

7. Noise & Vibration

7.1. Introduction

This chapter assesses the noise and vibration baseline conditions for the proposed residential development at a c. 17.9ha greenfield Site located in Blackrock, Dundalk, Co. Louth. It identifies the potential constraints relating to this topic for the Site. The Site currently comprises agricultural lands and the proposed development is to comprise of approximately 483no. residential units.

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7.2. Methodology

7.2.1. Assessment Criteria

Assessment criteria for the development Site takes account of the potential inward noise impact of the surrounding noise environment on proposed noise sensitive buildings to be developed within the Site and assesses the suitability of the Site taking account of any constraints related to any high noise areas. Consideration also needs to be given to the outward noise and vibration impact of the proposed development Site on existing noise sensitive properties in the surrounding environment (e.g. construction and operational phase outward noise and vibration).

7.2.2. Construction Assessment Criteria

7.2.2.1. Construction Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In lieu of statutory guidance an assessment of significance has been undertaken as per BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities. BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 7.1 sets out the values which, when exceeded, signify a potential significant impact at the facades of residential receptors.

Table 7.1 - Example threshold of potential significant impact at dwellings

| Assessment category and threshold value period | Threshold value, in decibels (dB LAeq, T) | | |
|---|---|-------------|-------------|
| | Category AA | Category BB | Category CC |
| Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00) | 65 | 70 | 75 |
| Evenings and weekends ^D | 55 | 60 | 65 |
| Night-time (23:00 to 07:00hrs) | 45 | 50 | 55 |

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

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

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

^D19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant impact is deemed to occur.

In the case of this development all noise sensitive receptor locations have been assigned category A threshold values in-line with the baseline noise levels presented in the Receiving Environment section of this Chapter. The category A threshold for daytime construction noise is 65 dB LAeq, T (where T is the appropriate threshold value period presented in Table 7.1). If the construction noise exceeds this category value, then a significant impact is deemed to occur.

The closest works area is approximately 20m from the nearest properties (although there is also potential for the early phases of the proposed development to become occupied prior to the commencement of construction works on other areas of the Site) with the remainder of works taking place across the Site at varying distances.

In order to assess a worst-case scenario, construction noise levels at distances of 20m and 50m have been used although a prediction to 10m distance is also provided as a reference. The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard Site hoarding, typically 2.4m height, will be erected around the perimeter of the construction Site for the duration of works.

7.2.2.2. Construction Vibration

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

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

BS5228-2 and BS7385 advise that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero.

The recommended vibration limits in order to avoid cosmetic damage to buildings, as set out in both documents referred to above, are reproduced in Table 7.2. The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 7.2. Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in the Table. It should be noted that these values refer to the base of the building.

Table 7.2 - Transient vibration guidance values for avoidance of cosmetic building damage

Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of

| 4 to 15 Hz | 15 to 40Hz | 40Hz and above |
|------------|------------|----------------|
| 15mm/s | 20mm/s | 50mm/s |

Human response to vibration stimuli occurs at orders of magnitudes below those associated with any form of building damage, hence vibration levels lower than those indicated in Table 7.3 can lead to concern. BS5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of PPV. Whilst the guide values are commonly used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources. Table 7.3 below summarises the range of vibration values and the associated potential impacts on humans.

Table 7.3 - Guidance on impacts of human response to PPV magnitudes

| Vibration Level | Impact |
|-----------------|---|
| 0.14 mm/s | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration. |
| 0.3 mm/s | Vibration might be just perceptible in residential environments. |
| 1 mm/s | It is likely that a vibration level of this magnitude in residential environments will cause complaint. |

The standard notes that single or infrequent occurrences of these levels do not necessarily correspond to the stated impact in every case.

7.2.3. Operational Assessment Criteria

7.2.3.1. Operation Noise

7.2.3.2. Louth Noise Action Plan 2018 – 2023

In the first instance, for the purposes of Noise Action plans, under EU Directive 2002/49/EC (as transposed into Irish Law as statutory instrument S.I No. 140 of 2006), Louth County Council has produced a Noise Action Plan for 2013 -2018.

The Noise Action Plan provides some discussion of external noise levels and defines particular noise assessment thresholds as reproduced below:

“For assessment of noise mitigation measures

- 70 dB L_{den}
- 57 dB L_{night}

For assessment of noise level preservation where they are good

- 55 dB L_{den}
- 45 dB L_{night} ”

The action plan provides some guidance on how to address the assessment of new developments for each threshold. Giving consideration to the prevalent noise environment at the proposed development Site, the following advice applies:

“Intermediate and Below Preservation Threshold Areas

The implementation of existing Planning and Licensing Regulations is considered adequate to address new development in areas both below the protection threshold and between the thresholds.”

7.2.3.3. BS 8233: Guidance on sound insulation and noise reduction for buildings: 2014

The Louth Noise Action Plan does not make reference to appropriate internal noise levels within dwellings. In the absence of specific local guidelines relating to appropriate internal noise levels in

dwellings, industry best practice guidance is found in 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 road/rail traffic. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended indoor ambient noise levels for residential dwellings are set out in Table 7.4.

Table 7.4 - Indoor ambient noise levels for dwellings from BS 8233:2014

| Activity | Location | Day 07:00 to 23:00hrs LAeq,16hr | Night 23:00 to 07:00hrs LAeq,8hr |
|----------|------------------|------------------------------------|-------------------------------------|
| Resting | Living Room | 35 | - |
| Dining | Dining room/area | 40 | - |
| Sleeping | Bedroom | 35 | 30 |

For the purposes of this study, it is appropriate to derive external assessment criteria based on the internal criteria noted in Table 7.4 above. This is done by factoring in the degree of noise reduction afforded by a partially open window which is nominally deemed to fall in the range of 15 dB in line with BS 8233 and WHO guidance. Based on the above, the following external noise levels would be considered reasonable in order to achieve suitable internal noise levels within residential properties both within and external to the development Site:

- Daytime (07:00 to 23:00 hours) 55 dB LAeq,15minute, and;
- Night (23:00 to 07:00 hours) 45 dB LAeq,15minute.

7.2.3.4. Noise Levels in External Amenity Spaces

In relation to noise levels in external amenity areas, BS 8233 provides the following guidance:

“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 LAeq,T, with an upper guideline value of 55 dB LAeq,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.”

In the case of the proposed development, based on guidance outlined in BS8233:2014, a design goal of 55 dB LAeq,16hr, or the lowest practicable level, is deemed to be appropriate for external amenity areas.

7.2.3.5. Operation Vibration

Given the proposed usage of the development it is not expected that any vibration emissions will occur during the operational phase. Additionally, there is no vibration impact expected on proposed development itself.

7.2.3.6. Vehicular Traffic

In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 7.5 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2011).

Table 7.5 - Likely Impact Associated with Change in Traffic Noise Level

| Change in Sound Level (dB LA10) | Subjective Reaction | Magnitude of Impact |
|------------------------------------|---------------------|---------------------|
|------------------------------------|---------------------|---------------------|

| | | |
|-----------|--------------------------------|------------|
| 0 | Inaudible | No Change |
| 0.1 – 2.9 | Barely Perceptible | Negligible |
| 3 – 4.9 | Perceptible | Minor |
| 5 – 9.9 | Up to a doubling of loudness | Moderate |
| 10+ | Doubling of loudness and above | Major |

Table 7.6 presents the likely impacts associated with change in traffic noise level from DMRB (2011). The corresponding significance of impact presented in the ‘EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017’ is also presented in Table 7.6 for consistency in wording and terminology for the assessment of impact significance.

Table 7.6 - Likely Impact Associated with Change in Traffic Noise Level

| Change in Sound Level DMRB, 2011 (dB LA10) | Subjective Reaction DMRB, 2011 | Impact Guidelines for Noise Impact Assessment Significance (Institute of Acoustics) | Impact Guidelines on the Information to be contained in the EAIR (EPA) |
|--|--------------------------------|---|--|
| 0 | Inaudible | None | Imperceptible |
| 0.1 – 2.9 | Barely Perceptible | Minor | Not Significant |
| 3 – 4.9 | Perceptible | Moderate | Slight, Moderate |
| 5 – 9.9 | Up to a doubling of loudness | Substantial | Significant |
| 10+ | Doubling of loudness and above | Major | Very Significant, Profound |

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

7.3. Receiving Environment

7.3.1. Baseline Study

A baseline noise survey was undertaken within the bounds of the Site to characterise the noise environment at the boundaries and across the Site to inform any constraints for new developments within the Site. The boundary locations were also representative of the closest existing noise sensitive properties which have the potential to be impacted by development within the Site.

7.3.2. Monitoring Locations

Noise monitoring was undertaken at four locations. These are described below and indicated on Figure 7.1.

Location UN1 - This monitoring location was positioned along the northern Site boundary within close proximity to the existing dwellings. An unattended noise survey was set up at this location to capture noise levels over day and night-time periods.

Locations AN1 to AN3 - Attended noise measurements were undertaken at these positions to determine the spread of noise levels across the Site, and in particular at each Site boundary where noise levels are anticipated to be of the highest magnitude.



Figure 7.1 - Monitoring Locations

The unattended noise monitoring equipment was set to log continuously over 15-minute intervals between 10:15 on 16th July 2018 to 10:45 on 18th July 2018. The monitoring equipment used was a RION NL-52 sound level meter.

Attended surveys were undertaken at locations AN1 to AN3 between 10:15 and 14:00hrs on 16th July 2018. The monitoring was undertaken using a Brüel and Kjaer 2250 Light sound level meter.

7.3.3. Survey Parameters

The following noise parameters are reported for the purpose of this study:

$L_{Aeq,T}$ - 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).

L_{AFmax} - The maximum RMS A-weighted sound pressure level occurring within a specified time period. Measured using the "Fast" time weighting.

L_{AF10} - Refers to those A-weighted noise levels in the top 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is used to determine the intermittent high noise level features of locally generated noise and usually gives an indicator of the level of road traffic. Measured using the "Fast" time weighting.

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

7.3.4. Survey Results

7.3.4.1. Location UN1

Survey results at monitoring location UN1 are summarised in Table 7.7 below for the daytime (07:00 – to 22:00 hrs) and night (23:00 – 07:00 hrs)

Table 7.7 - Summary of Measured Noise Levels for Location UN1

| Date | Period | dB LAeq,T | | dB LAFmax | | dB LAF10 | | dB LAF90 | |
|------------|--------------|-----------|---------|-----------|---------|----------|---------|----------|---------|
| | | Average | Range | Average | Range | Average | Range | Average | Range |
| 16/07/2018 | Day (16 hr) | 38 | 30 - 47 | 53 | 42 - 65 | 38 | 32 - 48 | 33 | 28 - 38 |
| | Night (8 hr) | 33 | 26 - 40 | 45 | 38 - 65 | 33 | 28 - 39 | 28 | 24 - 33 |
| 17/07/2018 | Day (16 hr) | 38 | 26 - 46 | 52 | 36 - 66 | 38 | 29 - 51 | 31 | 21 - 37 |
| | Night (8 hr) | 34 | 23 - 44 | 49 | 31 - 69 | 32 | 25 - 43 | 26 | 19 - 36 |

Figure 7.2 provides a summary of the night-time LAFmax dB noise levels measured at location UN1.

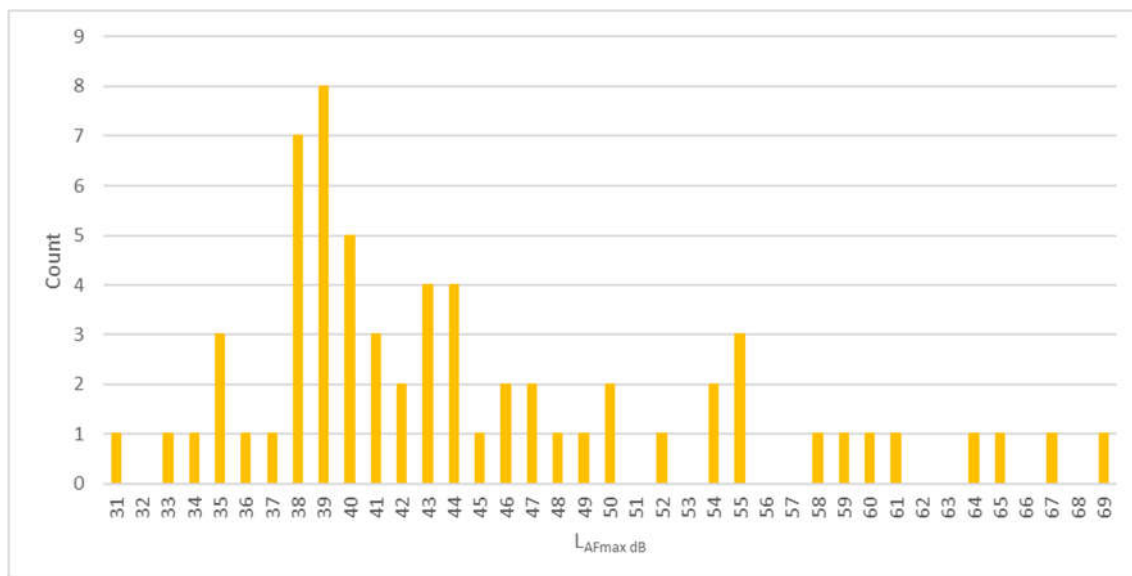


Figure 7.2 - Summary of night-time LAFmax noise levels at Location UN1

7.3.4.2. Location AN1

Survey results at monitoring location AN1 are summarised in Table 7.8 below.

Table 7.8 - Measured Noise Levels for Location AN1

| Time | dB LAeq,T | dB LAFmax | dB LAF10 | dB LAF90 |
|---------------|-----------|-----------|----------|----------|
| 10:27 – 10:44 | 34 | 60 | 35 | 31 |

| | | | | |
|---------------|----|----|----|----|
| 11:46 – 12:01 | 41 | 66 | 43 | 36 |
| 13:02 – 13:17 | 39 | 66 | 40 | 35 |

During the survey the main contributors to the noise environment at this location were noted to be plant noise, distant traffic noise, bird song, foliage rustling and golf players on the golf course.

7.3.4.3. Location AN2

Survey results at monitoring location AN2 are summarised in Table 7.9 below.

Table 7.9 - Measured Noise Levels for Location AN2

| Time | dB LAeq,T | dB LAFmax | dB LAF10 | dB LAF90 |
|---------------|-----------|-----------|----------|----------|
| 10:50 – 11:05 | 37 | 68 | 36 | 33 |
| 12:14 – 12:29 | 41 | 60 | 42 | 38 |
| 13:25 – 13:40 | 35 | 58 | 36 | 31 |

During the survey the main contributors to the noise environment at this location were noted to be distant construction noise, foliage rustling and distant traffic noise.

7.3.4.4. Location AN3

Survey results at monitoring location AN3 are summarised in Table 7.10 below.

Table 7.10 - Measured Noise Levels for Location AN3

| Time | dB LAeq,T | dB LAFmax | dB LAF10 | dB LAF90 |
|---------------|-----------|-----------|----------|----------|
| 11:17 – 11:32 | 36 | 53 | 38 | 35 |
| 12:37 – 12:52 | 43 | 56 | 45 | 39 |
| 13:47 – 14:02 | 36 | 56 | 38 | 33 |

During the survey the main contributors to the noise environment at this location were noted to be distant construction noise, foliage rustling and distant traffic noise.

7.3.5. Summary of Baseline Environment

Overall the noise environment measured at the development Site is low and typical of a semi-rural location set back from heavily trafficked roads and urban sources, this was despite the fact that construction noise was audible during the survey.

Daytime noise levels ranged from 34 – 47 dB LAeq. Night-time noise levels ranged from 23 – 44 dB LAeq and night-time maxima levels were found to not typically exceed 55 dB LAFmax.

7.4. Potential Noise Impacts during Construction phase

7.4.1. Construction Impacts

7.4.1.1. Noise

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

During the construction phase, it is anticipated that there will be a number of HGV's to/from Site. Excavators will be employed to move existing ground and then standard construction tools and methods will be employed for general construction and landscaping.

It is possible to predict indicative noise levels using guidance set out in BS 5228-1:2009+A1:2014 for the main phases of the proposed construction works. Table 7.11 summarises the construction noise prediction calculations at the nearest residences (i.e. nominal 20m and 50m distances). The predictions assume a 66% on-time for all items of plant (i.e. the items of plant are operational for 8 of the 12 hour period) and 5 dB attenuation due to partial screening of plant from the receptors.

Table 7.11 - Indicative Construction Noise Levels at Nearest Noise Sensitive Locations

| Construction Phase | Item of Plant (BS 5228-1:2009+A1:2014 Ref) | BS5228 Reference Noise Level dB LAeq at 10m | Predicted at Receiver (20m distance) dB LAeq | Predicted at Receiver (50m distance) dB LAeq |
|-----------------------------------|--|--|---|---|
| Site Clearance/ Groundworks | Tracked excavator (C2.21) | 71 | 58 | 50 |
| | Dump Truck (C2.30) | 79 | 66 | 58 |
| | Telescopic Handler (C4.54) | 79 | 66 | 58 |
| | Tracked Mobile Crane (C4.50) | 71 | 58 | 50 |
| | Diesel Generator (C4.76) | 61 | 48 | 40 |
| | Total Site Clearance | | | 70 |
| General Construction | Dump Truck (D2.30) | 79 | 66 | 58 |
| | Tracked excavator (D2.21) | 71 | 58 | 50 |
| | Compressor (D7.08) | 70 | 57 | 49 |
| | Telescopic Handler (D4.54) | 79 | 66 | 58 |
| | Hand Held Circular Saw (D4.72) | 79 | 66 | 58 |
| | Diesel Generator (D4.76) | 61 | 48 | 40 |
| | Internal Fit out | 70 | 57 | 49 |
| Total General Construction | | | 72 | 64 |
| Landscaping and Road | Asphalt Paver & Tipping Lorry (D5.30) | 75 | 62 | 54 |
| | Electric Water Pump (D5.40) | 68 | 55 | 47 |
| | Vibratory Roller (D5.20) | 75 | 62 | 54 |
| | Total Landscaping and Road Works | | 66 | 58 |

The predicted noise levels detailed in the above table indicate that at the closest distances to the receptors noise levels have the potential to exceed the thresholds previously outlined in Construction Assessment Criteria section of this Chapter. For distances of 50 m or greater from the receptors construction activities can operate within the thresholds.

It is important to note that the calculations set out above are based on assumed Site activity and a combination of plant items operating simultaneously. Construction noise and vibration mitigation measures will be employed during the construction phase with a view to minimising noise impacts.

7.4.1.2. Vibration

Due to the distances involved between the receptor locations and the proposed construction works no vibration impacts are expected.

7.5. Potential Noise Impacts during Operational Phase

7.5.1. Description of Operational Impacts

The main sources of noise for both potential inward and outward impacts will be as a result of traffic.

7.5.2. Inward Noise Impact

The specific baseline noise monitoring locations were selected to measure noise levels across the boundaries of the proposed development Site. As such the noise levels measured at these positions are considered to represent the higher values that may be experienced at any location across the Site (i.e. noise levels are expected to be slightly lower in the more sheltered middle sections of the Site). Figure 7.3 indicates the approximate baseline noise monitoring locations when superimposed on the proposed development plan (albeit draft).

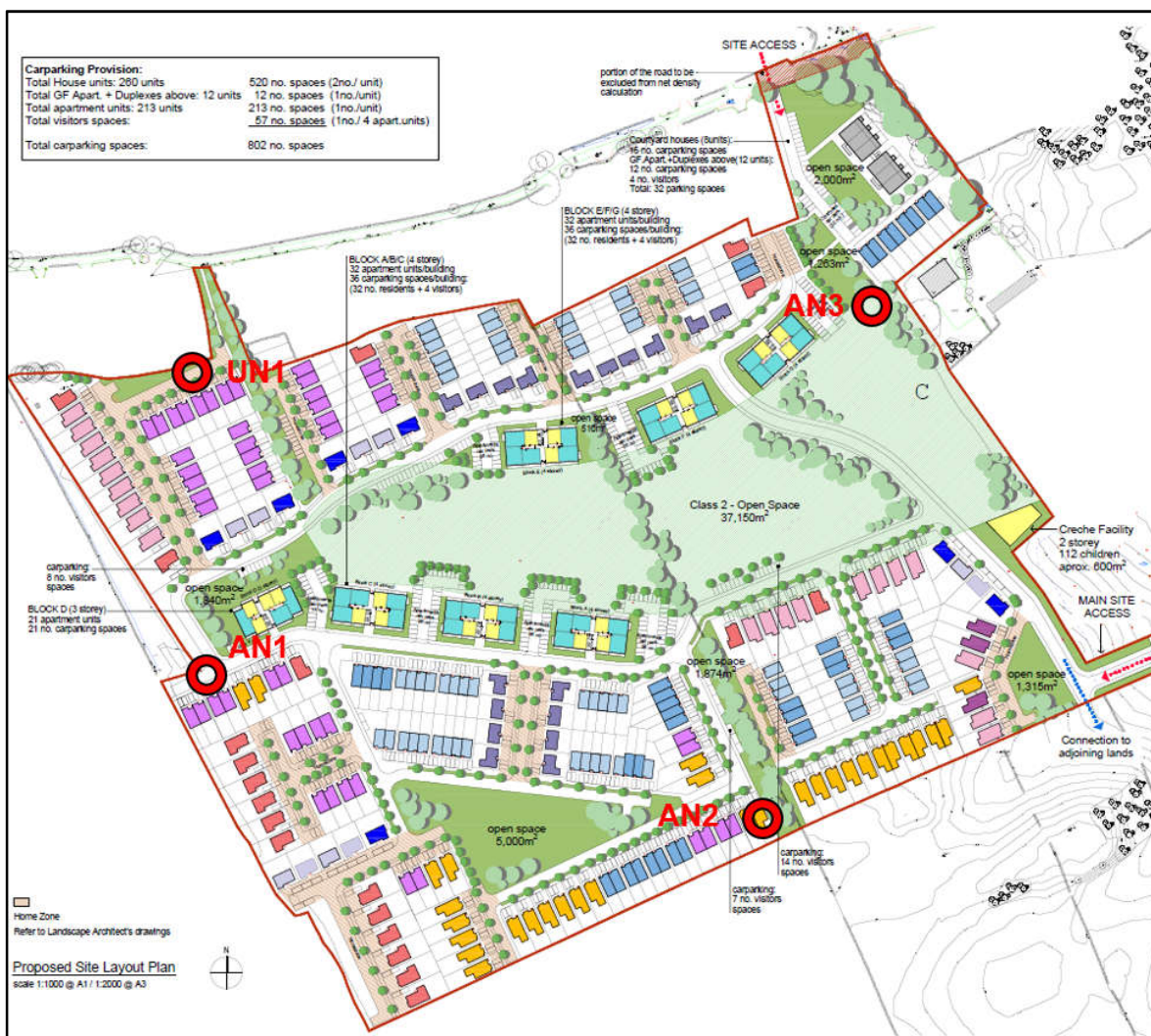


Figure 7.3 - Noise Monitoring Locations

Analysis of the measured data indicates daytime noise levels ranged from 34 – 47 dB LAeq. Night-time noise levels ranged from 23 – 44 dB LAeq and night-time maxima levels were found to not typically exceed 55 dB LAfmax.

All noise levels measured around the proposed development Site were lower than the desired external noise thresholds defined in the Operational Assessment Criteria section indicating that the

internal noise criteria of ≤ 35 dB $L_{Aeq, 16 \text{ hrs}}$ and ≤ 30 dB $L_{Aeq, 8 \text{ hrs}}$ will be met with the attenuation provided by a partially open window.

In addition to this, the measured noise levels indicate that the criteria for external amenity areas will be comfortably achieved.

Consequently, it can be concluded that standard construction materials will be sufficient for provision of attenuation to the external noise levels and that no particular noise mitigation measures are required for the proposed development.

7.5.3. Outward Noise Impact

An assessment of noise due to traffic from the proposed development has been undertaken to determine the impact, if any, of increased traffic on nearby and adjacent roads. Annual average daily data has been used to assess three separate years (i.e. 2020, 2025 and 2035). Table 7.12 presents the results of the assessment and Figure 7.4 identifies the particular areas that have been assessed.

Table 7.12 - Summary of Assessment of Change in Noise Level due to Increased Traffic

| Year | AA DT Development | no | AA DT Development | with | Difference (dB) |
|--------|----------------------|----|----------------------|------|-----------------|
| Site 1 | | | | | |
| 2020 | 7997 | | 9654 | | +0.8 |
| 2025 | 8643 | | 10121 | | 0.7 |
| 2035 | 9074 | | 10731 | | 0.7 |
| Site 2 | | | | | |
| 2020 | 7787 | | 8251 | | +0.3 |
| 2025 | 8241 | | 8705 | | +0.2 |
| 2035 | 8836 | | 9299 | | +0.2 |
| Site 3 | | | | | |
| 2020 | 113 | | 207 | | +2.6 |
| 2025 | 119 | | 213 | | +2.5 |
| 2035 | 128 | | 222 | | +2.4 |
| Site 4 | | | | | |
| 2020 | 9070 | | 9817 | | +0.3 |
| 2025 | 9599 | | 10346 | | +0.3 |
| 2035 | 10292 | | 11040 | | +0.3 |
| Site 5 | | | | | |
| 2020 | 2441 | | 3359 | | +1.4 |
| 2025 | 2583 | | 3502 | | +1.3 |

| | | | |
|--------|-------|-------|------|
| 2035 | 2770 | 3668 | +1.2 |
| Site 6 | | | |
| 2020 | 16233 | 16666 | +0.1 |
| 2025 | 17421 | 17421 | +0.0 |
| 2035 | 18421 | 18854 | +0.1 |

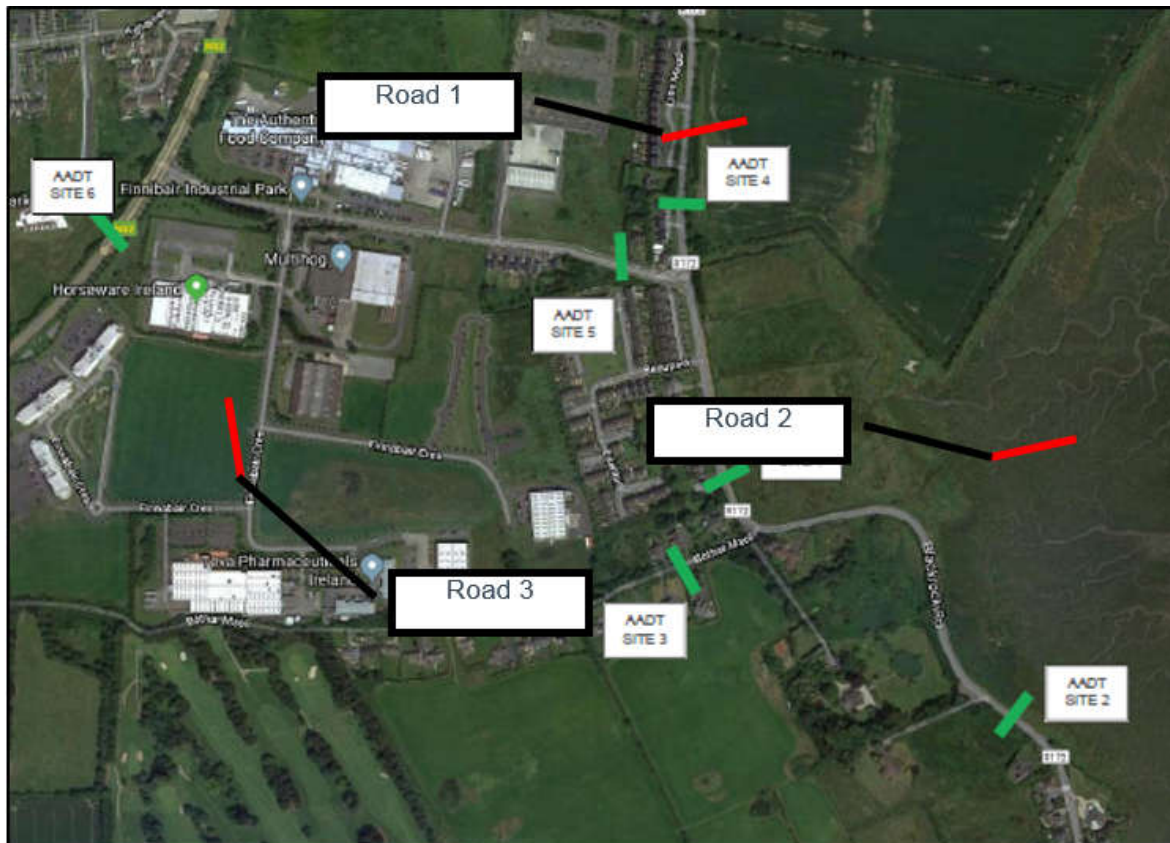


Figure 7.4 - Assessed Roads

Referring to the criteria defined in the Operational Assessment Criteria section of this Chapter, the calculated change in noise levels is *barely perceptible* for all assessed roads, with associated impacts *not significant*.

7.6. Cumulative Impacts

There are no known cumulative impacts as a result of this development.

7.7. Mitigation Measures

7.7.1. Construction phase Mitigation

With regard to construction activities, best practice control measures for noise and vibration from construction Sites are found within BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Whilst construction noise and vibration impacts are expected to be within the criteria set out in this document for the majority of the time, the contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant.

In this regard, various mitigation measures can be considered and applied during the construction of the proposed development, such as:

- Use of a standard Site hoarding, typically 2.4m height will be erected around the perimeter of the construction Site for the duration of works;
- Limiting the hours during which Site activities likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Maintaining Site access roads even so as to mitigate the potential for vibration from lorries;
- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of barriers as necessary around items such as generators or high duty compressors;
- Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary
- Establishing channels of communication between the contractor/developer, Local Authority and residents, and;
- Appointing a Site representative responsible for matters relating to noise and vibration.

7.7.2. Operational Phase Mitigation

There are no noise mitigation measures required for the operational phase.

7.8. Residual Impacts

7.8.1. Construction Noise Impacts

Some construction activities are predicted to exceed the noise threshold for potential significant impact when they occur at the closest proximity to the dwellings located on the North boundary. However, it should be noted that the assessment can be considered worst case and it is unlikely that all items of plant assessed will be in operation simultaneously. Additionally, the predictions only indicate a potential significant impact (based on a worst case scenario) when working at the closest location to the dwellings, with lesser impacts predicted at all other locations across the Site.

Construction noise and vibration mitigation measures will be employed during the construction phase with a view to minimising noise impacts.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|-------------------------|-----------------|
| Negative | Potentially Significant | Temporary |

7.8.2. Construction Vibration Impacts

Due to the distances involved between construction activities and local receptors it is considered that vibration will not cause a significant impact.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|---------------------|-----------------|
| Negative | Not Significant | Temporary |

7.8.3. Operational Noise Impacts

7.8.3.1. Inward Noise

In terms of inward noise impacts the assessment shows that no particular noise mitigation measures are required, and that the criteria for internal and external noise levels will be met comfortably.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|---------------------|-----------------|
| Neutral | Not Significant | Permanent |

7.8.3.2. Outward Noise

Predictions for outward noise impacts in terms of the increased traffic as a result of the proposed dwellings, indicate that any changes in noise levels will be imperceptible.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|---------------------|-----------------|
| Neutral | Not Significant | Permanent |

7.8.3.3. Inward Vibration

For inward vibration impacts the assessment shows that no vibration is expected to impact on the proposed dwellings.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|---------------------|-----------------|
| Neutral | Imperceptible | Permanent |

7.8.3.4. Outward Vibration

There are no outward vibration impacts expected as a result of this development.

| <i>Quality</i> | <i>Significance</i> | <i>Duration</i> |
|----------------|---------------------|-----------------|
| Neutral | Imperceptible | Permanent |

7.8.4. Noise and Human Health

The construction phase is short term and therefore any elevated levels of noise to off-Site receptors will be temporary and, as a result, are not expected to pose any risk to human health.

In terms of the noise exposure of construction workers and potential hearing damage that may be caused due to exposure to high levels of noise, the Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) provides guidance in terms of allowable workplace noise exposure levels for employees. The Regulations specify two noise Action Levels at which the employer is legally obliged to reduce the risk of exposure to noise. The appointed contractor will be required to comply with the Regulations and provide appropriate noise exposure mitigation measures where necessary. The noise exposure level to off-Site receptors during the construction phase will be below the lower Action Level and therefore the risk of noise exposure resulting in potential hearing damage to off-Site receptors is minimal.

No significant noise impacts are expected from the operational phase of the proposed development. As such, there is no anticipated risk of long term exposure to noise on human health resulting from the proposed development.

7.9. Monitoring Requirements

7.9.1. Construction phase

It is good practice for the appointed contractor to monitor levels of noise and vibration during critical construction periods at nearby sensitive locations and/or development Site boundaries.

7.9.2. Operational Phase

No additional monitoring is proposed for the operational phase of the proposed development and no noise mitigation measures are required for the operational phase.