saturday 15 May | 48 | 38 |
| Saturday 15 May to Sunday 16 May | 47 | 37 |
| Sunday 16 May to Monday 17 May | 48 | 38 |
| Monday 17 May to Tuesday 18 May | 50 | 37 |
| Tuesday 18 May to Wednesday 19 May | 50 | 38 |
| Wednesday 19 May to Thursday 20 May | 51 | 37 |

***Table 8*** Summary of Night-time Unattended Noise Measurements at UN1

During daytime periods, average noise levels were in the range 54 to 58dB $L_{Aeq,15min}$ and 42 to 49 dB $L_{A90,15min}$. During night-time periods, average noise levels were in the range 47 to 51dB $L_{Aeq,15min}$ and 37 to 41 dB $L_{A90,15min}$. These noise levels are considered representative of an urban location.

$L_{Aeq}$ and $L_{AFMax}$ values were measured at 15-minute intervals over the duration of the survey. Figure 4 presents the number of measured $L_{Aeq}$ and $L_{AFMax}$ events for each decibel level during the night period. It is noted that the noise level of 75 dB $L_{Amax}$ is not normally exceeded.

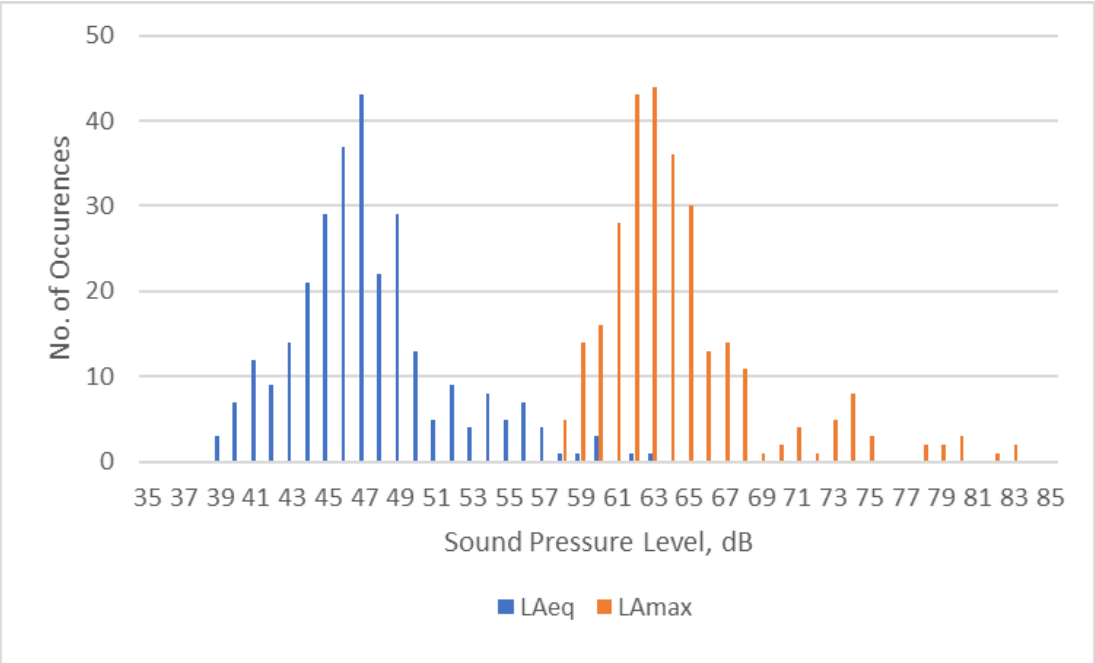


***Figure 4*** Number of Events at UN1 at Each Decibel Level – Night

### 4.5.2 Location UN2

The results of the unattended monitoring survey at Location UN2 are summarised for daytime periods in Table 9 and for night-time periods in Table 10.

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq,16hr}$ | $L_{A90}$ |
| 10/11/2022 | 62 | 51 |

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq,16hr}$ | $L_{A90}$ |
| 11/11/2022 | 57 | 49 |
| 12/11/2022 | 55 | 46 |
| 13/11/2022 | 54 | 44 |
| 14/11/2022 | 59 | 48 |

***Table 9*** Summary of Daytime Unattended Noise Measurements at UN2. $L_{Aeq}$ Averages refer to logarithmic averages and $L_{A90}$ averages refer to arithmetic averages.

| Monitoring Period | Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | |
|---|---|---|
| | $L_{Aeq}$ | $L_{A90}$ |
| 10/11/2022 | 53 | 45 |
| 11/11/2022 | 50 | 36 |
| 12/11/2022 | 49 | 37 |
| 13/11/2022 | 52 | 39 |

***Table 10*** Summary of Night-time Unattended Noise Measurements at UN2. $L_{Aeq}$ Averages refer to logarithmic averages and $L_{A90}$ averages refer to arithmetic averages.

Note that this location was partially obscured from the road and hence an adjustment based on partial line of site has been applied when considering impacts to facades at this location.

During daytime periods, average noise levels were in the range 54 to 57 dB $L_{Aeq,15min}$ and 44 to 49 dB $L_{A90,15min}$. During night-time periods, average noise levels were in the range 49 to 53 dB $L_{Aeq,15min}$ and 37 to 45 dB $L_{A90,15min}$.

$L_{Aeq}$ and $L_{AFMax}$ values were measured at 5-minute intervals over the duration of the survey. Figure 5 presents the number of measured $L_{AFMax}$ events for each decibel level during the day and night periods. It is noted from Figure 5 the noise level of 65 dB $L_{Amax}$ is not normally exceeded.

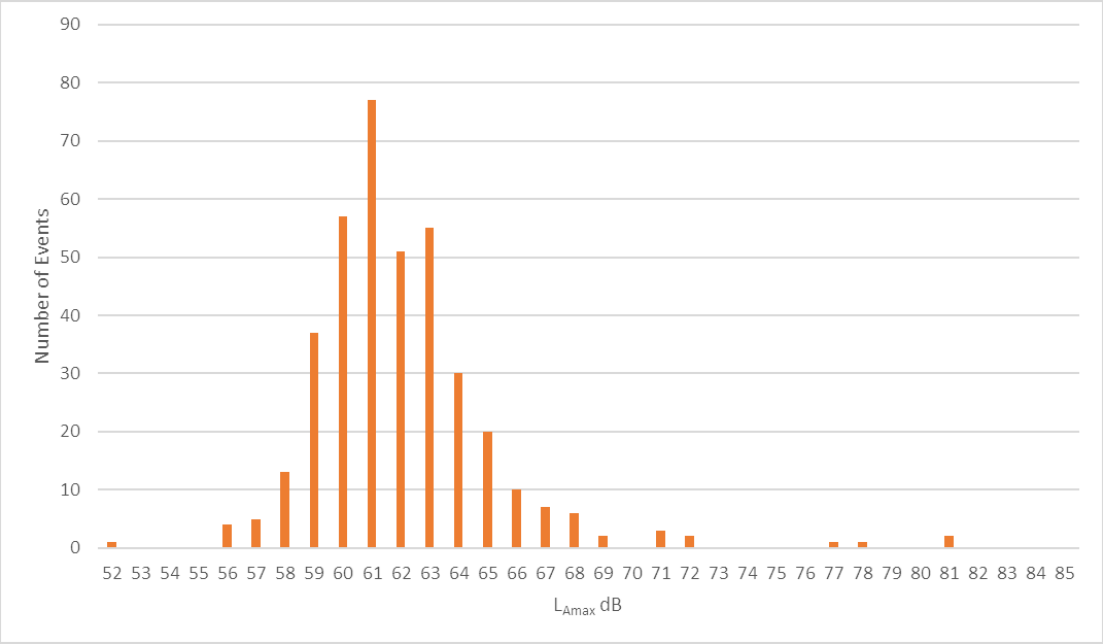


***Figure 5*** Number of Events at UN2 at Each Decibel Level – Night

### 4.5.3 Attended Noise Measurements

*Location AT1*

The survey results for the attended monitoring at location AT1 are given in Table 11.

| Start Time (hrs) | Subjective Impression of Noise Environment | Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | | | |
|---|---|---|---|---|---|
| | | $L_{Aeq.15min}$ | $L_{Amax}$ | $L_{A10}$ | $L_{A90}$ |
| 11:00 | Traffic on Richmond Road, birdsong, alarm at bridge over Tolka River | 65 | 77 | 69 | 54 |
| 11:31 | Traffic on Richmond Road, birdsong, pedestrian conversation | 65 | 77 | 69 | 52 |
| 12:25 | Traffic on Richmond Road, birdsong, | 64 | 81 | 68 | 51 |

***Table 11*** Attended Noise Measurement at Location AT1

Noise levels were in the range 64 to 65 dB $L_{Aeq}$ and 51 to 54 dB $L_{A90}$.

*Location AT2*

The survey results for the attended monitoring at location AT2 are given in Table 12.

| Start Time (hrs) | Subjective Impression of Noise Environment | Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | | | |
|---|---|---|---|---|---|
| | | $L_{Aeq.15min}$ | $L_{Amax}$ | $L_{A10}$ | $L_{A90}$ |
| 11:20 | Traffic on Richmond Road, barking dogs | 65 | 81 | 70 | 50 |
| 12:08 | Traffic on Richmond Road, birdsong | 66 | 79 | 70 | 51 |
| 12:42 | Traffic on Richmond Road, birdsong | 66 | 80 | 70 | 49 |

***Table 12*** Attended Noise Measurement at Location AT2

Noise levels were in the range 65 to 66 dB $L_{Aeq}$ and 49 to 51 dB $L_{A90}$.

*Location AT3*

The survey results for the attended monitoring at location AT3 are given in Table 13.

| Start Time (hrs) | Subjective Impression of Noise Environment | Measured Noise Levels (dB re. $2x10^{-5}$ Pa) | | | |
|---|---|---|---|---|---|
| | | $L_{Aeq.15min}$ | $L_{Amax}$ | $L_{A10}$ | $L_{A90}$ |
| 13:13 | Birdsong, distant DART, distant groundworks, conversation | 52 | 63 | 55 | 43 |
| 13:35 | Birdsong, distant DART, distant groundworks, conversation | 55 | 70 | 56 | 52 |
| 13:55 | Birdsong, distant DART, conversation | 44 | 57 | 46 | 42 |

***Table 13*** Attended Noise Measurement at Location AT3

Noise levels were in the range 44 to 55 dB $L_{Aeq}$ and 42 to 52 dB $L_{A90}$. This location is further from the Richmond Road road than AT2, leading to slightly lower noise levels.

## 4.6 Noise from Road Traffic

Figures 6 and 7 present the existing road traffic noise across the proposed development site as detailed in the Environmental noise directive (END) 2002/49/EC noise mapping (https://gis.epa.ie) for both $L_{den}$ and $L_{night}$ respectively. The contours indicate that the proposed development site is partially located within the 55 to 59 and 60 to 64 dB $L_{den}$ noise contours; and is partially within the 50 to 54 dB $L_{night}$ contour. These noise levels are typical of an urban environment location.

Future Traffic Noise Levels

It is noted that the proposed development site is located on an existing wholesaler's and distributor's yard. In the particular case of this site there is the potential for future noise levels to reduce as a result of the proposed development, as HGV and other traffic has the potential to be reduced on Richmond Road as a result of the wholesaler and distributor vacating the site.

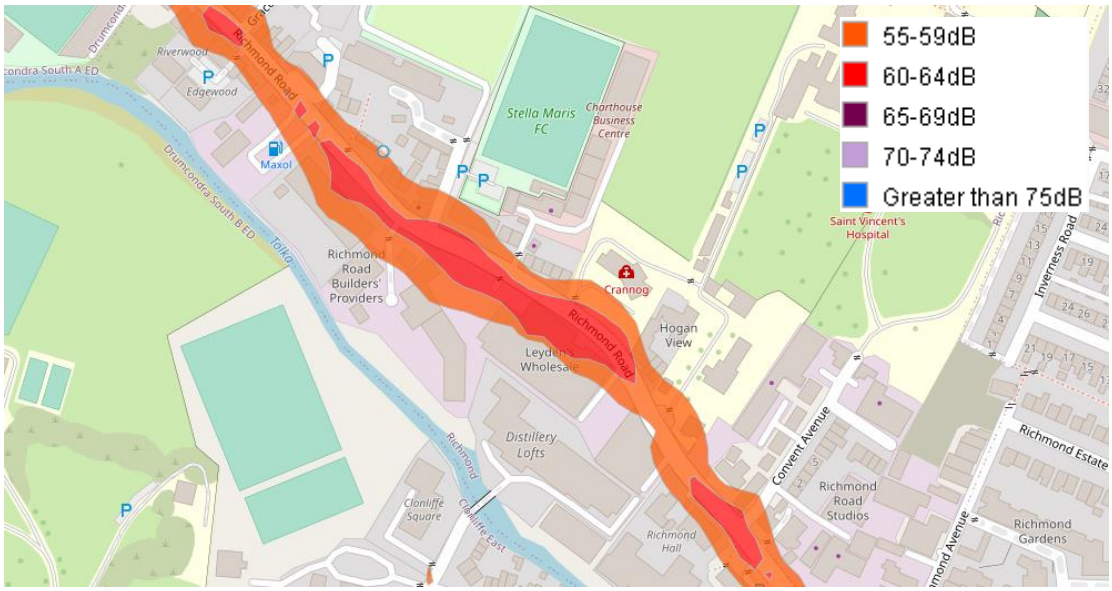


***Figure 6 $L_{den}$ Noise Contour – Road Traffic***

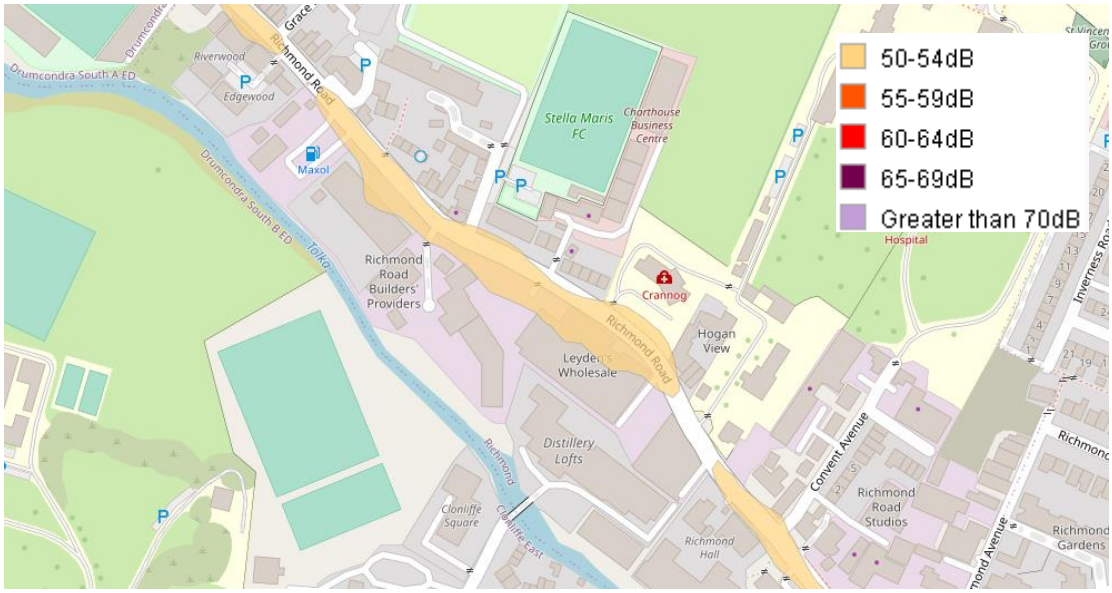


***Figure 7 $L_{night}$ Noise Contour – Road Traffic***

## 4.7 Movement Restrictions

The baseline noise survey for locations UN1 and AT1 to AT3 was undertaken during Phase 1 of the Irish Government's Roadmap for re-opening (May 2021) 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. Note that measurements at UN2 were undertaken in 'normal' conditions with no travel restrictions in place.

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.

In this instance, the measured $L_{day}$ of 54 to 58 dB $L_{Aeq,16hr}$ at UN1 compares favourably with the TII noise map which indicates that the measurement position, shown in Figure 7, lies on the edge of the 55 to 59 dB $L_{den}$ area. 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 and given the above it is considered that the survey results remain relevant for this assessment.

## 4.8 ProPG Stage 1 Noise Risk Assessment

Giving consideration to the noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site is considered to be medium. ProPG states the following with respect to low and medium risks:

| | |
|---|---|
| *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 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 suitably 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 IMPACTS

### 5.1 Construction Stage

*Construction Noise*

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 24 months in duration).

The nearest noise-sensitive locations to the site are the residential properties bounding the south of the site and the houses on the opposite site of Richmond Road. Based on the results of the baseline noise surveys undertaken, the ambient daytime noise level at these properties was found to be between 61 and 63 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 be taking 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 noise-sensitive locations, i.e. a barrier height will be chosen so as to completely hide the source. Table 14 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 $L_W$(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 14*** Potential construction noise levels at varying distances assuming attenuation of 10 dB from site barrier

The calculated noise levels in Table 14 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 9.1.

*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 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, however they may still be perceptible. The potential vibration impact during the construction phase is of short-term, neutral and slight 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, mechanical and electrical services used to service development buildings, usage of the commercial facilities and deliveries to the site. The relevant guidance documents in Section 3 will be used to assess potential operational noise and vibration 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 proposed development. These will typically be limited to heating and cooling plant, pumps and extraction units, depending on the building design and user requirements. Certain areas are likely to require mechanical services during the during daytime hours only, however, there may be requirement for night-time operational plant, depending on specific requirements.

In this instance, it is best practice to set appropriate noise limits that will inform the detailed design during the selection of building services plant for the development. The cumulative operational noise level from building services plant at the nearest noise sensitive location 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 it is considered an appropriate external design criterion is the order of 37 dB $L_{Aeq,15min}$ at the façade of any noise-sensitive location. This limit is set in order to achieve acceptable internal noise levels within residential spaces based on prevailing noise levels in the area. Building services noise shall not have any tonal or impulsive characteristics.

Taking into account that sensitive receptors within the development are closer than off-site sensitive receptors, once the relevant noise criteria are achieved within the development it is expected that there will be no negative impact off site. The associated likely noise and vibration impact is described as negative, not significant, local and long-term.

5.2.2 Deliveries and Waste Collection

Due to the short distance between the two loading bays to the nearest apartments, it is recommended that deliveries be carried out in daytime periods only (07:00 – 23:00) during which the impact will not be significant.

5.2.3 Additional Traffic on surrounding roads

In terms of the additional traffic on local roads that will be generated as a result of this development the following comment is presented: 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 this development will not result in a significant noise impact.

## 6.0 INWARD NOISE IMPACT (ProPG Stage 2)

### 6.1 Element 1 – Good Acoustic Design Process

6.1.1 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.

6.1.2 Application of GAD Process to Proposed Application

*Relocation or Reduction of Noise from Source*

The proposed development adjoins an existing public road and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

*Planning, Layout and Orientation*

Due to the compact nature of the site, the opportunities for reducing noise levels at the façade through relocation or reorientation of the buildings are limited.

*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:

> "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 good acoustic design measures that have been implemented on site, e.g. upgrading the glazing along certain façades are not considered to have effects on fire risk issues or health and safety.

*Assess Viability of Alternative Solutions*

The option of introducing additional noise screening along the boundary of the site was considered. However, given the proximity to the nearby road and the height of the proposed building it was not considered practicable to provide a noise screen to the boundary of the site along 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. Given that the external areas are on a raised podium level the line of sight to the road will be removed, hence noise from road traffic will be greatly reduced at this location. Consequently, it is predicted that noise levels on the external podium areas will be within the ProPG guideline values. Additionally, ground floor external areas that are not adjacent to Richmond Road will gain the benefit of road traffic noise reduction due to the location and positioning of the proposed buildings, these areas are also predicted to meet the external ProPG guideline noise levels.

### 6.1.3 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, which will ensure a good acoustic environment according to the noise criteria in Table 1.

## 6.2 Element 2 – Internal Noise Guidelines

### 6.2.1 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 1, 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 15.

| Level Desired | Day<br>07:00 to 23:00hrs | Night<br>23:00 to 07:00hrs |
|---|---|---|
| Good<br>(i.e. at or below the internal noise levels) | 50 – 55 dB LAeq,16hrs | 45 dB LAeq,8hrs |
| Reasonable<br>(i.e. 5 dB above the internal noise levels) | 55 – 60dB LAeq,16hrs | 50 dB LAeq,8hrs |

***Table 15*** External Noise Levels Required to Achieve Internal Noise Levels

Given the above, an appraisal of facades that are unable to meet reasonable noise levels with windows open is provided in Section 6.2.2.

### 6.2.2 Façade Levels

Based on the measured noise levels facades have been catagorised into two zones with a range of noise levels. The facades that are not highlighted are calculated to meet the internal noise levels with no further mitigation required.

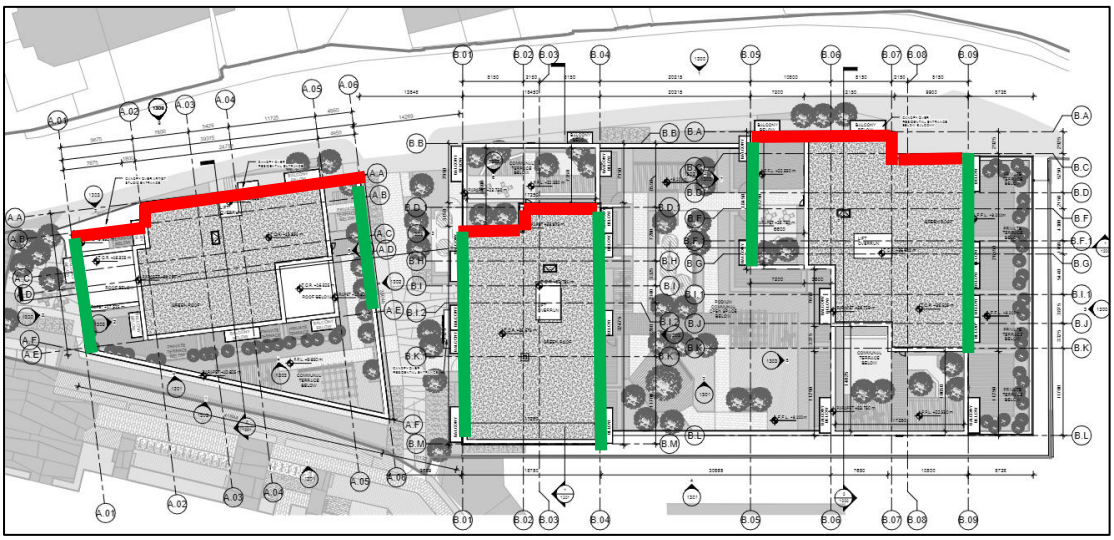

***Figure 8*** Façade Noise Zones

| Zone | Period | Overall dB(A) |
|---|---|---|
| RED | Daytime $L_{Aeq}$ | 66 |
| | Night-time $L_{Aeq}$ | 60 |
| | Night-time $L_{Amax}$ | 76 |
| GREEN | Daytime $L_{Aeq}$ | 63 |
| | Night-time $L_{Aeq}$ | 57 |
| | Night-time $L_{Amax}$ | 73 |

***Table 16*** 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.

### 6.2.3 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[2] 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 the facades in the zones **RED** and **GREEN** will be provided with glazing that, when closed, achieve the minimum sound insulation performance as set out in Table 17.

[2] 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.

| Zone (See Figure 11) | Octave Band Centre Frequency (Hz) | | | | | | $R_w$ |
|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1k | 2k | 4k | |
| **RED** | 26 | 27 | 34 | 40 | 38 | 46 | 37 |
| **GREEN** | 29 | 25 | 32 | 34 | 36 | 38 | 34 |

***Table 17*** Sound Insulation Performance Requirements for Glazing, SRI (dB)

The acoustic specifications listed in Table 18 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 be adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively.

Table 18 presents the acoustic specification for the vents:

| Zone (See Figure 11) | Octave Band Centre Frequency (Hz) | | | | | | $D_{n,e,w}$ |
|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1k | 2k | 4k | |
| **RED** | 35 | 34 | 33 | 38 | 49 | 49 | 39 |
| **GREEN** | 32 | 31 | 30 | 35 | 46 | 46 | 36 |

***Table 18*** Sound Insulation Performance Requirements for Vents, SRI (dB)

### 6.2.5 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

As previously discussed in Section 6.2.1, the inhabitants will have access to outdoor amenity area on the podium of the development site, as well as ground floor areas shielded from Richmond Road, where the expected noise level is ≤55dB $L_{Aeq,16hr}$ which is recommended in ProPG.

## 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 Dublin City Noise Action Plan specifies desirably low external noise levels and also noise levels above which noise mitigation measures should be considered.

This inward noise impact assessment included in this report 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 drawn 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.
- Outdoor amenity spaces are available within the proposed development.

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 CHILDCARE FACILITY NOISE ASSESSMENT

A childcare facilty is proposed as presented in Figure 9. This section of the report presents the noise assessment of the proposed childcare facility.

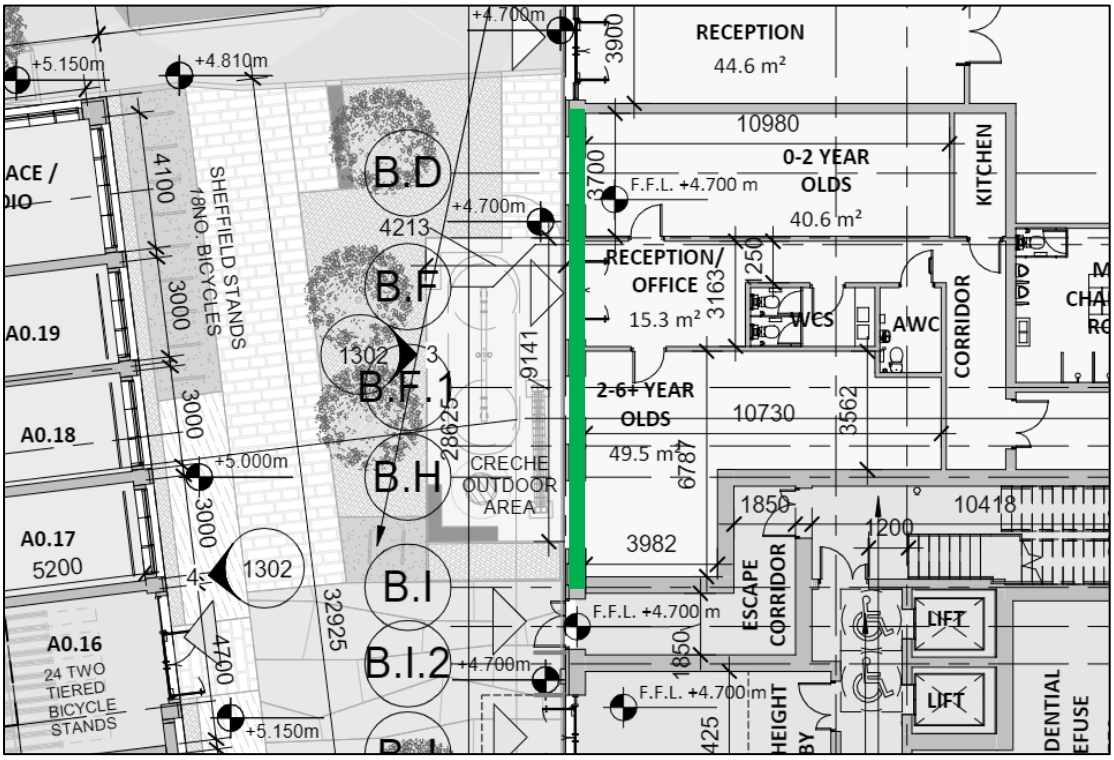


***Figure 9*** Proposed Childcare Facility Location

The glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. Taking account of the predicted noise levels, a minimum specification for the glazing system (including the glass, frames, seals and any openable elements) has been calculated to ensure adequate sound insulation performance is provided to meet the criterion outlined in Table 4.

Table 19 gives the recommended minimum Sound Reduction Index (SRI) of the glazing for the various room of the building.

| Item | Nominal $R_W$ (dB) | Octave Band Centre Frequency (Hz) Sound Insulation dB $R_w$ | | | | | |
|---|---|---|---|---|---|---|---|
| | | 125 | 250 | 500 | 1k | 2k | 4k |
| **GREEN** | 33 | 24 | 22 | 29 | 39 | 33 | 38 |

***Table 19*** Minimum Sound Reduction Indices for External Glazing (R, dB)

Note that glazing specifications are only required for sensitive rooms. Corridors, stairwells and entrance lobbies do not require enhanced acoustic specifications for glazing.

The external areas of the creche are protected from the majority of road traffic noise due to the layout of the proposed buildings. Given the distance to the roads and the shielding from noise provided within the building it is predicted that noise levels in these areas will be within the proposed external levels of 55 dB $L_{Aeq,16hr}$.

## 8.0 SEPERATING CONSTRUCTIONS

The following are some indicative measures to mitigate noise and vibration from gyms or commercial/creche areas to residential areas. Note that these are indicative only and the final design will need to account for the usage of the rooms and the expected noise and activity levels. Other mitigation measures may be available that would be suitable for the defined usages, hence, these preliminary designs may be developed on, iterated on or alternative designs may be used at the detailed design stage.

## 8.1 Gym Area

The following recommendations have been prepared in relation to any potential proposed gym areas.

In terms of a gym consideration needs to be given to the issue of airborne noise transfer (e.g. aerobics classes with music) and impact noise (e.g. dropping of weights). As discussed previously there may be a further requirement to impose a noise limit within the gym area despite the recommendation of the below specifications.

*Ceiling Treatment*

The following typical ceiling treatment may be considered in relation to gym areas:

*2 layers of 12.5mm SoundBloc on vibration isolation hangers to form 150mm cavity (approx.) between the rear of the plasterboard and the underside of the concrete slab. 50mm Rockwool insulation (≥12kg/m$^3$) placed in the cavity.*

**NOT TO SCALE**

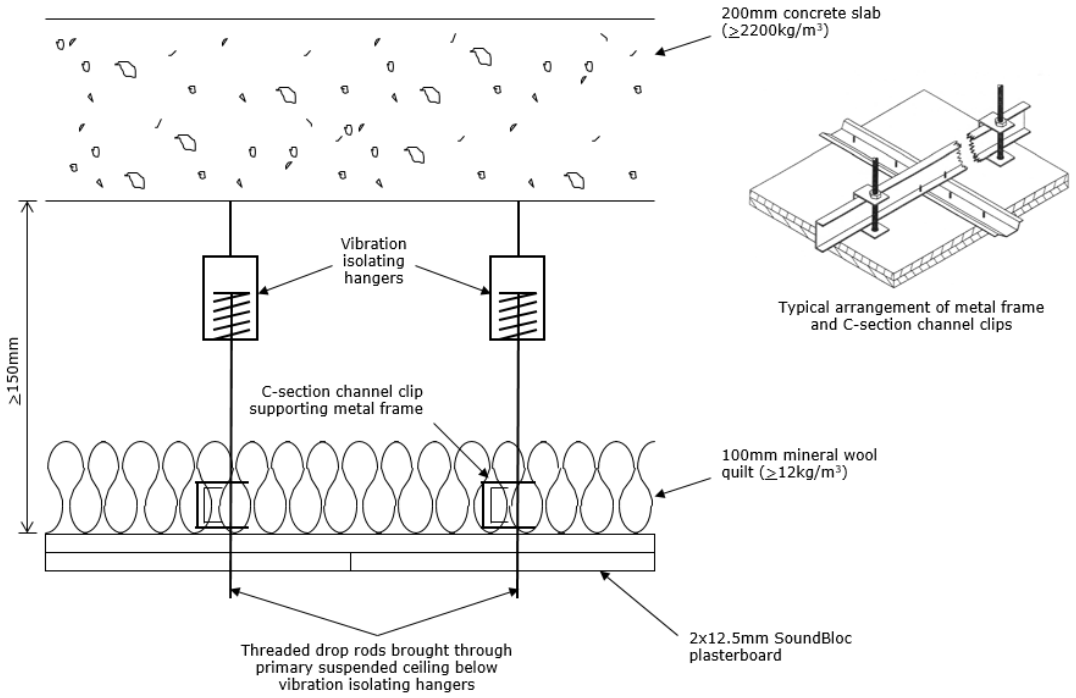


***Figure 10*** Typical Suspended Ceiling for Gym

The concrete slab construction shall offer a minimum mass per unit area of 365kg/m$^2$.

*Vibration Isolation*

Finally, it is also recommended that a suitable vibration isolated floor is installed in any gym area adjoining a residential dwelling to avoid structureborne transfer to the apartments. Due to the complexities of vibration transfer within a building, it is largely not possible to predict the level of building response to vibration excitation without conducting specific site testing. Buildings of a similar construction can respond significantly differently depending on small changes in the structural make up.

The most common forms of vibration isolation used for gym floors within sensitive buildings tend to comprise one or a combination of the following:

- Acoustic Floating Floor, or;
- Resilient Mat Build up Floor.

An isolated floor, commonly called a "floating floor", is used to minimize impact and airborne sound transmissions through the floor/ceiling structure.

Floating floor composite constructions consist of a built-up floor (e.g., concrete slab, wood, etc.) supported by a resilient mount placed on top of the base concrete slab (i.e. non-isolated floor).

Floating floor systems must be decoupled at all edges from walls and other non-isolated building components. Creating airspace and resiliently decoupling the mass of the isolated floor from the non-isolated structure will disrupt noise transmission into the floor/ceiling structure. There are a range of different options for resilient mounts including springs, rubber pads or a combination of both, depending on the level of isolation required.

*Example Floating Floor*

A concrete floating floor with spring mounts provides the highest level of impact and airborne isolation whereas a timber floating floor on rubber/foam underlay for example provides the least.

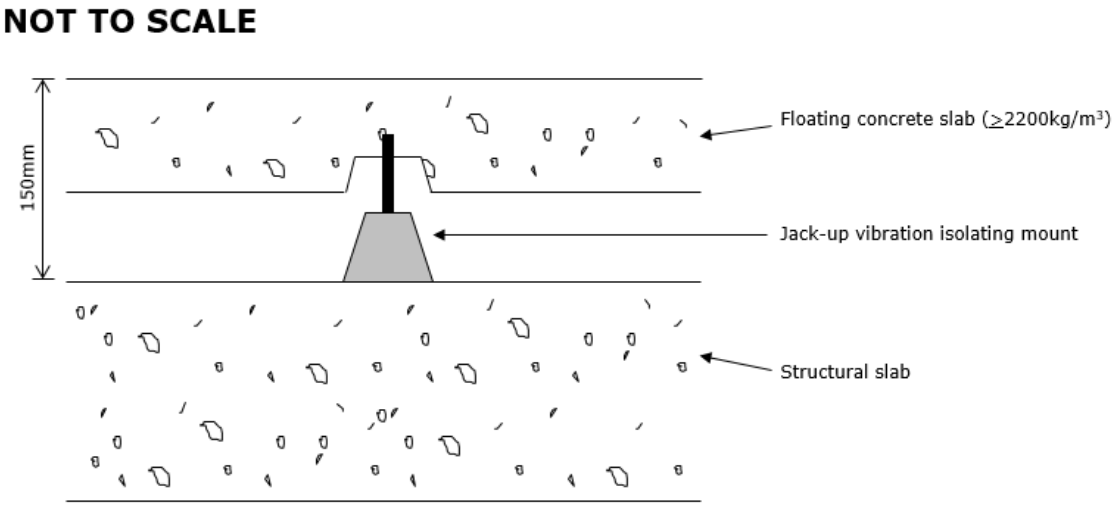


***Figure 11*** Floating Floor Build Up

The exact construction of a floating floor would require detailed consideration at the design stage.

*Resilient Mat Build Up*

In recent years, there has been considerable development in terms of the flexible solutions to gym vibration isolation given the requirement for retrospective solutions, flexible floor designs due to lease holds and other engineering design constraints.

Alternative options to floating floors include the use of resilient floor mats which can be installed in different configurations to achieve varying levels of vibration isolation. Depending on the configuration chosen, this system can, in certain circumstances, provide an equivalent level of vibration isolation compared to a structural floating floor.

*Impact Absorbers*

The use of impact (shock) absorbers to exercise equipment/machines is an effective means of incorporating vibration isolation at source to reduce the level of impact incident on the separating floor itself.

The use of impact absorbers installed between the weight base and the frame are recommended for resistance machines which can be used either in isolation or in conjunction with a resilient floor covering, depending on the level of vibration isolation required.

***Figure 12*** Resilient Mat Build up Within Free Weights Area


***Figure 13*** Impact Absorbers to Resistance Equipment

In conjunction with an appropriate management of activities within these spaces it is envisaged that this specification should limit excessive noise transfer to sensitive areas.

## 8.2 Retail Unit

Given the proposed use of the ground floor retail unit and the sensitivity of the residential spaces above it is recommended that suitable separating construction installed to provide enhanced sound insulation between the two areas. For the purpose of this development a criterion of 65 dB $D_{nT,w}$ is recommended to be achieved between the retail unit and the residential units. This is over 10 dB higher than the minimum Building Regulation requirement for partitions separating dwellings.

One option to achieve this value is for a suspended ceiling be installed below the structural slab in each of the spaces under consideration. The following specification would be suitable:

> *metal frame suspension system to give a minimum 300mm deep void below the underside of the concrete slab – 100mm mineral wool quilt (≥18kg/m$^3$) on the rear of the plasterboard – 2x12.5mm SoundBloc plasterboard*

In order to preserve the sound insulation performance of this acoustic suspended ceiling, there should be no penetrations of the plasterboard in order to suspend services and/or fittings. It will therefore be necessary to bring fixings through the plasterboard directly below the suspension points. A threaded drop rod is fixed to the roof structure at one end and to the acoustic suspended ceiling at the other, passing through a C-section channel clip that supports the metal frame of the suspended ceiling. The drop rod is then brought through the plasterboard, thereby providing a mechanism by which services/fittings or a secondary support grid (e.g. Unistrut) may be hung below the acoustic ceiling. This arrangement is shown on Figure 14.

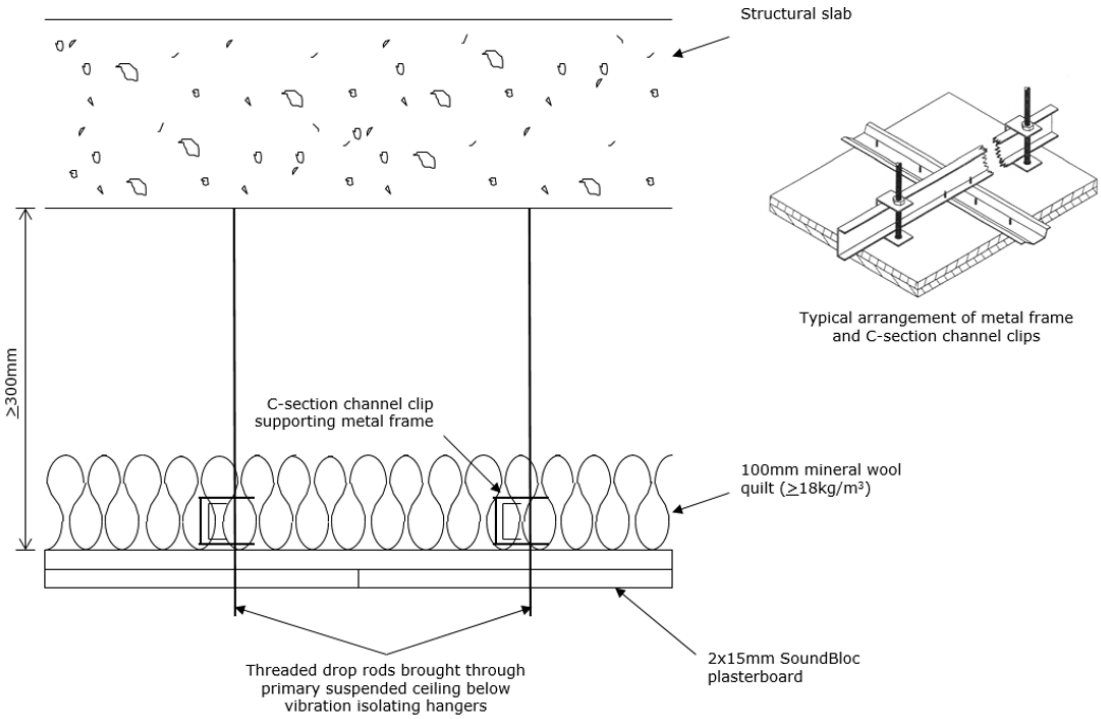


***Figure 14*** Upgraded Ceilling Construction

The estimated in-situ performance of this floor/ceiling is the order of 65 dB $D_{nT,w}$ assuming high levels of workmanship, detailing and a concrete slab construction offering a minimum mass per unit area of 365kg/$m^2$.

Note that this is an example of how to achieve the proposed criteria, alternative constructions offering equivalent or better in-situ performance would also be considered acceptable.

## 9.0 ENTERTAINMENT NOISE ASSESSMENT

At this stage it is not possible to predict the level of entertainment break-out from potential sources within the development. However, it is recommended that a comprehensive review of this issue should be undertaken prior to the development becoming operational. During this review the entertainment sound shall be so controlled that its level at any adjacent noise sensitive location shall not cause the ambient (measured in the absence of said entertainment sound) to increase, when assessed over 5 minute back to back periods. Similar criteria shall apply to the 63Hz & 125Hz octave band levels. Some possible mitigation measures that may be considered are discussed in Section 9.2.4 of this report.

## 10.0 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.

### 10.1 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 noise sensitive locations 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, Dublin City 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.

## 10.2 Operational Phase

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

### 10.2.1 Building Services Plant

Noise emissions from the plant areas will be designed to ensure that noise levels at the façade of the noise-sensitive locations both within the development and in the surrounding area do not exceed the criteria discussed at Section 3.2.

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.

10.2.2 Deliveries and Waste Collection

Following limitation of delivery to daytime hours only it is predicted that there will be no further noise impacts, consequently no further mitigation measures are required.

10.2.3 Additional Traffic on Surrounding Roads

While the development will generate additional traffic flows, in order to increase traffic noise levels by 1 dB, traffic volumes would need to increase by the order of 25% approximately. This level of change is not expected to apply to this development, particularly given that sustainable modes of transport will be promoted for this development with regard to a reduced level of car parking provision in addition to car share spaces and bicycle parking. Therefore no mitigation measures are expected to be required in respect of additional traffic on surrounding roads.

10.2.4 Entertainment Noise

At this stage it is not possible to definitively state what mitigation measures are required to ensure control of entertainment noise. However, the following issues, amongst others, may be considered during 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 areas from external locations should be via acoustic lobbies with double doors separated by an appropriate distance. Access to areas from other locations within the demise should be via doors offering good acoustic performance. All doors required to offer good acoustic performance should be a thick solid core timber construction and should have proprietary acoustic seals on head, jambs and meeting stiles. Furthermore, one doorset in each lobby should have a threshold seal.

*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* The 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 venue (i.e. a noise level that should not be exceeded in order to ensure that noise emissions are kept to an acceptable level).

## 11.0 CONCLUSION

A predominantly residential development is proposed in the grounds of an existing commercial premises at Richmond Road, Dublin 3. 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 an urban 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, deliveries and waste collection, 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.

## 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 ($L_{AF90,T}$).

**broadband** Sounds that contain energy distributed across a wide range of frequencies.

**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 $L_{pA}$** 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.

**$L_{Aeq,T}$** 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. As standard it is measured using the fast time weighting constant of 125ms.

**$L_{AFN}$** 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.

**noise** Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

**noise sensitive location** NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

**sound pressure level** The sound pressure level at a point is defined as:

$$L_P = 20 \log \frac{P}{P_0} \text{ dB}$$

**tonal** Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.