## Longford County Council

## Newtownforbes Residential Development – Noise Impact Assessment

Issued



Client: Longford County Council

Site: Newtownforbes, Co Longford Project No: 4162

Name:

Position: Signature: Prepared by: David Courtney

Consultant

Checked by: Gary Duffy

**Principle Consultant** 



Approved by: Gary Duffy

**Principle Consultant** 

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Unit 2A, Century Business Park Dublin, D11 TOHV, Ireland t. +353-1-8775088 e. info@enfonic.com t. +353-1-8775088 e. info@enfonic.com w. www.enfonic.com Directors: G. Duffy & S. Duffy Registered in Ireland No. 360524

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## Executive Summary

This noise impact assessment report includes consideration of:

- Compliance with Longford County Council's Noise Action Plan
- Construction Phase
- Operational Phase
- Building Envelope Design

The findings of the report demonstrate that:

- 1. The construction and operational phases of the proposed development shall not result in adverse impact.
- 2. Road traffic has been assessed and a Good Acoustic Design methodology applied to demonstrate that the internal noise criteria set out in BS8233:2014 will be satisfied with appropriate glazing and ventilator specification.

## 1.0 Introduction

Enfonic have been commissioned to conduct a noise impact assessment on behalf of Longford County Council for a residential development comprised of:

- 4no. 2 Bedroom, 2 storey terraced houses
- 2no. 2 Bedroom, 1 storey semi-detached houses

The development is situated along the N4 route and the associated traffic noise levels warrant a noise impact assessment to ensure that design criteria will be achieved. This report assesses several elements with regard to the potential noise impact and the acoustic design including:

- 1. The noise impact during both the construction phase of the development. The construction phase will likely result in increased levels for a relatively short period.
- 2. The Acoustic Design Statement (ADS) methodology considers the external noise levels for day and night periods and the effectiveness of the building's design to meet the required noise criteria.

### 2.0 Methodology and Guidance

The study has been undertaken using the following methodology:

- Baseline Noise monitoring has been undertaken at the development site to quantify the existing noise levels.
- A review of the most applicable standards and guidelines has been conducted to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development, this is summarised in the following sections.
- An Acoustic Design Statement has been prepared setting out minimum glazing specification and consideration of outdoor amenity spaces.
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development.

### 2.1 Guidance

This assessment has been prepared using the following guidance documents:

- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 – Noise.
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 2 -Vibration.
- TII Guidelines for the Treatment of Noise and Vibration in National Road Schemes
- Longford County Council Noise Action Plan (2018-2023)
- BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings.
- ProPG: Professional Practice Guidance on Planning & Noise. New Residential Development. May 2017.
- Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Noise Impact Assessment'
- The World Health Organisation (WHO) in their 2018 publication entitled Environmental Noise Guidelines for the European Region
- ISO 1996: 2017: Acoustics Description, Measurement and Assessment of Environmental Noise.

### 2.2 Noise Sensitive Location

The assessment criteria will apply to Noise Sensitive Locations (NSLs), the definition of which is given in the EPA NG4 document as:

"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."

### 2.3 Construction Phase – Assessment Criteria

In general, the noise impact due to the construction phase will be from the specific items of plant used, the duration and phasing of the construction methods, the time of day that each plant will be used and their location.

At this stage of the planning for the proposed development however, a definitive construction plan is not yet formalised. Typically, a worse-case scenario is adopted whereby the plant associated for each phase e.g., site perpetrations, demolition, piling, general construction etc, is assumed to operate simultaneously. This can then inform the construction management plan and be refined as required if the proposed development were to proceed. Noise and vibration monitoring during construction can ensure compliance.

### 2.3.1 BS 5228

BS 5228 - 1:2009 +A1 2014 Code of practice for noise and vibration control on construction and open sites – Noise provides basic information on the prediction and measurement of noise from construction sites and operations such as mines and quarries. It also includes a large database of source noise levels for commonly used equipment and activities on construction sites.

The standard provides guidance on the 'threshold of significant effect' in respect of noise impact at dwellings. One suggested method for determining threshold noise levels is known as the 'ABC method'. This involves measuring existing ambient noise levels at noise sensitive locations and categorising them A, B or C accordingly, with the relevant threshold level derived from the category as set out in Table 1.

Table 1. BS 5228 - Example of significant effect at dwellings

| Assessment category and                              | Threshold value (dB)     |                          |                          |
|--|--------------------------|--------------------------|--------------------------|
| threshold value period (L <sub>Aeq</sub> )           | Category A <sup>A)</sup> | Category B <sup>B)</sup> | Category C <sup>C)</sup> |
| Night-time (23.00-07.00)                             | 45                       | 50                       | 55                       |
| Evenings and weekends <sup>D)</sup>                  | 55                       | 60                       | 65                       |
| Daytime (07.00–19.00) and<br>Saturdays (07.00–13.00) | 65                       | 70                       | 75                       |

NOTE 1 A significant effect has been deemed to occur if the total L<sub>Aeq</sub> noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total  $L_{Aeq}$  noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

- A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
- B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
- C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
- <sup>D)</sup> 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

### 2.3.2 NRA/TII Guidelines

#### 2.3.2.1 Noise

The National Roads Authority (now TII) publication *Guidelines for the Treatment* of Noise and Vibration in National Road Schemes contains information on the permissible construction noise levels for various hours of operation.

The noise level limits are similar to BS5228 and are outlined in Table 2.

| Table 2. Maximum permissible noise levels at the façade of dwellings during construction. |                       |                    |  |  |
|---|-----------------------|--------------------|--|--|
| Period  | Noise Levels          |                    |  |  |
|   | L <sub>Aeq(1hr)</sub> | L <sub>AFmax</sub> |  |  |
| 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*                |  |  |
| dB re. 2x10⁵Pa  |                       |                    |  |  |

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

It is appropriate to use these criteria to control construction noise from the proposed development.

#### 2.3.2.2 Vibration

The TII Guidance goes on to recommend that vibration levels are limited to the values set out in Table 3 to prevent cosmetic or structural damage to buildings.

Table 3. Summary of TII recommended construction vibration limits.

| Allowable vibration velocity (Peak Particle Velocity) at the closest part of any |           |         |  |  |
|--|-----------|---------|--|--|
| sensitive property to the source of vibration, at a frequency of:                |           |         |  |  |
| Less than 10Hz 10 to 50Hz 50 to 100Hz (and above                                 |           |         |  |  |
| 8 mm/s   | 12.5 mm/s | 20 mm/s |  |  |

It is appropriate to use these criteria to control construction vibration from the proposed development.

### 2.4 Operational Phase – Noise Assessment Criteria

### 2.4.1 Longford County Council Action Plan (2019-2023)

The operational phase of the development has been assessed with regard to the Longford County Council Noise Action Plan (NAP) 2019-2023.

The Longford County Council NAP is prepared as a requirement of Environmental Noise Regulations, 2006. It is primarily concerned with road traffic noise but includes some useful guidance for other noise sources.

Section 2.3 states:

"At present there is no existing legislation that limits noise levels to a particular value. To address the lack of legislative measures and unify the approach taken by Action Planning Authorities the EPA have issued guideline noise levels for the onset of assessment of noise exposure and prioritising areas for noise mitigation measures. The proposed onset of assessment levels relating to road traffic noise are given below:

Table 4. Onset levels for noise mitigation and preservation

| Parameter  | L <sub>DEN</sub> | L <sub>Night</sub> |
|--|------------------|--------------------|
| Onset levels for noise mitigation<br>measures                      | 70dB             | 57dB               |
| Onset levels for measures to preserve the existing noise situation | 55dB             | 45dB               |

These levels reflect an annual average 24-hour period. The levels above apply to the Action Planning Process only and should not be used for planning purposes generally.

#### 2.4.2 BS 8233:2014

To assess the building envelope design, it is appropriate follow the guidance set out in *BS 8233:2014 Guidance on sound insulation and noise reduction for buildings* which is concerned with noise ingress into dwellings.

The recommended levels for indoor ambient noise in residential dwellings is summarised in Table 5.

| Activity  | Location         | Location 07:00 – 23:00     |  |  |  |
|---|------------------|----------------------------|--|--|--|
|   |                  | hours                      | hours  |  |  |
| Resting   | Living room      | LAeq,16hr 35dB             | -  |  |  |
| Dining  | Dining room/area | L <sub>Aeq,16hr</sub> 40dB | -  |  |  |
| Sleeping (daytime resting)  | Bedroom          | L <sub>Aeq,16hr</sub> 35dB | L <sub>Aeq,8hr</sub> 30dB<br>L <sub>AFMax,8hr</sub> 45 <sup>1</sup> dB |  |  |
| 1"For a wood along it is ballowed that indeen according a sound have been been been at an and |                  |                            |  |  |  |

Table 5. BS 8233:2014 Recommended internal noise limits.

<sup>1</sup>"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L<sub>AFmax</sub> more than 10-15 times per night"

#### 2.4.3 ProPG

An Acoustic Design Statement methodology is set out in the Professional Practice Guidance on Planning and Noise (ProPG) which focuses on the adoption of Good Acoustic Design for dwellings when required as a result of high external noise levels.

ProPG also provides guidance on flexibility of the internal noise level targets set out in BS8233:2014. For instance, in cases where the development is considered

necessary or desirable, then a relaxation of the internal  $L_{Aeq}$  values by up to 5dB can still provide reasonable internal conditions.

It also provides the following guidance regarding 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 50-55dB  $L_{Aeg, 16hr.}$ "

In addition, it offers flexibility on the amenity noise targets provided that residents have access to a quiet recreational environment.

#### 2.4.4 Operational Noise

The likely significant sources of noise associated with the operational phase of the proposed residential development is the potential increase to the local traffic.

#### 2.4.4.1 Traffic

The increase in traffic numbers associated with the scheme's residences is a likely source of noise during the operational phase of the scheme.

The most appropriate criteria for assessing disturbance or annoyance from noise arising from the site would be related to the significance of perceived changes in noise levels.

The Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Noise Impact Assessment' gives appropriate impacts which have been summarised with relevant guidance in Table 6 below.

| Noise Level | Subjective Reaction              | Impact      | of Effects <sup>1</sup> |
|-------------|----------------------------------|-------------|-------------------------|
| 0           | No change                        | None        | Imperceptible           |
| 0.1 to 2.9  | Barely perceptible               | Minor       | Slight                  |
| 3.0 to 4.9  | Noticeable                       | Moderate    | Moderate                |
| 5.0 to 9.9  | Up to a doubling of loudness     | Substantial | Significant             |
| 10+         | More than a doubling of loudness | Major       | Profound                |

Table 6. Summary of appropriate impact for changes in traffic noise levels.

A change in traffic noise of less than 2dBA is generally not noticeable to the human ear whilst a change of 3dBA is generally considered to be just perceptible. Changes in noise levels of 3 to 5 dBA would however be noticeable and, depending on the final noise level, there may be a slight or moderate noise impact. Changes in noise level in excess of 6dBA would be clearly noticeable, and depending on the final noise level, the impact may be moderate or significant.

However, a significant change in traffic volumes or traffic category i.e., increase in the use of a road by HGVs, would likely be required to result in such increases.

The UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that a change in noise level of 1dB  $L_{A10,18h}$  is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3dB  $L_{A10,18h}$  is equivalent to a 100% increase or a 50% decrease in traffic flow.

<sup>&</sup>lt;sup>1</sup> EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017)



### 2.5 Significance of Effects

The criteria for determining the significance of impacts and the effects used in this report are in line with the EPA Guidelines (Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports 2017).

The EPA guidelines do not quantify the impacts in decibel terms. In absence of such information, reference is made to "Guidelines for Environmental Noise Impact Assessment" from the Institute of Environmental Management and Assessment (IEMA), 2014.

Table 7 presents the degree of effect matrix from the IEMA guidelines and Table 8 presents the effect descriptions.

| Magnitude / Scale of | Sensitivity of Receptor |             |          |            |
|----------------------|-------------------------|-------------|----------|------------|
| Change               | High                    | Medium      | Low      | Negligible |
| Large                | Very Substantial        | Substantial | Moderate | None       |
| Medium               | Substantial             | Substantial | Moderate | None       |
| Small                | Moderate                | Moderate    | Slight   | None       |
| Negligible           | None                    | None        | None     | None       |

Table 7. Degree of Effect Matrix (IMEA, 2014)

#### Table 8. Effect Descriptions (IMEA, 2014)

| Effect               | Description   |  |  |
|----------------------|---|--|--|
| Very Substantial     | Greater than 10 dB LAeq change in sound level perceived at a receptor of great sensitive to noise   |  |  |
| Substantial          | Greater than 5 dB LAeq change in sound level at a noise-<br>sensitive receptor, or to a 5 to 9.9 dB LAeq change in<br>sound level at a receptor of great sensitivity to noise         |  |  |
| Moderate             | A 3 to 4.9 dB LAeq change in sound level at a sensitive or<br>highly sensitive noise receptor, or a greater than 5 dB LAeq<br>change in sound level at a receptor of some sensitivity |  |  |
| Slight               | A 3 to 4.9 dB LAeq change in sound level at a receptor of some sensitivity  |  |  |
| None/Not Significant | Less than 2.9dB LAeq change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals.                         |  |  |

For this assessment, it has been assumed that dwellings have high sensitivity. Table 9 presents the impact scale adopted in this assessment as well as the corresponding significance of impact based on definitions the EPA guidance (EPA, May 2022) guidelines.

| <b>T</b> I I A |         | <b>D</b>     |            |               |
|----------------|---------|--------------|------------|---------------|
| Table 9.       | Effects | Descriptions | (IMEA-2014 | and EPA-2017) |

| Noise Level change<br>dB(A) | IEMA Guidelines      | EPAs Significance of<br>Effects |  |  |
|-----------------------------|----------------------|---------------------------------|--|--|
| Less than 2.9               | None/Not significant | Imperceptible                   |  |  |
|                             |                      | Not Significant                 |  |  |
| 3.0 - 4.9                   | Slight               | Slight Effects                  |  |  |
|                             | Moderate             | Moderate Effects                |  |  |
| 5.0 – 9.9                   | Substantial          | Significant Effects             |  |  |
| Greater than 10.0 dB        | Very Substantial     | Very Significant                |  |  |
|                             |                      | Profound Effects                |  |  |

#### 2.6 Guidance Summary

In summary, noise and vibration criteria adopted in this report are set out in Table 10.



Table 10. Summary of noise criterion

| Activity      | Metric                 | Guidance | Criteria        |
|---------------|------------------------|----------|-----------------|
| Construction: |                        |          |                 |
| Noise         | L <sub>Aeq</sub>       | BS5228   | 65-75dB Daytime |
| Vibration     | PPV                    | TII      | 8-20mm/s        |
|               |                        |          |                 |
| Dwellings:    |                        |          |                 |
| Bedroom       | L <sub>Aeq</sub>       | BS 8233  | 35dB Daytime    |
|               |                        |          | 30dB Night-time |
|               | L <sub>AFMax,8hr</sub> |          | 45dB Night-time |
| Living Room   | L <sub>Aeq</sub>       |          | 35dB Daytime    |
| Amenity Space | L <sub>Aeq</sub>       | ProPG    | 55dB Daytime    |
|               |                        |          |                 |
| Operational:  |                        |          |                 |
| Traffic       | L <sub>Aeq</sub>       | DMRB     | ΔdB             |

### 3.0 Receiving Environment

### 3.1 Development Description

The development will consist of 4no. two storey terraces houses and 2no. semidetached houses along the N4 in Newtownforbes.

There are several existing residences surrounding the site and these are considered as the nearest Noise Sensitive Locations (NSLs) for the purposes of this impact assessment. The proposed site plan is shown in Figure 1.



Figure 1. Proposed Site Plan

### 3.2 Background Noise Survey

A baseline noise survey has been conducted at the site 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.* Specific details are set out below.

A Noise Monitoring Location (NML) was chosen as the closest façade to the N4 which was observed to be the most significant noise source. The NML is presented in Figure 2 an images of installation are included in Appendix B.



Figure 2. Noise Monitor Location

The noise monitor was installed on 22/08/2023 and left in-situ for over 48 hours. Weather conditions were dry and calm throughout.

#### 3.2.1 Survey Results

#### 3.2.1.1 Noise

For the purposes assessing building façade performance the noise data was analysed and complied into equivalent Daytime (07:00-23:00) and Night-time (23:00 - 07:00) values as given in Table 11.

| Table 11. Summary of noise monitoring | results |
|---------------------------------------|---------|
|---------------------------------------|---------|

| Period                     | L <sub>Aeq</sub> (dB) | Dominant Noise Source |
|----------------------------|-----------------------|-----------------------|
| Daytime (07:00 – 23:00)    | 68                    | Road Traffic Noise N4 |
| Night-time (23:00 – 07:00) | 58                    | Road Traffic Noise N4 |

### 4.0 Impact Assessment

The potential noise impact associated with the construction phase of the proposed development are discussed in the following section.

### 4.1 Construction Phase

#### 4.1.1 Noise Limits

The adopted construction noise limits are set out in Table 12 below.

Table 12. Defined Construction Noise Limits at Noise Sensitive Locations

| Period   | Noise Levels           |                     |
|--|------------------------|---------------------|
|  | L <sub>Aeq (1hr)</sub> | L <sub>AFmax</sub>  |
| Monday to Friday 07:00 to 19:00hrs                                 | 75                     | 80                  |
| Monday to Friday 19:00 to 22:00hrs                                 | 65*                    | 70*                 |
| Saturdays 07:00 to 13:00hrs  | 75                     | 80                  |
| Sundays & Bank Holidays 08:00 to 16:30hrs                          | 65                     | 70*                 |
| * Construction activity at these times, other than that required f | or emergency w         | orks, will normally |
| require the explicit permission of the relevant local authority.   |                        |                     |

These criteria satisfy TII and BS 5228 guidance. The limits should be included in the construction management plan and appropriate mitigation measures applied to ensure that the criteria are not exceeded. Appropriate mitigation measures may include plant selection, operational times, phasing of the works, screening etc. The BS 5228-1 standard provides advise on useful noise control techniques.

Construction works are generally expected to be confined to daytime periods Mon-Fri. The impact is expected to be negative, perceptible and short-term.

#### 4.1.2 Construction Phase – Traffic Noise

Consideration should also be given to the addition of construction traffic along the site haulage routes. Access to the development site for construction traffic will be via the adjoining roads.

The existing daytime noise environment is dominated by road traffic on the N4 and the noise generated by construction traffic is not expected to change the character of the existing noise environment significantly.

The impact is expected to be neutral, imperceptible, short-term

#### 4.1.3 Construction Phase – Vibration

BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration provides empirical vibration levels from various activities at various distances.

A detailed construction plan is not available at this stage of the development application however, it can be said that vibration levels rapidly diminish as they propagate through the ground. Given the distances between the construction site and the nearest NLS and the typical nature of the likely construction activities, vibration levels will be below criteria likely to cause any cosmetic damage and an order of magnitude below criteria likely to cause structural damage. This assumes that the NSLs are of modern construction and that no pile-driving or other highly impulsive activities occur.

The impact is therefore considered to be neutral, imperceptible and short-term.

#### 4.1.4 Ameliorative, Remedial or Reductive Measures

The impact assessment conducted for the construction activities has demonstrated that the construction noise levels ought to be within the adopted criterion. However, the following mitigation measures may be considered during certain construction activities in order to further reduce the noise and vibration impact to nearby noise sensitive areas.

As part of these mitigation measures it is recommended that the Contractor should compile a Noise and Vibration Management Plan (NVMP) which will deal specifically with management processes and strategic mitigation measures to remove or reduce significant noise and vibration impacts, and cumulative noise and vibration impacts from the construction works. The Plan will also define noise and vibration monitoring and reporting. The NVMP will also include method statements for each phase of the works, the associated specific measures to minimise noise and vibration in so far as is reasonably practicable for the specific works covered by each plan and a detailed appraisal of the resultant construction noise and vibration generated.

The contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to



generate appreciable levels of noise or vibration, explaining the nature and duration of the works.

With regard to potential mitigation measures during construction activities, BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- control of noise sources;
- screening;
- hours of work;
- liaison with the public, and;
- monitoring.

Noise control measures that will be considered include the selection of quiet plant, enclosures, and screens around noise sources, limiting the hours of work and carrying out noise/vibration monitoring as required.

A suitable site hoarding would protect the residents immediately adjacent to the construction site.

### 4.2 Operational Phase

Once operational, there are no significant sources of noise associated with the operational phase expected.

There are no significant sources of vibration associated with the operational phase expected.

#### 4.2.1 Associated Traffic Noise

It is appropriate to consider the increase in traffic noise level that may arise as a result of vehicular movements associated with the development.

A traffic impact assessment has not been conducted. Due to the size of the development and its location along a main national road it unlikely that there will be <1% additional traffic. This equates to a <1dB increase in associated noise level as described in Table 6. There will be no noise impact for additional traffic.

### 5.0 Building Envelope Specification

The Acoustic Design Statement of the building envelope should consider the external noise levels with a view to achieving the internal design goals from BS 8233 as set out in Table 5.

The façades of dwellings include several critical elements including glazing, walls, ventilators and roof/ceiling. By calculating the combined effect of these it's possible to predict the internal noise level based on the known external levels for a given building design.

The acoustic performance of the individual building element is usually rated in terms of the Weighted Sound Reduction Index (Rw) which is a number used to rate the effectiveness of a soundproofing system or material. Increasing the Rw by one translated to a reduction of approximately 1dB in noise level. Therefore, the higher the Rw number, the better a sound insulator it will be.

The  $R_w ctr$  parameter is a variation which should be used when the incident noise on the building is primarily from road traffic. It is therefore appropriate to use it here.



### 5.1 Acoustic Design Statement

By applying the guidelines in ProPG and BS8223, an Acoustic Design Statement (ADS) will provide the predicted interior noise levels based on the proposed construction and inform the building design. It will also present options to achieve the attenuation required should the predicted internal noise level exceed the required criteria.

The ADS does not consider the sound attenuation of internal elements such as walls and floor/ceiling or other acoustic topics; these are covered by *Building Regulations, Technical Guidance Document, Part E.* 

### 5.2 Design Criteria

The daytime and night-time criteria are defined as  $L_{Aeq}$  noise levels over 16hrs and 8hrs respectively. A summary of the internal noise criteria is given in Table 13.

Table 13. Summary of internal noise criteria.

| Period   | Parameter   | Internal Criteria (dB) |
|--|-------------|------------------------|
| Daytime (07:00 – 23:00)  | LAeq, 16hrs | 35                     |
| Night-time (23:00 – 07:00)   | LAeq, 8hrs  | 30                     |
|  | LAFMax      | 45 <sup>1</sup>        |
| 1"For a good aloon, it is ballowed that indeer sound pressure levels should not evered |             |                        |

<sup>1</sup>"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L<sub>AFmax</sub> more than 10-15 times per night".

### 5.3 Noise Propagation Model

The external façade levels are dependent on their orientation and proximity to the roads adjacent to the site and a noise propagation model was created to plot façade noise levels across the site. The measured noise levels are used to 'calibrate' the noise propagation model. From the predicted levels the glazing and ventilator specifications can be derived to achieve the criteria.

The property software used, Type 7810-C Predictor, calculates noise levels in accordance with *ISO 9613:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.* 

The resultant noise levels are calculated considering a range of factors affecting the propagation of the sound, including:

- The magnitude of the noise source in terms of traffic flows in accordance with CRTN
- The distance between the source and the receiver
- The presence of obstacles such as buildings in the propagation path.
- Topography of the site and area
- The presence of reflecting surfaces
- The acoustic property of the intervening ground between the source and the receiver
- Attenuation due to atmospheric absorption

A noise propagation model was developed which included the daytime and nighttime traffic flows from N4, R526 and R510 roads. The traffic flows were set such to result in a noise level withing ±2dB of the measured noise levels at the NSL. This 'calibrated model' can then be used to predict façade noise levels across the proposal development. These levels are used to then calculate the glazing and ventilator acoustic performance to achieve the internal noise level criteria.



#### 5.4

#### Windows open

Opening a window will compromise the acoustic performance of the facade but it is a desirable feature or necessary to provide purge ventilation. Following the ProPG/BS8233 guidelines, the performance of the façade with windows open should be considered initially.

The World Health Organisation (WHO) Environmental Noise Guidelines for European Region (WHO, 2018) document describes the typical reduction of an open window as being 15dB.

It was found that with an open window, the design goal will not be satisfied for façades adjacent to the roads. The design goal will however be achieved with a closed window of appropriate specification, and the option remains for the windows to be opened at the resident's discretion.

For façades not facing the roads, the design criteria can be achieved with open windows.

#### 5.5 **Glazing Specification**

From the noise propagation model, the incident façade noise levels for daytime and night-time periods were established. Each facade was broken into various receivers which are presented below in Figure 3. The relevant levels, design criteria and required glazing performance for each of the facades are presented in Table 14. The daytime criteria was the more stringent criteria in this case as the traffic levels were significantly higher during the daytime than the night-time.

| Table 14. Summary of Facade Noise Levels, Criteria and Required Glazing Performance. |                  |            |               |                                    |
|--|------------------|------------|---------------|------------------------------------|
| Reciever   | Parameter        | Predicted  | Design        | Minimum Required                   |
|  |                  | Level (dB) | Criteria (dB) | Performance (R <sub>w, ctr</sub> ) |
| R2   | L <sub>Aeq</sub> | 68.1       | 35            | 36                                 |
| R1   | L <sub>Aeq</sub> | 68         | 35            | 36                                 |
| R9   | L <sub>Aeq</sub> | 64.1       | 35            | 32                                 |
| R7   | L <sub>Aeq</sub> | 63.2       | 35            | 31                                 |
| R3   | L <sub>Aeq</sub> | 59.9       | 35            | 28                                 |
| R4   | L <sub>Aeq</sub> | 59.9       | 35            | 28                                 |
| R8   | L <sub>Aeq</sub> | 58.2       | 35            | 26                                 |
| R10  | L <sub>Aeq</sub> | 55.3       | 35            | 23                                 |
| R5   | L <sub>Aeq</sub> | 54         | 35            | 22                                 |
| R6   | L <sub>Aeq</sub> | 42.9       | 35            | 11                                 |

The noise propagation model with identified facades and minimum glazing performances is given in Figure 3.



Figure 3. Glazing performance mark-up from noise propagation model.

Table 15 below sets out typical glazing examples for the marked-up façades illustrated above.

| Minimum<br>Required R <sub>w, ctr</sub>                                | Glazing<br>Unit | Typical Construction                     |
|--|-----------------|--|
| 36   | Double          | 8 - 16 argon - Pilkington Optiphon™ 12,8 |
| 32   | Double          | 4 - 16 argon - 10                        |
| Assumed:<br>Room volume = $45m^3$ , Window area = $2.4m^2$ , RT = 0.5s |                 |  |

Table 15. Glazing acoustic performance for identified façades.

**Note**: Glazing specifications apply to habitable rooms only i.e. Living/Dining and Bedrooms. It does not apply to bathrooms or other rooms.

#### 5.5.1.1 Ventilators

Background ventilators on façades marked-up in Figure 3 should include internal baffles and acoustic insulation to achieve a minimum sound insulation performance of 36dBA  $D_{n,e,w}$  (ctr).

#### 5.5.2 Other Façades

There are no specific glazing or ventilator requirement for facades not marked-up above.

**Note**: Façade acoustic performance will be finalised in the detailed design phase should the development proceed.

#### 5.6 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 or ventilation 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 51dB  $R_w$  for this construction.

### 5.7 Amenity areas

The amenity areas consist of outdoor residential spaces. The maximum criteria of 55dB set out in ProPG will be satisfied at the north eastern facades of both proposed units as these areas will benefit from a screening effect of the buildings.

### Appendix A

Measured Noise Levels.



Figure 4. NMT Noise Data

## Appendix B Monitoring Locations



Figure 5. NMT installation



## Appendix C Noise Contours

