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# GOWAN HOUSE, RESIDENTIAL DEVELOPMENT NAAS ROAD, DUBLIN

# INWARD NOISE IMPACT ASSESSMENT

Technical Report Prepared For

**Malclose Limited**

Technical Report Prepared By

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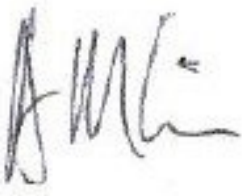
| Signature |  |  |
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## EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts incident to the proposed Residential Scheme at Gowan House, Carriglea Business Park, Naas Road, Dublin 12 and to advise on the acoustic design requirements to the site and façade to achieve suitable internal noise levels for residents.

The site is bound to the north by the Naas Road and the Luas Red Line, to the south by the Carriglea residential development site (part constructed), to the east by office and light industrial buildings, to the west by commercial units and residential granted developments further west. This report considers the noise climate across the site relating to road and rail traffic noise and provides recommendations in order to provide a suitable noise environment within and external to the site, within the site constraints.

The baseline noise environment at the development site has been determined through noise surveys and also making reference to published noise contour maps available for the site by the EPA. Based on this review, the assessment has classified the development site as having a 'medium to high' risk to environmental noise across the majority of the site in accordance with guidance from the UK planning document ProPG *Planning and Noise* (2017) in the absence of any development buildings on site. Highest noise levels are experienced along the northern site boundary facing towards the Naas Road and the Luas line. Moving south within the site, noise levels reduce by the order of 10 dB compared to the northern boundaries. Once the proposed student accommodation development buildings are incorporated onto the site, their presence provides a high level of screening from road traffic and rail movements to the southern and mid portion of the site.

The assessment has concluded that it will be necessary to provide enhanced acoustic glazing to the northern facades of Blocks 1 and 2 to ensure that when windows are closed that the internal noise environment is acceptable.

The noise level internally with the windows open will be within the good to reasonable noise range in line with the ProPG and BS 8233 guidance within occupied rooms within the southern residential units of Block 1 and 2.

Noise levels across the external amenity areas have been assessed. Noise levels at ground floor between Blocks 1 and 2 can achieve suitable external noise levels across the majority of this area. The main external amenity area is located at second floor roof level of Block 1 which is calculated to achieve acceptable external noise levels.

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## 1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts incident to the proposed large-scale residential development principally comprising student accommodation at Gowan House, Carriglea Business Park, Naas Road, Dublin 12 and to advise on the acoustic design requirements to the site and façade to achieve suitable internal noise levels for residents.

Works to upgrade of the access road to the west of the site on an area measuring c. 0.081 Ha are also proposed comprising new surfacing to the carriageway, the provision of inbound and outbound bicycle lanes from the development entrance to the Naas Road, the provision of a controlled pedestrian crossing on the access road at the Naas Road junction, and the provision of a further uncontrolled pedestrian and bicycle crossing linking the subject site with the approved Concorde SHD development (ABP Ref: TA29S.312218) to the west.

On the Naas Road, works are proposed on an area measuring c. 0.086 Ha comprising the realignment and widening of the existing pedestrian footpath along the westbound carriageway of the Naas Road and the provision of linkages from the realigned footpath to the development site, and the provision of new controlled pedestrian crossings across the eastbound and westbound carriages of the Naas Road and the provision of a new uncontrolled crossing of the Luas tracks. The development site area and roadworks areas will provide a total application site area of c. 1.13 Ha.

The proposed development will principally consist of: the demolition of the existing two-storey office/warehouse building and outbuilding (5,172 sq m); and the construction of a development in two blocks (Block 1 (eastern block) is part 2 No. storeys to part 15 No. storeys over lower ground floor and basement levels with roof plant over and Block 2 (western block) is part 9 No. storeys to part 11 No. storeys over basement with roof plant over) principally comprising 941 No. Student Accommodation bedspaces (871 No. standards rooms, 47 No. accessible studio rooms and 23 No. studios) with associated facilities, which will be utilised for short-term lets during student holiday periods. The 871No. standard rooms are provided in 123 No. clusters ranging in size from 3 No. bedspaces to 8 No. bedspaces, and all clusters are served by a communal living/kitchen/dining room.

The development also provides: ancillary internal and external communal student amenity spaces and support facilities; cultural and community floor space (1,422 sq m internal and 131 sq m external) principally comprising a digital hub and co-working space with ancillary cafe; a retail unit (250 sq m); public open space; the daylighting of the culverted River Camac through the site; a pedestrian bridge link at first floor level between Blocks 1 and 2; vehicular access at the south-western corner; the provision of 7 No. car-parking spaces, 2 No. motorcycle parking spaces and 2 No. set down areas; bicycle stores at ground and lower ground floor levels; visitor cycle parking spaces; bin stores; substations; hard and soft landscaping; roof gardens; green and blue roofs; new telecommunications infrastructure at roof level of Block 1 including antennas and microwave link dishes, 18 No. antennas and 6 No. transmission dishes, together with all associated equipment; boundary treatments; plant; lift overruns; and all associated works above and below ground.

The gross floor area of the development is c. 33,140 sq m comprising 30,386 sq m above lower ground and basement level.

The site is bound to the north by the Naas Road and the Luas Red Line, to the south by the Carriglea residential development site (part constructed), to the east by office

and light industrial buildings, to the west by commercial units and residential granted developments further west.

The focus of this report is to provide input into the acoustic design of the proposed development, identify any potential noise impacts and provide measures to minimise or mitigate those impacts.

Figure 1 presents the outline of the proposed development site in the context of the surrounding environment.

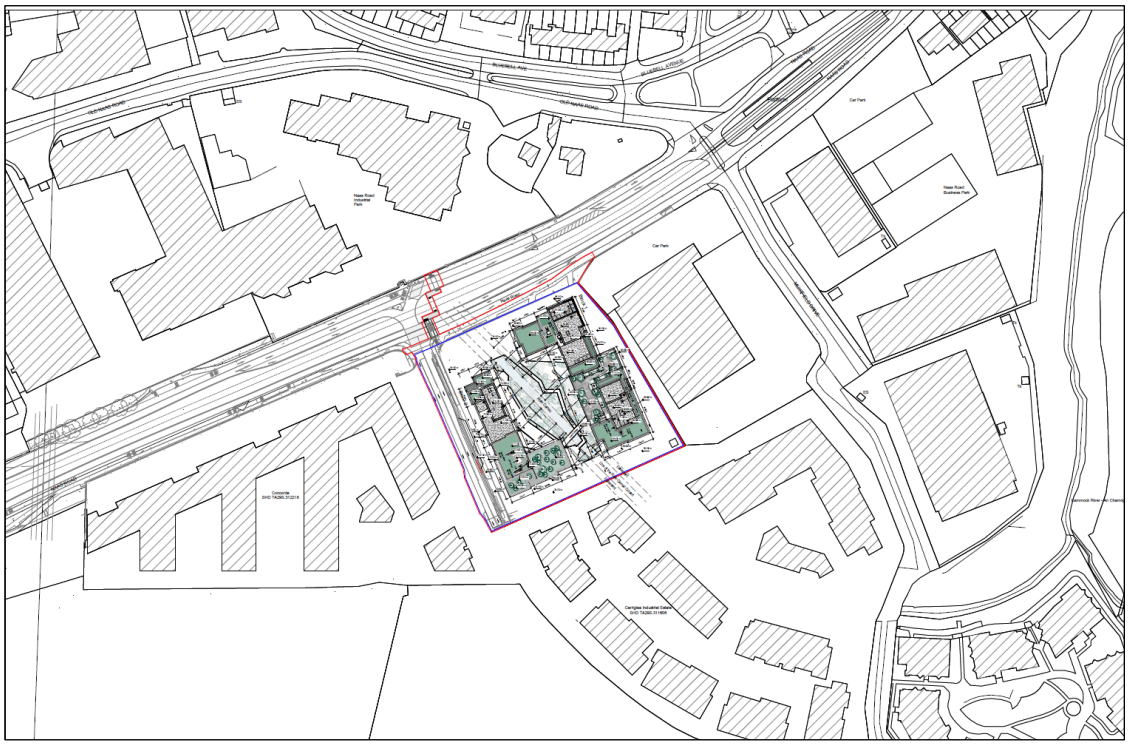

***Figure 1*** Location of proposed development and approximate red line boundary

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

# 2.0 DESIGN GUIDANCE

## 2.1 Dublin City Council Noise Action Plan (NAP)

The *Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Volume 1: Dublin City Council* 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."*

The internal noise criteria will be designed in line with best practice from BS 8233: 2014. This document focuses on achieving acceptable internal noise levels from external sources through consideration of the site location, external noise sources and control measures to the facade.

## 2.2 Dublin City Development Plan 2022 – 2028

Section 15.18.9 *Noise* of the Dublin City Development Plan notes the following with respect to new residential developments:

> *"Development proposals for residential development within designated noise zones, such as Dublin Airport Aircraft Noise Zones or which may generate noise sensitive activities should be accompanied by a noise impact assessment to analyse the potential noise impact on the development proposal. The applicant is required to demonstrate good acoustic design has been followed to mitigate against any potential noise impacts. Airport Noise Zone C is partially located within the Dublin City Council administrative boundary. For further details and map based information, see Fingal County Development Plan 2017-2023 Variation 1. https://www.fingal.ie/fingal-development-plan-2017-2023".*
>
> *"Construction noise assessment should form part of the construction management plan and set out clear mitigation measures in place throughout the entire construction phase"*

The proposed development lies outside of the Dublin Airport Aircraft Noise Zones hence an assessment of aircraft noise is not required. The approach for demonstrating good acoustic design is however, considered within this report with respect to mitigating against potential noise impacts.

## 2.3 ProPG: Planning and Noise

The *Professional Guidance on Planning & Noise* (ProPG) 2017 document prepared by the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH), has been largely adopted by Irish Local Authorities to review the suitability of new residential developments adjacent to existing noise sources. This document is generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance. In line with Section 15.18.9 of the Dublin City Development Plan, it sets out procedures for good acoustic design.

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, to illustrate overall compliance of the scheme with best practice guideline. 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.

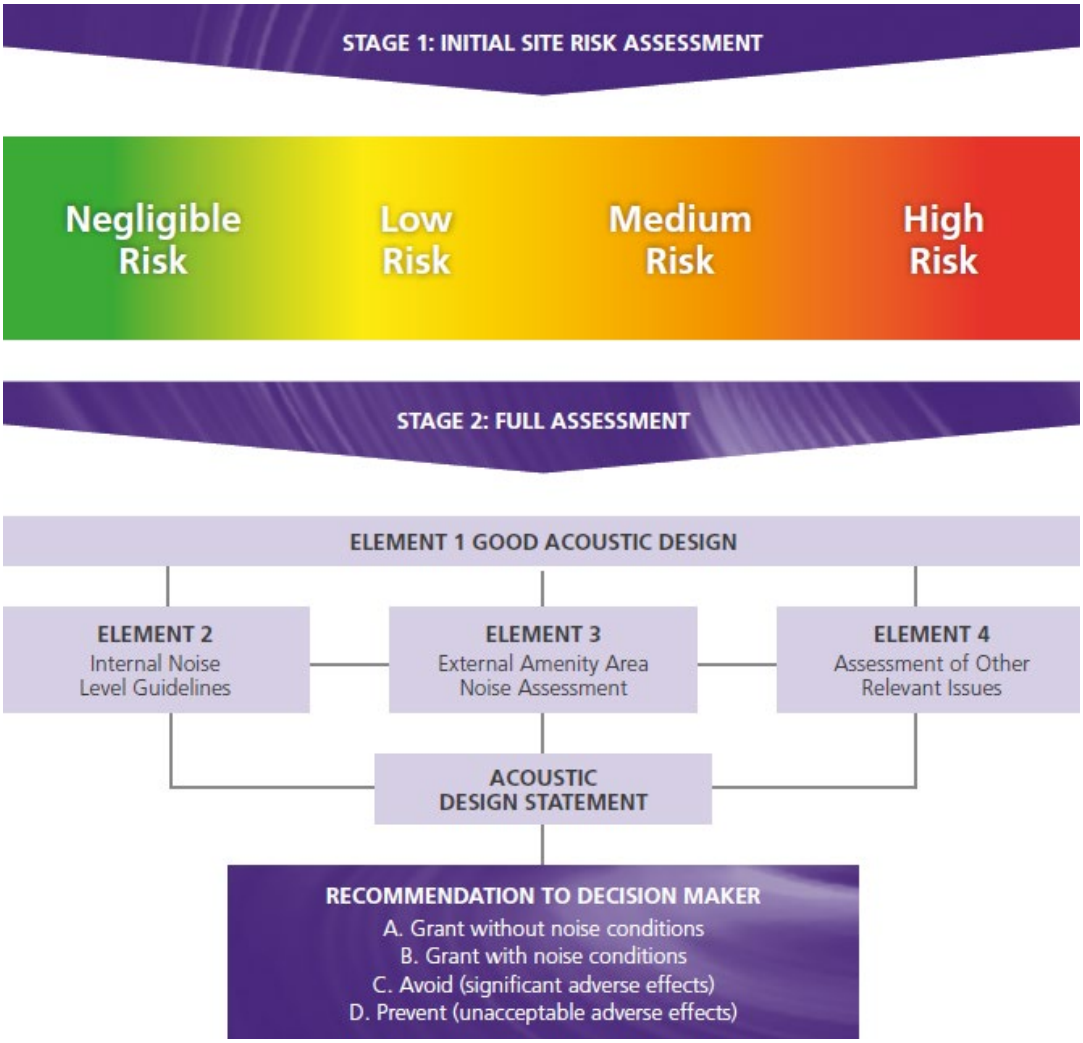


***Figure 2*** ProPG Approach (Source: ProPG)

## 2.4 BS 8233 (2014)

### 2.4.1 Internal Noise Guidelines

Element 2 of the ProPG document sets out recommended internal noise targets derived from 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 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 more than 10 time per night to avoid a significant internal noise level.

### 2.4.2 External Noise Guidelines

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

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

# 3.0 STAGE 1 – NOISE RISK ASSESSMENT

## 3.1 Methodology

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 3 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

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

Paragraph 2.9 of ProPG states that,

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

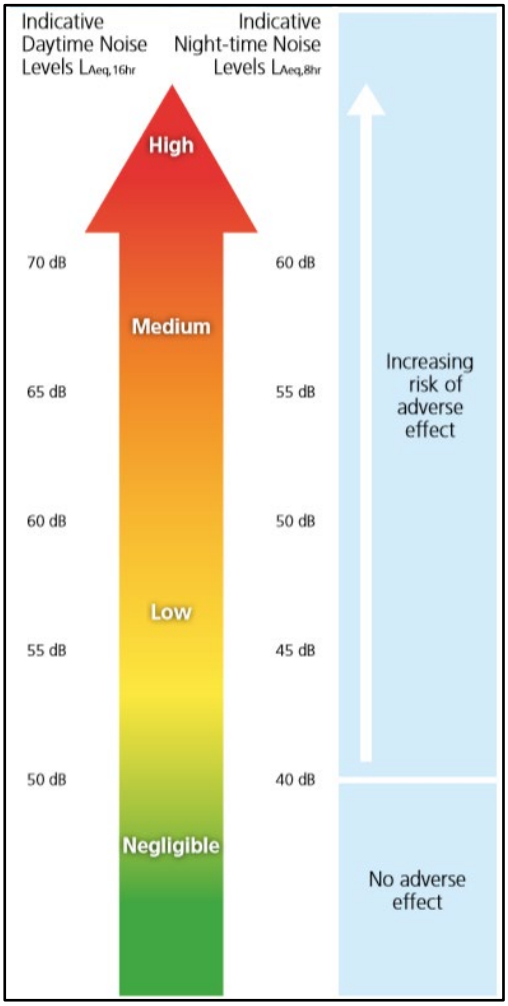


***Figure 3*** ProPG Stage 1 - Initial Noise Risk Assessment

In order to characterise the noise environment of the development site, a baseline noise survey has been undertaken in addition to a review of published noise maps produced by the EPA as part of the noise mapping requirements under the European Noise Directive (END). These maps present the noise levels incident across the site over the course of an annual average.

ProPG states the following with respect to the initial risk assessment:

> *"The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application. In other words, the risk assessment should include the acoustic effect of any existing site features that will remain (e.g. retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain (e.g. buildings to be demolished, fences and barriers to be removed) if development proceeds."*

## 3.2 Baseline Noise Environment

### 3.2.1 Baseline Noise Survey and Mapping

A baseline noise survey was undertaken at the development site during June 2023. The survey comprised an unattended noise survey over a period of 4 days, located on the roof of Gowan House. Attended noise measurements were also made around the site perimeter.

Published noise mapped data relating to road and rail (Luas) traffic was also reviewed to obtain noise level data over annual average periods. The data is based on the published Round 3 mapping by the EPA, via the www.gis.epa.ie portal.

Baseline survey details and results and noise mapping data are presented in Appendix B. The typical range of measured and mapped noise levels across the site are shown in Figure 4.

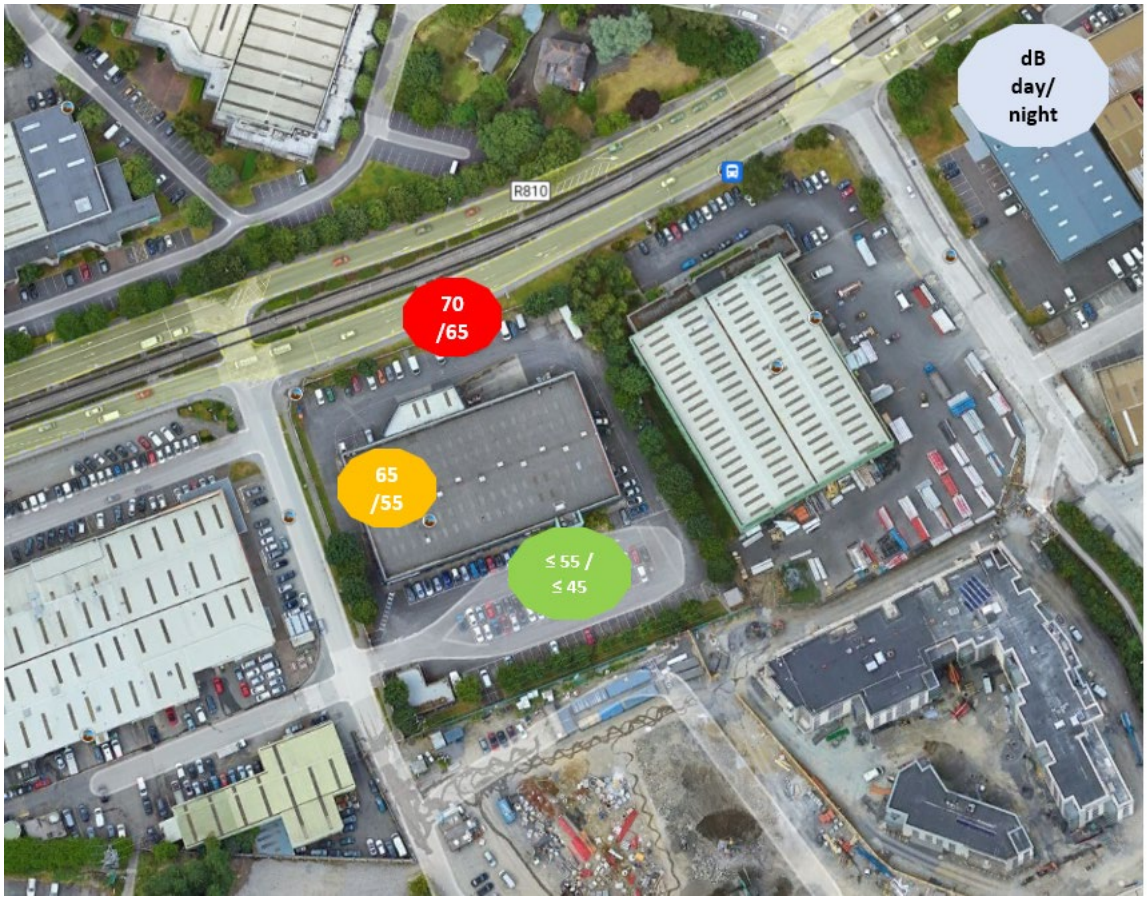


***Figure 4*** Typical baseline noise levels across development site

The survey and mapped results confirm that highest noise levels are experienced along the northern site boundary which are dominated by road traffic along the R810 Naas Road and the Luas Red Line. Noise levels are typically of the order of 70 dB $L_{Aeq}$ during daytime periods and up to 65 dB $L_{Aeq, T}$ during night-time periods. Moving south into the site, the contribution from road and rail noise sources reduce to at below 55 and 45 dB for day and night-time periods respectively.

Noise levels across the site in the absence of the existing building has been modelled to determine the full baseline noise environment for the development site. Model details are discussed in the following section.

### 3.2.2 Noise Model of Site

*Methodology*

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels across the full extent of the proposed site. The selected software, SoftNoise Type 7810 *Predictor*, calculates noise levels in accordance with the *Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3)* issued by the UK Department of Transport in 1988.

The model was developed to calibrate the noise monitoring and noise mapping data hence noise sources were modelled to replicate the noise levels discussed in Section 3.2.1.

*Model Validation*

Noise levels recorded at the noise survey positions in addition to the rail and road EPA noise mapping were used to calibrate the noise model to within 1 to 3 dB of the calculated values. This is regarded as very strong correlation in respect of predicted noise levels, particularly for attended locations which provide a shorter snap shot of baseline noise levels. Table 2 presents the modelled and measured noise levels in terms of the $L_{Aeq}$ parameter over the 16 hour daytime period, i.e. 07:00 to 23:00hrs and 8 hour night-time period, 23:00 to 07:00 hrs.

| Location | Time Period | Measured Noise Level, dB | Calculated Noise Level, dB |
|---|---|---|---|
| UT1 | Daytime, $L_{Aeq,16hr}$ | 60 | 60 |
| | Night-time, $L_{Aeq,8hr}$ | 56 | 56 |
| AT3 | Daytime, $L_{Aeq,T}$ | 71 - 75 | 70 |
| AT2 | Daytime, $L_{Aeq,T}$ | 56 | 55 |
| AT1 | Daytime, $L_{Aeq,T}$ | 63 | 66 |

***Table 2*** Calculated and Measured Noise Levels at Development Site

Figure 5 displays the calculated noise contours across the existing site for daytime at a height of 4m above ground. This takes account of the existing building on site.

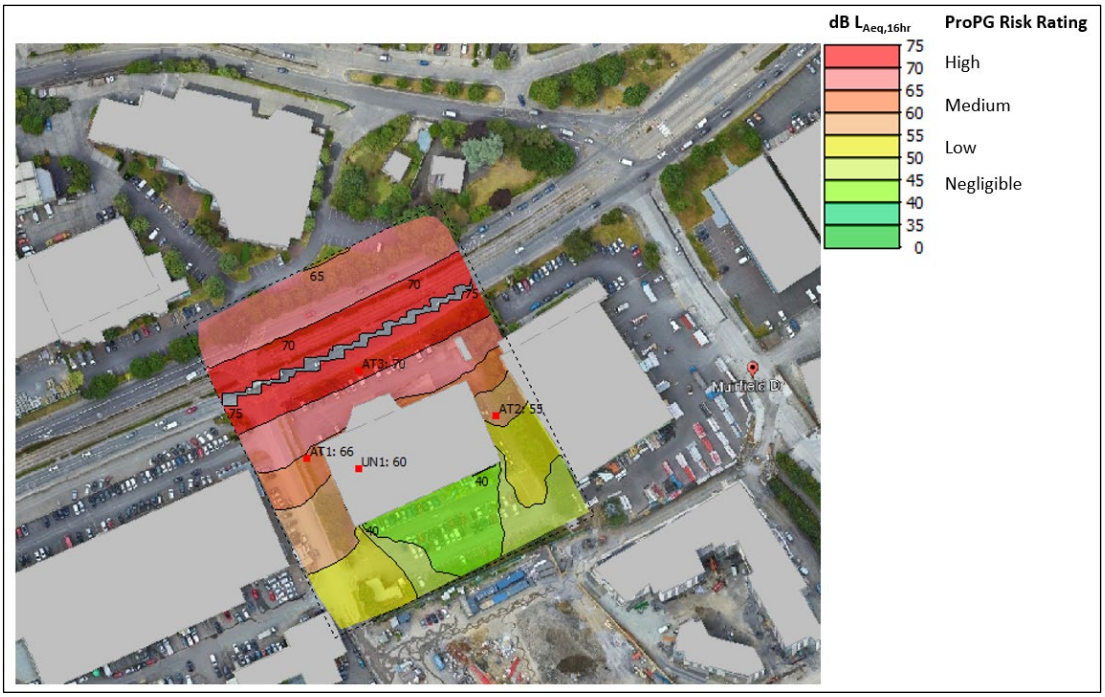


***Figure 5*** Calibration Noise Model of Existing Site – Daytime at 4m

The calculated noise levels across the development site in the absence of the existing building is illustrated in Figure 6.

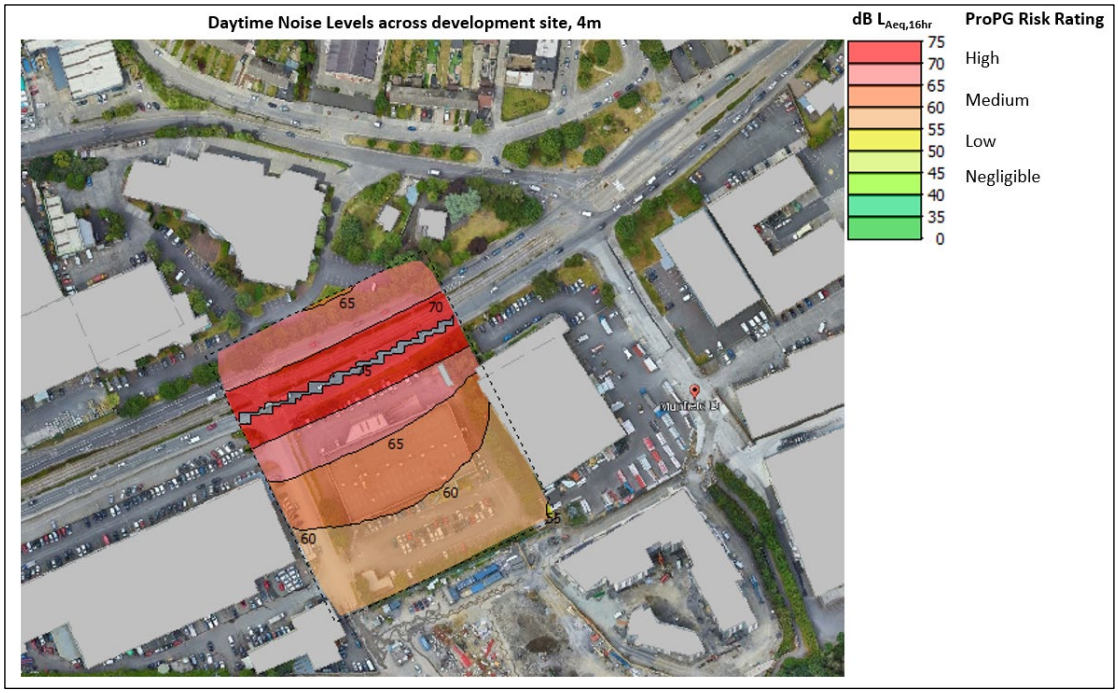


***Figure 6*** Calculated Daytime Noise Levels Across Development Site

The results of the modelling exercise calibrate against those measured and mapped across the site, as discussed in Section 2. Highest noise levels are along the northern boundary, reducing south within the site away from road and rail sources.

### 3.3 Noise Risk Assessment Conclusion

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 lies within the medium to high risk categories.

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

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

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

An Acoustic Design Strategy is therefore 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."*

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

# 4.0 STAGE 2 – FULL ACOUSTIC ASSESSMENT

## 4.1 Element 1 – Good Acoustic Design Process

### 4.1.1 ProPG Guidance

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

Section 2.23 of the ProPG outlines the following checklist for Good Acoustic Design:

- Check the feasibility of relocating, or reducing noise levels from relevant sources;
- Consider options for planning the site or building layout;
- Consider the orientation of proposed building(s);
- Select construction types and methods for meeting building performance requirements;
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
- Assess the viability of alternative solutions; and,
- Assess external amenity area noise.

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

### 4.1.2 Application of Good Acoustic Design (GAD) Process to Proposed Application

*Relocation or Reduction of Noise from Source*

Noise sources incident upon the development site (i.e. road and rail traffic) are located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source. The proposed development is multistorey in height with living accommodation located above ground floor level, hence boundary treatments would have limited benefit in terms of reduction of noise at façade levels at bedrooms and living spaces of the student residences.

*Planning, Layout and Orientation*

As part of the project design, the residential buildings are set back from the Naas Road across the majority of the development. Block 1 is the closest building to the Naas Road and Luas tracks. The orientation of bedrooms across the majority of the block are orientated in an east / west direction thus windows are facing away from the road and Luas line. Residential units in the southern element of this block are significantly screened from the road. Block 2 is set back further south into the site and bedrooms are also oriented in an east/ west direction facing away from the Naas Road and Luas line.

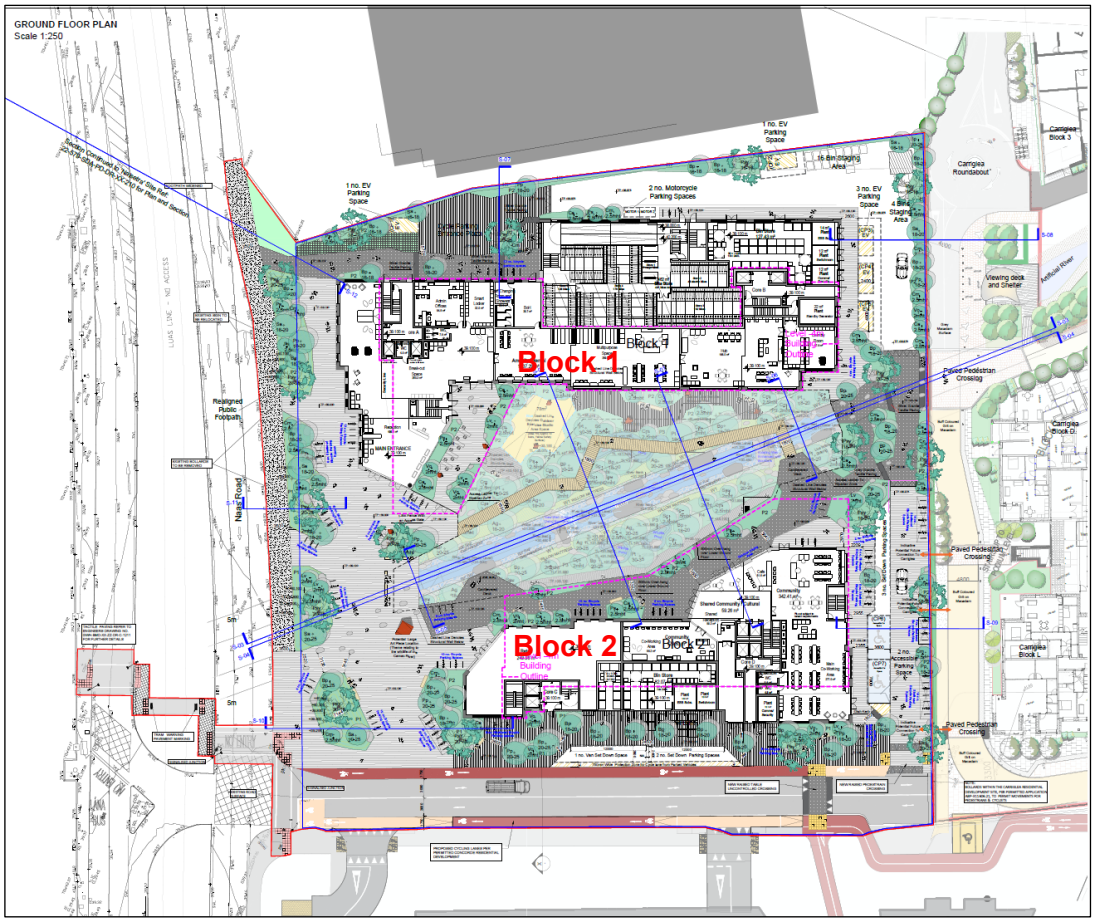


***Figure 7*** Building Arrangement on Site

Overall the orientation of the buildings and their internal layouts illustrate good acoustic design by limiting the number and type of sensitive rooms away from the highest noise boundary of the site and orienting windows such that direct line of sight to highest noise sources is avoided across the majority of the units.

*Select Construction Types for meeting Building Regulations*

The main building will offer high level of sound insulation performance in line with standard building types. 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 the acoustic performance of the glazing and the building ventilation elements which are the weakest path relating to noise intrusion. Note, for high external noise environments, it will not be possible to achieve the desirable internal acoustic environments with windows open. Instead, the proposal here will be to provide bedrooms and living / kitchen areas with glazed elements and 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, however, doing so will increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following (note emphasis has been added in bold):

> "2.22 *Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided;* ***occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be***

***considered unsatisfactory when open**. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents* "

*Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal $L_{Aeq}$ target levels should not normally be exceeded*

2.34 *Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, **which may be the case in urban areas and at sites adjacent to transportation noise sources**, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal $L_{Aeq}$ target noise levels should not generally be exceeded*."

It is important to note that it is impractical to achieve the good internal noise levels with windows open across the vast majority of development sites in close proximity to major infrastructure such as roads and railways. Such sites would need to be classified as having a negligible risk in accordance with the ProPG noise risk assessment approach (i.e. have external noise levels of less than 45dB $L_{night)}$. For this reason, there are no guidance documents either at a local level or an international level that AWN is aware of which would support the approach of achieving the ideal internal noise levels only in the open window scenario. It is therefore considered entirely correct and justifiable to provide building facades with a good degree of sound insulation such that with windows closed but vents opened a good internal acoustic environment is achieved.

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

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

*Assess Viability of Alternative Solutions*

The major noise sources incident on the site are road traffic and luas trams. Road traffic from the Naas Road and Luas line rail movements are mitigated by the distance from the road edge to the building, existing boundary treatments, screening by the on-site buildings and orientation of windows to bedrooms. All the measures listed above aid in the control of noise intrusion to the apartment living areas and bedrooms across the majority of the development.

*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 impact of noise on external amenity areas is addressed in Section 4.3.

*Summary*

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

In terms of viable alternatives to acoustic treatment of façade elements, there are no requirements for additional options for mitigation outside of proprietary acoustic glazing and ventilation.

## 4.2 Element 2 – Internal Noise Guidelines

### 4.2.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in Table 3 and are based on annual average data.

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

***Table 3*** ProPG Internal Noise Levels

*Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded up to 10 times per night without a significant impact occurring.

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

### 4.2.2 Façade Noise Levels

Noise levels have been predicted across the development site at each floor level to determine the external façade noise level incident on the proposed buildings during day and night-time periods.

*Kitchen / Living Room – Daytime Noise Levels*

Figure 8 displays the horizontal calculated daytime noise levels across the student accommodation blocks during daytime periods at 4m and 16m above ground. Note noise levels have been calculated across all floor heights.

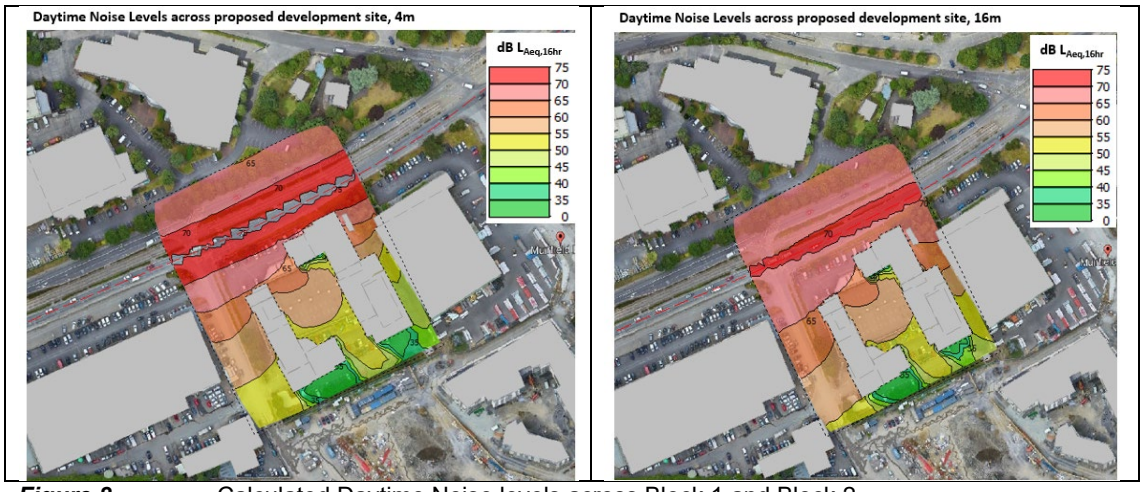


***Figure 8*** Calculated Daytime Noise levels across Block 1 and Block 2

Table 4 presents the calculated daytime noise levels at living room windows across Block 1 and 2 across all floors.

| Block | Core / Location | Calculated Daytime, $L_{Aeq,16hr}$ | |
|---|---|---|---|
| | | Minimum | Maximum |
| Block 1 | Core A<br>Living room / Kitchen | 53 | 70 |
| Block 1 | Core B<br>Living room / Kitchen | ≤30 | 60 |
| Block 2 | Core C<br>Living room / Kitchen | 55 | 65 |
| Block 2 | Core D<br>Living room / Kitchen | ≤35 | 58 |

***Table 4*** Calculated Daytime Noise Levels at Living / Kitchen Room Facades

In Block 1, highest noise levels are calculated for units in Core A. The highest values are those along the northern façade facing the Naas Road (70 dB $L_{Aeq, 16hr}$) and lowest are those along the south-west of Core A (53 dB $L_{Aeq, 16hr}$) which are set back into the site and screened by the northern part of Core A.

In Core B of Block 1, noise levels are highest along the east façade (60 dB $L_{Aeq, 16hr}$) and lowest are those along the southern façade, set back from the Naas Road (≤30 dB $L_{Aeq, 16hr}$).

In Block 2, highest noise levels are calculated for units in Core C. The highest values are those along the northern façade facing the Naas Road (65 dB $L_{Aeq, 16hr}$) and lowest are those along the south-east of Core D facing into the site and along the southern façade (≤35 dB $L_{Aeq, 16hr}$).

*Bedroom – Night- Noise Levels*

Figure 9 displays the horizontal calculated night-time noise levels across the student accommodation blocks during daytime periods at 4m and 16m above ground. Note noise levels have been calculated across all floor heights.

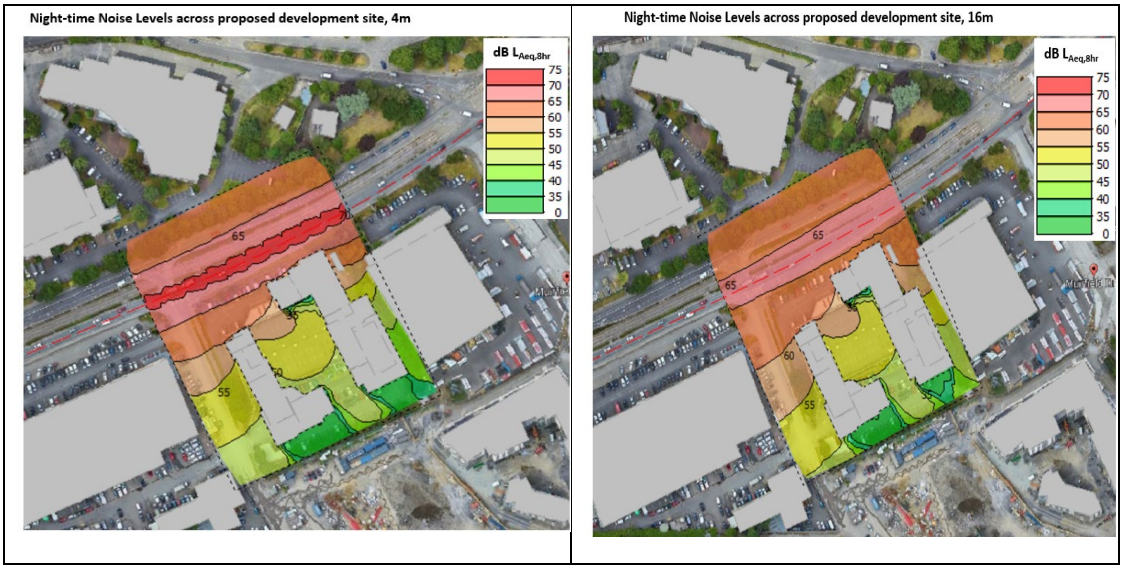


***Figure 9*** Calculated Daytime Noise levels across Block 1 and Block 2

Table 5 presents the calculated night-time noise levels at bedroom windows across Block 1 and 2 across all floors.

| Block | Location | Calculated Night-time, $L_{Aeq,8hr}$ | |
|---|---|---|---|
| | | Minimum | Maximum |
| Block 1 | Core A Bedrooms | 49 | 65 |
| Block 1 | Core B Bedrooms | ≤30 | 55 |
| Block 2 | Core C Bedrooms | 50 | 60 |
| Block 2 | Core D Bedrooms | ≤30 | 54 |

***Table 5*** Calculated Night-time Noise Levels at Bedrooms

In Block 1, highest noise levels are calculated for bedrooms in Core A. The highest values are those along the northern façade facing the Naas Road (65 dB $L_{Aeq, 8hr}$) and lowest are those along the south-west of Core A (~50 dB $L_{Aeq, 8hr}$) which are set back into the site and screened by the northern part of Core A.

In Core B of Block 1, noise levels are highest along the east façade (55 dB $L_{Aeq, 8hr}$) and lowest are those along the southern façade, set back from the Naas Road (≤30 dB $L_{Aeq, 8hr}$).

In Block 2, highest noise levels are calculated for units in Core C. The highest values are those along the northern façade facing the Naas Road (60 dB $L_{Aeq, 8hr}$) and lowest are those along the south-east of Core D facing into the site and along the southern façade (≤30 dB $L_{Aeq, 8hr}$).

4.2.3 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 is typically applied as 15dB[1] to 18dB.

Considering the internal design criteria outlined in Table 3 and a sound reduction across an open window of 15dB, 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 with windows open (i.e. 5 dB above the internal noise levels) have been summarised in Table 6.

| Level Desired | Day 07:00 to 23:00hrs | Night 23:00 to 07:00hrs |
|---|---|---|
| Good (i.e. at or below the internal noise levels) | 50 – 55dB $L_{Aeq,16hour}$ | 45dB $L_{Aeq,8hour}$ |
| Reasonable (i.e. 5 dB above the internal noise levels) | 55 – 60dB $L_{Aeq,16hour}$ | 50dB $L_{Aeq,8hour}$ |

***Table 6*** External Noise Levels Required to Achieve Internal Noise Levels with windows open

Making reference to the predicted noise levels in Tables 4 and 5, the following is determined:

*Daytime Noise Levels - Living Rooms*

- Good to reasonable internal daytime noise levels can be achieved within the all living spaces of Block 1 and 2 with windows open and closed with exception of those along the northern facades.

[1] Section 2.33 of ProPG, additional information can be found in the DEFRA NANR116: *'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows'*

- Good or reasonable internal daytime noise levels will not be achieved within kitchen / living rooms of Block 1 (Core A) facing directly towards the Naas Road and Block 2 (Core C) facing directly towards the Naas Road with windows open. In this instance appropriate acoustic specifications to windows will be provided to ensure the rooms achieve the good internal noise levels detailed here.

*Night-time Noise Levels – Bedrooms*

- Good to reasonable internal night-time noise levels can be achieved bedrooms with windows open of Blocks 1, Core B facing west and south;
- Good to reasonable internal night-time noise levels can be achieved within the bedrooms of Block 2, Core D with windows open, facing east and south;
- Good or reasonable internal night-time noise levels will not be achieved within bedrooms in Block 1, Core A and majority of Block 2, Core C with windows open. In this instance appropriate acoustic specifications to windows will be provided to ensure the rooms achieve the good internal noise levels detailed here.

#### 4.2.4 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 of BS8233 provide a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS8233 has been adopted here to determine the required performance of the building facades. This approach corrects the noise levels to account for the frequency content of road traffic noise which has been determined from the baseline survey.

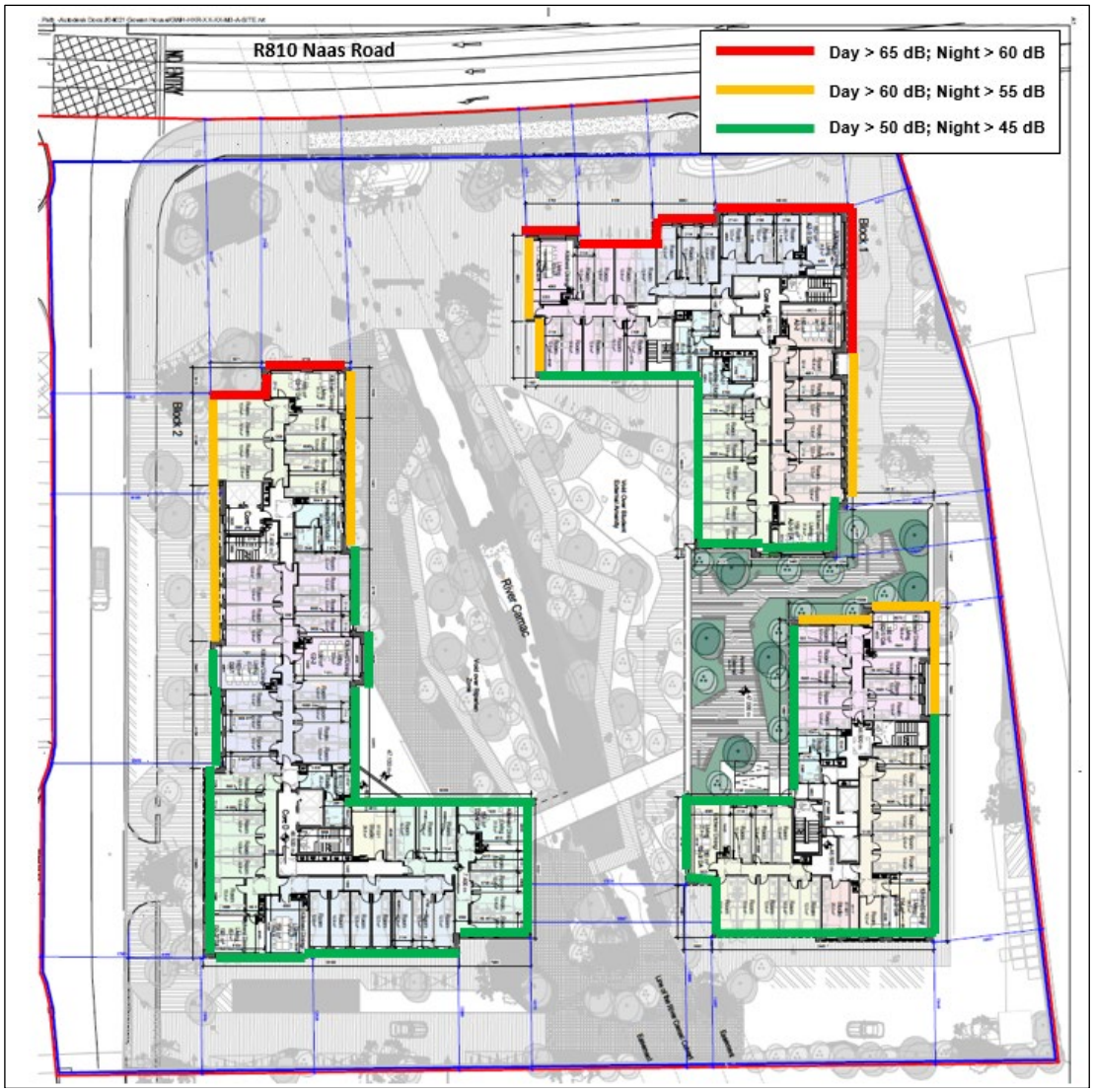


***Figure 10*** Façade Incident Noise Levels for Assessment

*Glazing*

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. In this instance the façade designations illustrated in Figure 10 have the following acoustic rating for the glazing as set out in Table 7.

| Glazing Specification for Façade Designation | Octave Band Centre Frequency (Hz) | | | | | | $R_w$ |
|---|---|---|---|---|---|---|---|
| | 125 | 250 | 500 | 1k | 2k | 4k | |
| **Red** | 27 | 29 | 36 | 41 | 42 | 52 | 40 |
| **Orange** | 26 | 27 | 34 | 40 | 38 | 46 | 38 |
| **Green** | 20 | 19 | 29 | 38 | 36 | 45 | 32 |

***Table 7*** Sound Insulation Performance Requirements for Glazing, SRI (dB)

The acoustic specification for Glazing Type Red and Orange can be achieved using a double glazed configuration with thicker glass panes than standard double glazing. Glazing Type Green can be achieved using a standard double glazed configuration.
A summary of the façade treatment measures has been indicated in Figure 11 overleaf.

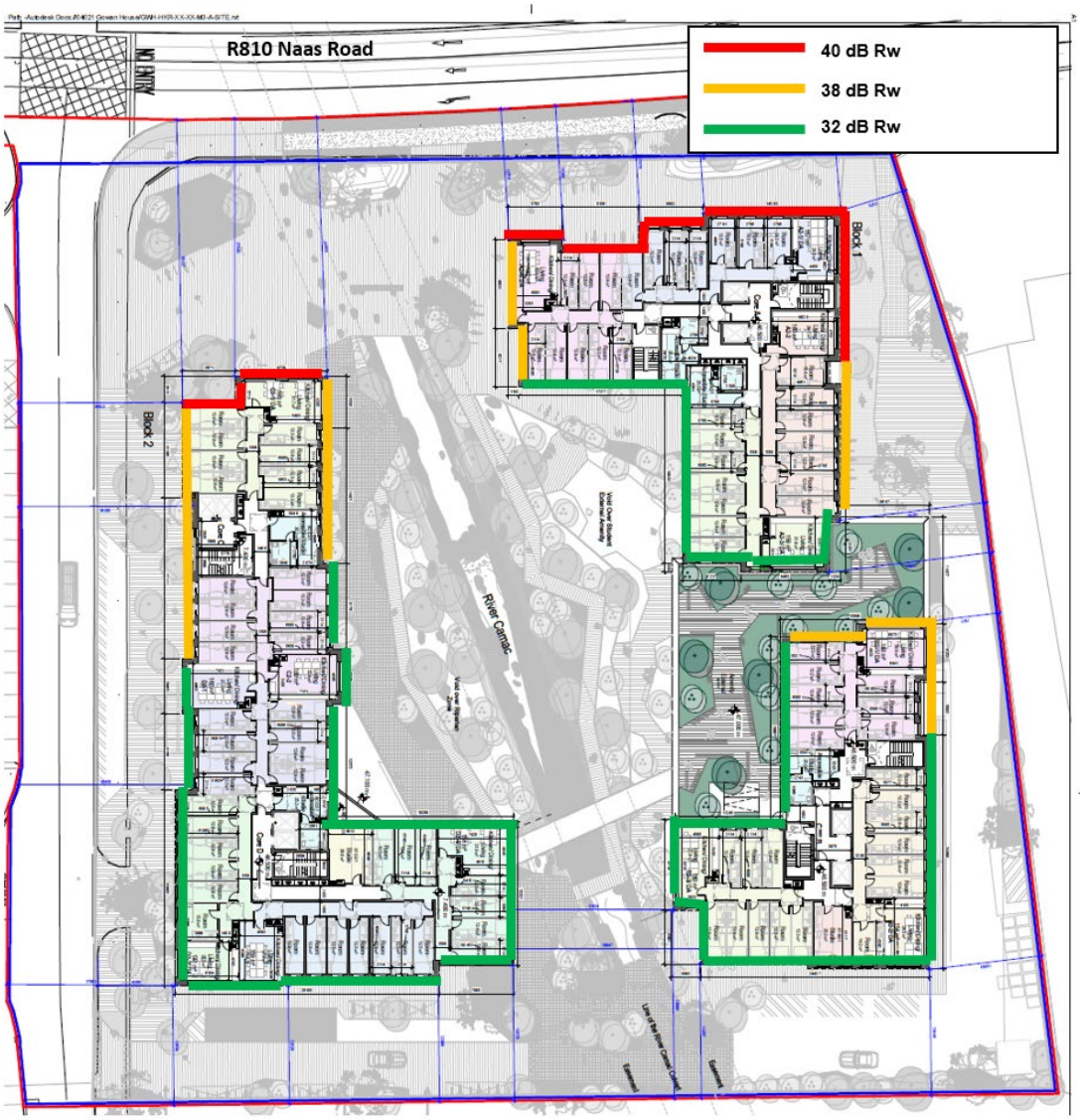


***Figure 11*** Acoustic Rating to Glazing for Façade Across Development

The typical glazing configurations and overall $R_w$ outlined above are provided for information purposes only. The over-riding requirement is the Octave Band sound insulation performance values. Any alternative system will be required to achieve the internal noise levels in Table 3.

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

It is advised that the window supplier provides laboratory tests confirming the sound insulation performance, (to British Standard 2750 Part 3:1980 and British Standard 5821, or British Standard EN ISO 140 Part 3 1995 and British Standard EN ISO 717, 1997).

The glazing illustrated in Figure 11 relate to bedrooms and living spaces. For staircore and windows to non-sensitive spaces, there is no acoustic rating required. Glazing green would provide a suitable level of sound insulation for all non-noise sensitive areas.

*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. The *Climate Action, Energy and Sustainability Statement* for the proposed development notes that a Mechanical Ventilation with Heat Recovery (MVHR) system is proposed within the student accommodation clusters. In this instance, passive wall or window vents are not proposed for the development.

4.2.5 Internal Noise Levels

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

## 4.3 Element 3 – External Amenity Area Noise Assessment

The ProPG document includes a requirement to address external noise levels across amenity spaces as part of the acoustic design statement. ProPG refers directly to the guidance contained within BS 8233 (2014) for this element of the assessment which states:

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

BS 8233 also notes:

> *Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55*

*dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."*

A portion of the site at ground floor level will be usable open space. Noise levels within the accessible areas at or below 55 dB $L_{Aeq,16hr}$ in the mid to southern portion of the external area and between 55 and 60 dB $L_{Aeq,16hr}$ in the northern portion of the external area.

An external area is located at second floor of Block 1 above the internal multipurpose space and internal student amenity area. The calculated noise levels are typically in the range of 50 to 55 dB $L_{Aeq,16hr.}$ Calculated noise level at this external area is presented in Figure 12.


***Figure 12*** Calculated Noise Levels across External Amenity Areas at Second Floor.

Element 3(v) of the Pro PG document noted the following with respect to external amenity areas:

*Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*

*• a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or;*

*• a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or;*

*• a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or;*

*• a relatively quiet, protected, publically accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.*

The development under consideration incorporates a landscaped external area space at ground level between the two blocks of which a portion is usable public open space. The development also includes an amenity roof terrace at second level which provides a noise environment which is within acceptable ranges for external areas.

The provision of the spaces available is considered to achieve the objective for "*a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings"*

## 4.4 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.

### 4.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings or student accommodation relating to internal noise levels. The Dublin City Development plan discussed in Section 2.2 notes the requirement to demonstrate good acoustic design to mitigate against potential noise impacts to new residential developments. This document has addressed this issue.

This Acoustic Design Statement has assessed the impact of traffic and rail noise levels on the proposed development hence complies with Section 15.8.9 of the development plan.

It is noted that a construction noise should form part of the construction management plan. The contractor will be required to follow the Dublin City Council guidance, *Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition*

This document refers to the control of noise through best practice guidance from *BS 5228: 2009+A1:2014: Code of practice for noise and vibration control on construction*

*and open sites* Parts 1 and 2. The contractor will therefore be required to comply with these control measures.

Mitigation measures that will be employed in order to control construction noise at its source include the following:

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Use rubber linings in, for example, chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start up plant and vehicles sequentially rather than all together;
- The normal operating hours of the site will be adhered to. This also applies to the movement of plant onto and around the site;
- The plant and activities chosen to carry out the construction work will be the quietest available means of achieving the required purpose;
- Modifications may be made to plant and equipment, if appropriate, for noise attenuation purposes, provided the manufacturer has been consulted. For example, a more effective exhaust silencer may be fitted to a diesel engine;
- As far as is reasonably practicable, sources of significant noise will be enclosed provided that ventilation and potential hazards to operators have been considered;
- Plant and noisy activities will be located away from noise-sensitive areas where practicable and sources of directional noise should be oriented away from noise-sensitive areas; and
- All plant and equipment will be regularly maintained (increases in plant noise are often indicative of future mechanical failure).

Mitigation measures that will be employed in order to control the spread of construction noise include the following:

- The distance between noise sources and noise-sensitive areas will be increased as much as is reasonably practicable; and

- Where noise control at source is insufficient and the distance between source and receiver is restricted, screening will be implemented. The location of barriers providing screening is an important consideration. Barriers will be located either close to the source of noise (as with stationary plant) or close to the listener. The height of the barrier must also be considered. BS 5228-1 states that an approximate attenuation of 5 dB is achieved when the top of the plant is just visible to the receiver over the noise barrier, while an attenuation of 10 dB is achieved when the noise screen completely hides the sources from the receiver.

Mitigation measures that will be employed in order to control vibration from construction works, with reference to BS 5228-2, include the following:

- The plant and activities chosen to carry out the construction work will be chosen to cause as little vibration as possible while achieving the required purpose;
- All plant and equipment will be regularly maintained to reduce unnecessary vibration; and
- Activities causing significant vibration will be located away from sensitive areas and/or isolated using resilient mountings where practicable.

4.4.2 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 occupied student accommodation spaces across both Blocks have been designed to achieve the good level of internal noise levels specified within ProPG with windows closed;
- A large proportion of units set back from the road and rail are screened by the development buildings can achieve good to reasonable internal noise levels with windows open;
- External amenity areas have been assessed and are determined to be within the guidance level at landscaped open areas of the site, particularly between buildings;
- The provision of external landscaped areas provide a relatively quiet external amenity space residents can access.

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

4.4.3 Likely Occupants of the Development

The proposed development is for student accommodation and hence is designed for the purpose of residential accommodation. The criteria adopted as part of this assessment are based on those recommended for permanent dwellings and are therefore considered robust and appropriate for the occupants.

4.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

4.4.5 Acoustic Design v Wider Planning Objectives

Acoustic design must be considered in the context of wider planning objectives, particularly the National Planning Framework 2040. The National Planning Framework (NPF) is an important document which must be taken into consideration in the making of local planning policy to be contained in new statutory plans.

The NPF signals a shift in Government policy towards securing more compact and sustainable urban development, to enable people to live nearer to where jobs, education and services are located. There will be a major new policy emphasis on renewing and developing existing built-up areas rather than continual expansion and sprawl of cities and towns out into the countryside, with a target of at least 40% of new housing to be delivered within the existing built-up areas of cities, towns and villages on infill and/or brownfield sites such as this development site.

## 5.0 ADDITIONAL EXTERNAL SOURCES

Once operational, there will be an element of mechanical and electrical services required to service the buildings, some of which will operate on a 24/7 basis.

During the detailed design stage, operational noise levels associated with these units will be reviewed to ensure noise levels at the nearest noise sensitive buildings do not exceed the internal noise levels within Table 3.

Building services plant will be located within the student residence units with some supporting common plant located at basement level and within plant areas within enclosures at roof level (Energy plant and heat pumps etc).

All items of plant at roof level will be screened by plant enclosure. Operational noise levels from any plant items in this area will also be designed to ensure noise levels within the residential apartments do not exceed the internal noise levels within Table 3.

## 6.0 CONCLUSION

An initial site noise risk assessment has been carried out on the proposed student accommodation development at Gowan House, Carriglea Business Park, Naas Road, Dublin 12. The initial site assessment has classified the development site as having a medium to high noise risk across the site in accordance with ProPG guidance. This was determined through a review of baseline noise measurements, noise modelling of the site and review of published noise maps for the local road network and adjacent Luas Line in the vicinity of the development site.

The assessment has concluded that it will be necessary to provide an enhanced acoustic glazing to the northern and north-east and north-western facades of Blocks 1 and 2 to ensure that when windows are closed that the internal noise environment is acceptable.

The noise level internally with the windows open will be within the good to reasonable noise range in line with the ProPG and BS 8233 guidance within bedrooms within Block 1, Core B, facing west and south and Block 2, Core D, facing east and south.

Along the northern façades of Blocks 1 and 2, the use of an enhanced acoustic glazing have been specified to achieve internal noise levels with windows closed along these façades.

# APPENDIX A
# GLOSSARY OF ACOUSTIC TERMINOLOGY

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

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

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

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

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

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

**$L_{Aeq,T}$** — This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the $L_{Aeq}$ value is to either the $L_{AF10}$ or $L_{AF90}$ value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.

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

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

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

# APPENDIX B
# BASELINE NOISE SURVEY DETAILS

## B.1 Noise Monitoring Locations

An environmental noise survey has been conducted in order to quantify noise levels at the site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Sound Pressure Levels*. The following sections reviews the existing noise environment.

A total of four survey locations were chosen. This included one long-term unattended location and three short-term attended locations. The monitoring locations are described below:

**UT1** The unattended survey was carried out by placing the monitoring equipment on the rooftop of Gowan house. The microphone was extended to a height of 3.8m above ground level.

**AT1** The first attended survey was carried out to the west of Gowan house, adjacent to Sky Motors and south of the Naas Road.

**AT2** The second attended survey was carried out to the east of Gowan house, adjacent to Origen Energy and placed further south of the Naas Road.

**AT3** The final attended survey was carried out to the North of Gowan house. The meter was placed at a much closer proximity to Naas Road.

These survey locations are representative of the most exposed site boundaries to existing noise sources. The noise monitoring locations and installation photos are displayed below.

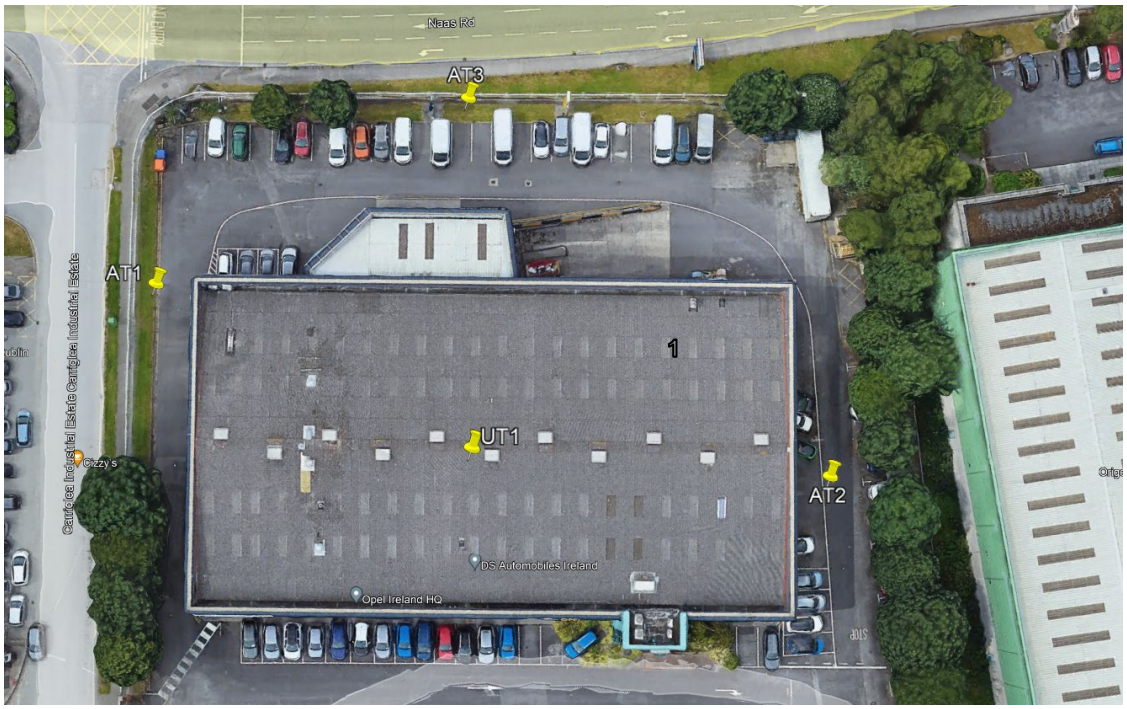


***Figure B1*** Noise Monitoring Locations

***Figure B2*** UT1 Installation

AT1 Monitoring Location

AT2 Monitoring Location

AT3 Monitoring Location

***Figure B3*** Attended Noise Monitoring Locations

## B.2 Noise Monitoring Equipment and Periods

AWN staff installed and collected the noise and vibration monitoring equipment. The following instrumentation were used in conducting the noise.

| Equipment | Type | Serial Number | Calibration Date |
|---|---|---|---|
| Sound Level Meter | RION NL-52 | 976162 | September 2022 |
| Sound Level Meter | Brüel & Kjær 2250 | 2818091 | November 2021 |
| Sound Calibrator | Brüel & Kjær Type 4231 | 2263026 | January 2023 |

***Table B1*** Monitoring Equipment for Noise Survey

For the unattended survey at UT1, continuous noise measurements with intervals of 15 minutes were conducted between 10:00 hrs on Friday 2nd June 2023 and 10:15 hrs on Tuesday 6th June 2023. For the attended measurements, three 15-minute recordings were carried out at each location with a rotation between each location once the 15-minute measurements were completed.

## B.3 Noise Survey Results

Detailed analysis has been undertaken on the measured data to derive the typical baseline noise environment in the vicinity of the proposed development.

### B.3.1 Unattended Location UT1

Table B2 summarises the ambient $L_{Aeq,16hr}$ value over the daytime period (07:00 and 23:00hrs) and the $L_{Aeq,8hr}$ over the night-time (23:00 to 07:00hrs) period measured at Location UT1.

| Date | Measured Ambient Noise Levels | |
|---|---|---|
| | Daytime dB $L_{Aeq,16hr}$ | Night-time dB $L_{Aeq,8hr}$ |
| 02/06/2023 | 61 | 58 |
| 03/06/2023 | 59 | 56 |
| 04/06/2023 | 59 | 56 |
| 05/06/2023 | 59 | 56 |
| 06/06/2023 | 62 | 55 |
| Average | 60 | 56 |

***Table B2*** Measurement Results for Location UT1

Figure B4 graphs the measured LAeq, LA90 and LAFmax over the survey duration at UT1

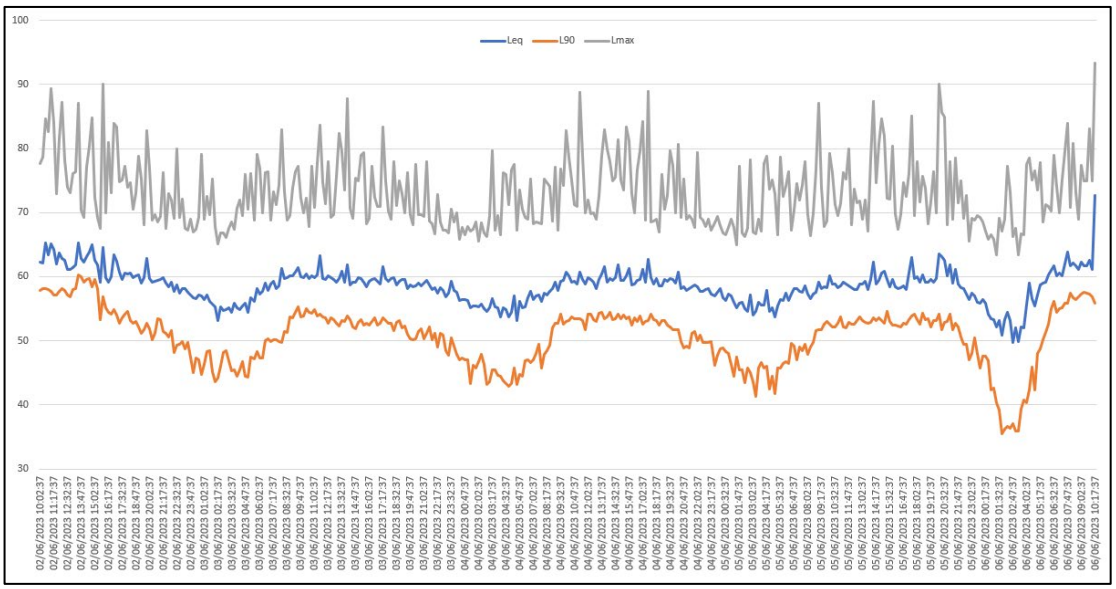


***Figure B4*** Unattended Survey Data at UT1

The measured $L_{AFmax}$ values over the night-time period at Location UT1 are presented in Figure B5.

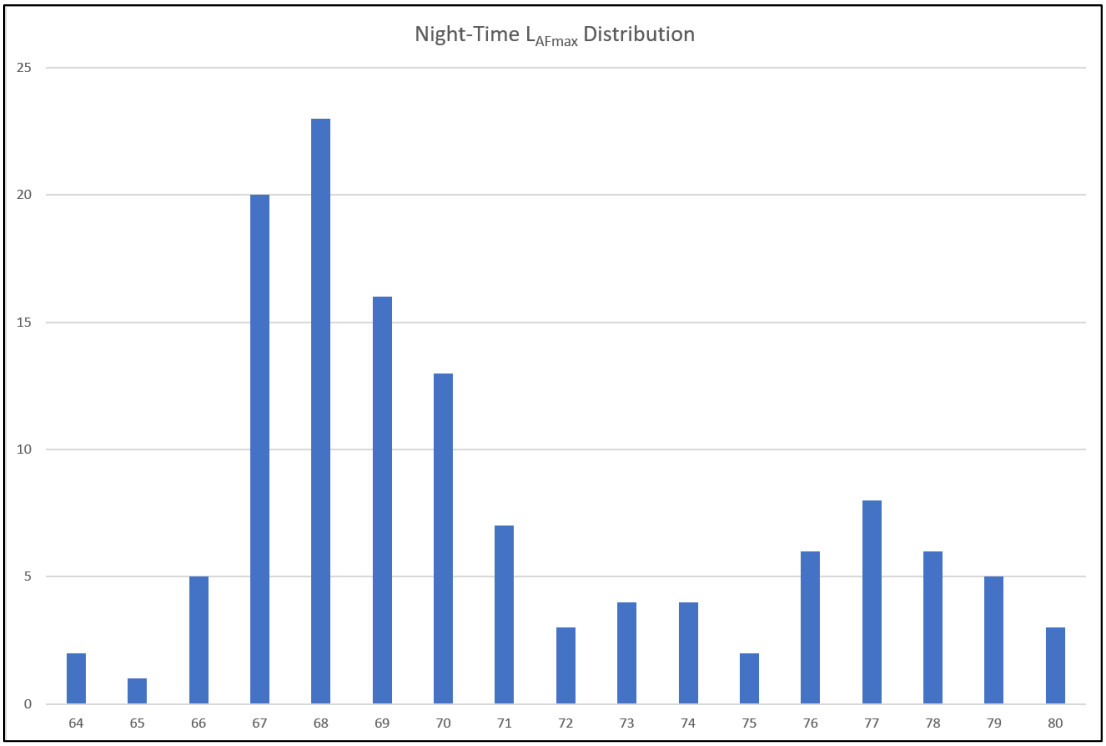


***Figure B5*** Night-tine $L_{AFmax}$ distribution at Location UT1

The noise environment at this monitoring location was dominated by road traffic along the Naas Road, as well as noises from seagulls because of a nearby nest. The highest measured $L_{AFmax}$ value is 80 dB during this survey period. The dominant $L_{AFmax}$ value measured is 68 dB.

### B.3.1 Attended Noise Monitoring Locations

Table B3 summarises the measured noise levels made at Locations AT1 to AT3.

| Location | $L_{Aeq}$ | $L_{Amax}$ | $L_{Amin}$ | $L_{A90}$ |
|---|---|---|---|---|
| AT1 | 61 | 73 | 49 | 53 |
| | 63 | 80 | 48 | 53 |
| | 63 | 82 | 46 | 55 |
| AT2 | 56 | 76 | 45 | 48 |
| | 56 | 77 | 46 | 50 |
| | 56 | 75 | 44 | 49 |
| AT3 | 75 | 99 | 47 | 55 |
| | 71 | 74 | 48 | 53 |
| | 71 | 83 | 47 | 55 |

***Table B3*** Attended Noise Measurement Results

During the attended survey period, the road traffic was the dominant noise source at locations AT1 and AT3 as they were positioned close to the Naas Road. AT2 was located closer to the construction site south of Gowan House at Carriglea residential development and hence, construction activities contributed to noise levels measured at this location. Seagull noises were audible during surveys at all three attended locations.

In addition to the baseline noise surveys measured on site, reference has been made to the most recent Round 3 noise maps published by the epa (http://gis.epa.ie) for road traffic and Rail (Luas) traffic within the Dublin Agglomeration. The published noise maps are provided for the overall day-evening-night period in terms of $L_{den}$ and for the night-time period in terms of $L_{night}$. For this assessment, reference is made to the $L_{night}$ mapping information to compare against the relevant parameters of the ProPG assessment.

Figure B6 presents the mapped noise levels across the development site for road traffic during the night-time periods using the $L_{night}$ parameter. The outline of the site is marked in green.

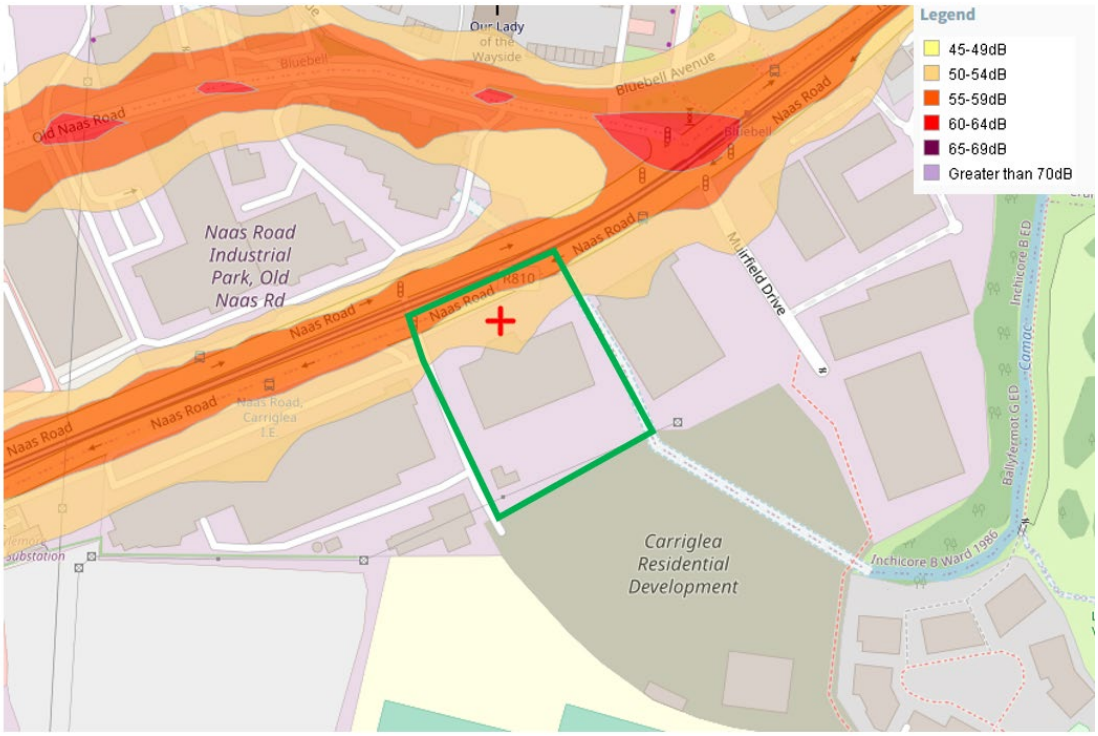


***Figure B6*** $L_{night}$ Noise Contours for Road Traffic across the site

The noise mapping indicates a road traffic noise level between 55 to 59 dB $L_{night}$ along the most northern boundary along the Naas Road. Within the majority of the northern portion of the site traffic noise levels are mapped within the 50 to 54 dB $L_{night}$ contour. Further into the site road traffic noise levels are reducing to below 45 dB $L_{night}$.

Figure B7 presents the mapped noise levels across the development site for rail noise from the Luas line during the night-time periods using the $L_{night}$ parameter. The outline of the site is marked in green.

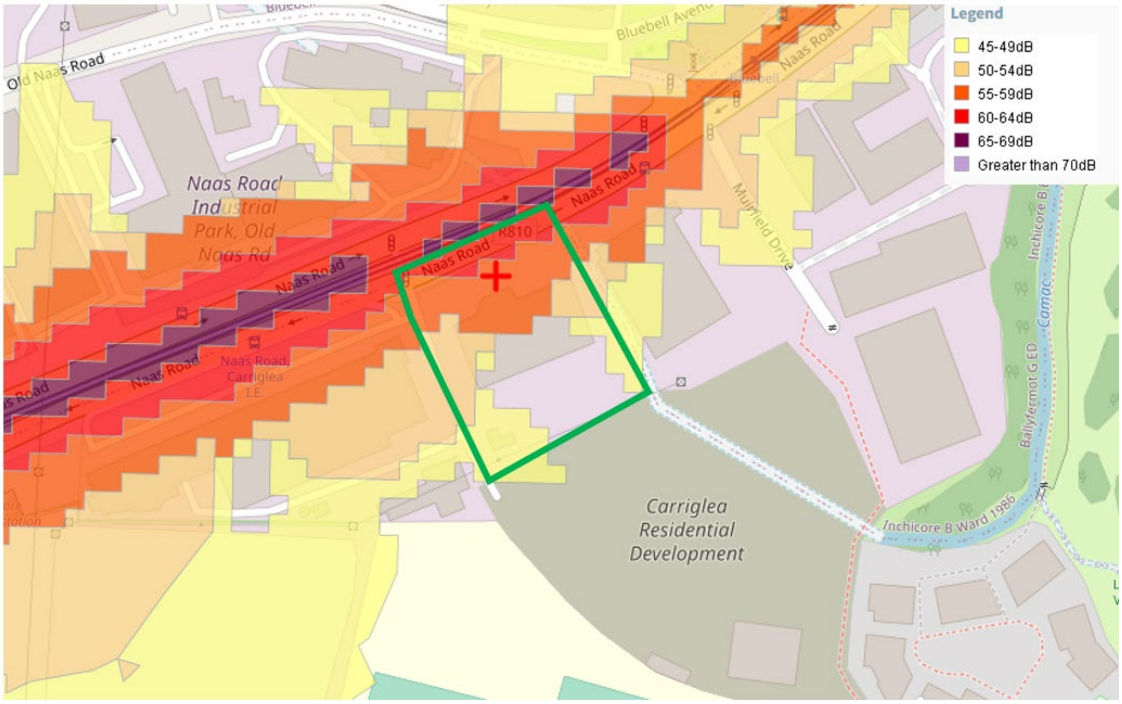


***Figure B7*** $L_{night}$ Noise Contours for Rail across the site

The noise mapping indicates rail traffic noise levels are between 55 to 59 dB $L_{night}$ along the northern portion of the site, reducing to below 45 dB $L_{night}$ further south into the site