Chapter 10:

Noise and Vibration

10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

AWN Consulting Ltd. has been commissioned to carry out a noise and vibration impact scoping assessment of the proposed SHD development at Golf Lane, Carrickmines, Dublin. This assessment has been prepared by Alistair Maclaurin BSc PgDip MIOA, Senior Consultant at AWN Consulting who has over 7 years' experience as an acoustic consultant.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the subject site, an assessment of the potential noise and vibration impact associated with the proposed development during both the short-term construction phase and the long term operational phase on its surrounding environment.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated in an environmentally sustainable manner in order to ensure its minimal impact on the receiving noise climate.

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this chapter and included in the references section. In addition to specific noise guidance documents, the following guidelines were considered and consulted for the purposes of this chapter:

- European Commission, Guidance on the preparation of the Environmental Impact Assessment Report (2017)
- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports Draft (August 2017)

10.2 STUDY METHODOLOGY

The following methodology has been prepared based on the requirements of the above guidance documents and on our experience of preparing the noise & vibration chapters for similar developments. The following approach has been used for this assessment:

- Baseline noise monitoring has been undertaken at the development site in order to characterise the existing noise environment;
- A review of the most applicable standards and guidelines has been reviewed in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations relating to construction phase impacts has been undertaken at the nearest sensitive locations to the development site;
- Potential inward noise impacts to the proposed development during the operational phase have been assessed;
- Potential noise impacts associated with the operational phase of the development at the most sensitive locations surrounding the proposed development have been determined and assessed, and;
- A schedule of mitigation measures has been included to reduce, where necessary, identified potential outward impacts relating to noise and vibration from the proposed development.

10.2.1 Construction Phase - Noise

BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2

There is no published statutory Irish guidance relating to the maximum permissible noise and vibration levels that may be generated during the construction phase of a project. It is common practice to use *BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2* with respect to the controlling noise and vibration impacts. In this instance, appropriate criteria relating to permissible construction noise levels are taken from Part One of the standard Noise.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting 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. Note that, in accordance with the BS5228 guidance, this assessment criterion is only applicable to residential receptors.

The closest neighbouring noise sensitive properties to the proposed development are the residential dwellings that bound the south and west of the site. The closest is located approximately 20m from the development site.

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 10.1 sets out the values which, when exceeded, signify a potential significant effect at the facades of residential receptors.

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

Table10.1: Example Threshold of Potential Significant Effect at Dwellings

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

Transport Infrastructure Ireland

Overall acceptable levels of construction noise for large construction projects are set out in the Transport Infrastructure Ireland (TII) publication Guidelines for the Treatment of Noise and Vibration in National Road Schemes . The levels should not be exceeded at noise sensitive locations during the construction phase of the development. Table 10.2 sets out these levels.

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

Table 10.2: Example Threshold of Potential Significant Effect at Dwellings

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

Taking the above into account it is considered appropriate to adopt a construction noise limit of 70 dB $L_{Aeq,1hr}$ Monday to Friday 07:00 to 19:00hr and 65 dB $L_{Aeq,1hr}$ Saturday 08:00 to 16:30hr.

Figure 10.1 identifies the closest noise sensitive receptors to the proposed development.

Figure 10.1: Identified Noise Sensitive Receptors

10.2.2 Construction Phase - Vibration

In terms of vibration, British Standard *BS 5228-2:2009+A1:2014 Part 2: Vibration* recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this lower value. Taking the above into consideration the vibration criteria in Table 10.3 are recommended.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15Hz	15 to 40Hz	40Hz and above
12 mm/s	20 mm/s	50 mm/s

Table 10.3: Vibration Thresholds during Construction

10.2.3 Operational Phase – Additional Vehicular Activity on Public Roads

In order to consider the potential noise impact associated with the proposed development introducing additional traffic onto the existing road networks, and given that vehicle movements on public roads are assessed using a different parameter (the ten percentile noise level; L_{A10}), it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development in terms of the L_{A10} parameter.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 10.4 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2019).

Long Term Magnitude	**DMRB Magnitude of Impact Long Term Noise Change (dB $L_{A10,18hr}$ or L_{night})**
Greater than or equal to 10.0	Major
5.0 to 9.9	Moderate
3.0 to 4.9	Minor
Less than 3.0	Negligible

Table 10.4 Likely Impact Associated with Change in Traffic Noise Level

10.2.3 Operational Phase – Mechanical Plant and Services

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

The most appropriate standard used to set operational noise limits relating to fixed item of plant to noise sensitive areas is *BS 4142: 2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound*. This standard describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

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

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

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

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

If the rated plant noise level is +10dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context. The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

10.2.3 Operational Phase – Inward Noise Assessment

Dún Laoghaire Rathdown Noise Action Plan (NAP)

The Dún Laoghaire Rathdown Noise Action Plan (NAP) 2018 – 2023 that guidance within the *ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise* document should be referred to for inward noise impact assessments:

> *"In the scenario where new residential development or other noise sensitive development is proposed in an area with an existing climate of environmental noise, there is currently no clear national guidance on appropriate noise exposure levels. The EPA has suggested that in the interim that Action Planning Authorities should examine the planning policy guidance notes issued in England titled, 'ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise'. This has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England."*

In accordance with this NAP policy, this criterion has been adopted for this assessment.

Professional Guidance on Planning & Noise (ProPG)

The *Professional Guidance on Planning & Noise* (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since it's adoption it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

The ProPG outlines a systematic risk based 2 stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows:

- Stage 1 - Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and,
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:
    - Element 1 - Good Acoustic Design Process;
    - Element 2 - Noise Level Guidelines;
    - Element 3 - External Amenity Area Noise Assessment
    - Element 4 - Other Relevant Issues

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 10.2 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

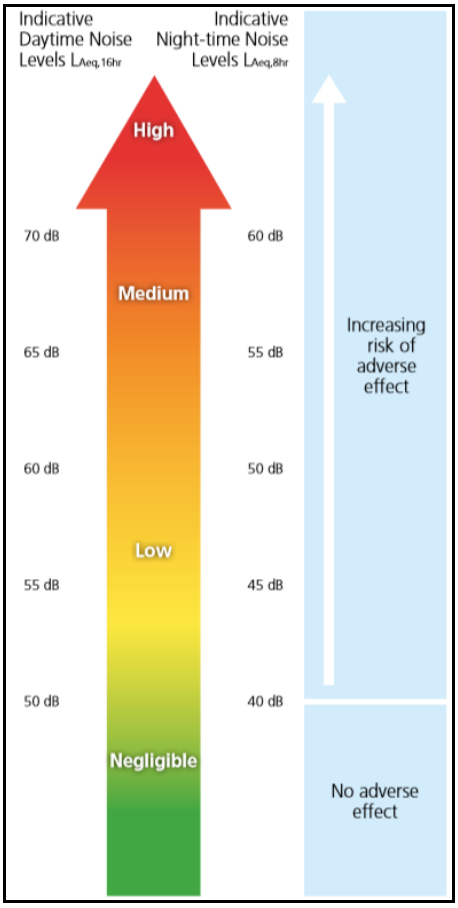

Figure 10.2: ProPG Stage 1 - Initial Noise Risk Assessment

It should be noted that a site should not be considered a negligible risk if more than 10 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.

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 10.5 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

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 $L_{Aeq, 8hr}$ 45 dB L_{AFmax}

Table 10.5: ProPG Internal Noise Levels

*Note - The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded no more than 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 noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

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

10.3 THE EXISTING RECEIVING ENVIRONMENT

An environmental noise survey was conducted at the development site as part of the assessment. The noise survey was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with *ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.* Specific details are set out below.

10.3.1 Choice of Measurement Locations

One measurement location was selected and is shown on Figure 10.3.

Location 1 is located on the site of the proposed development and is exposed to noise from the M50 and surrounding roads.

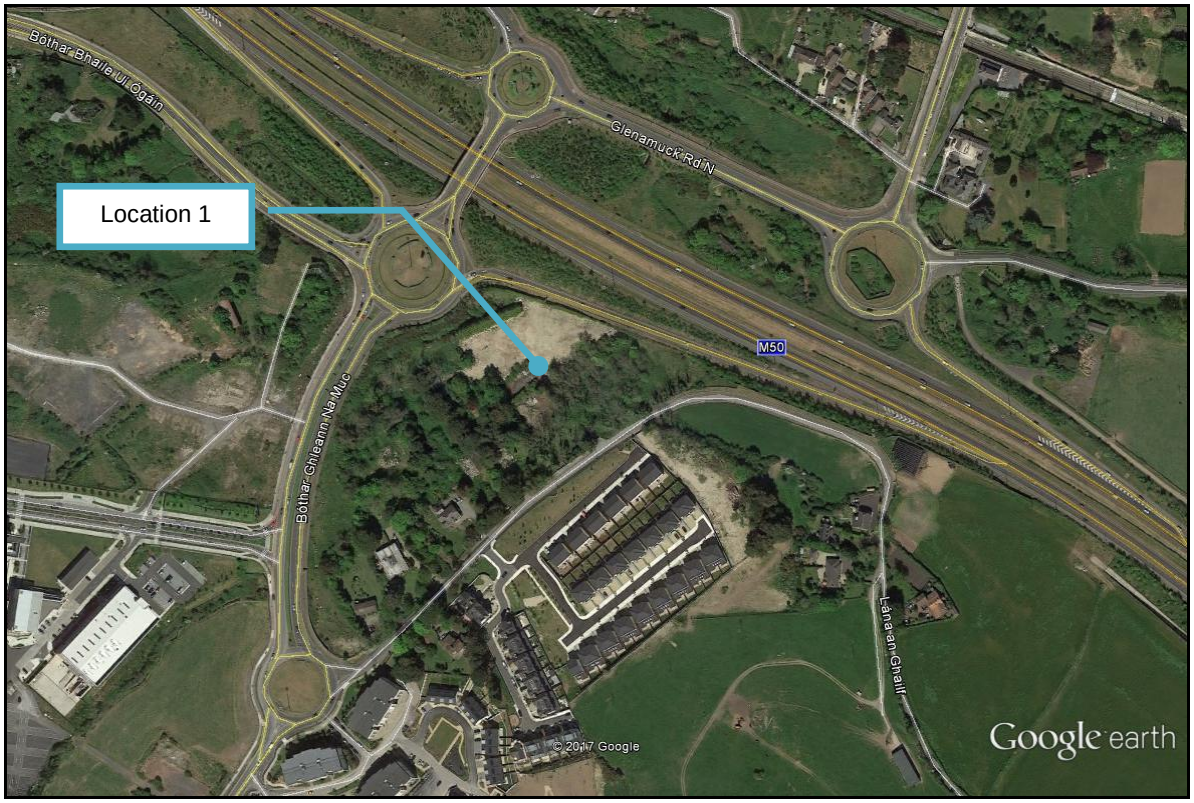

Figure 10.3 Noise Survey Location

10.3.2 Survey Periods

Unattended noise measurements were conducted at Location 1 over the course of the following survey period:

- 15:00hrs on 12 June to 10:00hrs on 14 June 2017.

The weather during the survey periods were dry and calm.

10.3.3 Instrumentation

The unattended noise measurements were performed using a Brüel & Kjær Type 2250 Precision Sound Level Analyser.

Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

10.3.4 Procedure

Unattended noise measurements were conducted at Location 1 continuously with the microphone at a height of 4m above ground level. The results were saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up during setup and collection. Sample periods for the unattended noise measurements were 15 minutes.

10.3.5 Measurement Parameters

The noise survey results are presented in terms of the following parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

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

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

10.3.6 Results

Table 10.6 below presents the noise survey data recorded at Location 1.

Date	Period	Measured Noise Levels (dB re. 2x10-5 Pa)			
		L_{Aeq}	L_{AFmax} (range)	L_{AF10}	L_{AF90}
12/06/17	DAY	60	60 – 74	60	57
	NIGHT	52	57 – 68	53	43
13/06/17	DAY	58	59 – 80	59	56
	NIGHT	52	54 – 65	52	43
14/06/17	DAY	59	62 - 76	60	57

Table 10.6: Noise Survey Results at Location 1

Noise levels at the site ranged from 52 to 62 dB $L_{Aeq,15min}$ with an average value of 59 dB $L_{Aeq,15min}$ during the day. At night the noise levels ranged from 42 to 59 dB $L_{Aeq,15min}$ with an average value of 52 dB $L_{Aeq,15min}$. Background noise levels were an average of 56 dB L_{A90} during the day and 43 dB L_{A90} during the night. Night-time L_{AFmax} levels were in the range of 54 to 68 dB.

The noise climate was typically dominated by road traffic movements along the M50.

Whilst it is noted that the noise survey was undertaken in 2017, given the current circumstances surrounding COVID-19 it is expected that this baseline would be more accurate than any conducted in present times. Additionally, it takes a 25% increase in traffic to increase noise levels by 1 dB (which would be imperceptible), given that the M50 was the dominant source of noise it can be considered that the 2017 baseline measurements are still relevant today as traffic numbers have not increased by any level that would be perceptible through noise.

10.4 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

10.4.1 Construction Phase - Noise

It is noted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators.

The proposed general construction hours are 07:00 to 19:00hrs Monday to Friday and 09:00 to 13:00 on Saturdays.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise.

It is possible to predict typical noise levels using guidance set out in BS5228-1: 2009+A1: 2014. Table 10.7 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme at a standard reference distance of 10 metres from the various plant items as well as predicted activity noise levels at receptor locations, without considering mitigation.

Phase	Item of Plant (Ref. BS 5228-1:2009+A1:2014)	BS5228 Item Noise Level at 10 m distance dB $L_{Aeq,1hr}$	Predicted Construction Noise Level at 25 m distance (NSL1), dB $L_{Aeq,1hr}$	Predicted Construction Noise Level at 50 m distance (NSL2), dB $L_{Aeq,1hr}$
Site Preparation	Wheeled Loader Lorry (D3 1)	67	59	53
	Track Excavator (C2 22)	64	56	50
	Dozer (C2.13)	70	62	56
	Dump Truck (C4.2)	70	62	56
Site Preparation Total			**66**	**60**
Foundations	Tracked Excavator (C3.24)	74	58	52
	Breaker Mounted on Backhoe (C1.2)	92	76	70
	Concrete Pump (C3.25)	78	62	56
	Compressor (D7 6)	77	61	55
	Poker Vibrator (C4 33)	78	62	56
Foundations Total			**77**	**71**
General Construction	Hand tools	81	65	59
	Tower Crane (C4.48)	76	60	54
	Pneumatic Circular Saw (D7.79)	75	59	53
	Internal fit – out	70	54	48
General Construction Total			**67**	**61**
Landscaping	Dozer (C2.13)	78	62	56
	Dump Truck (C4.2)	78	62	56
	Surfacing (D8.25)	68	52	46
Landscaping Total			**65**	**59**

Table 10.7: Construction Noise Predictions

During the foundations activity it is predicted that a potentially significant impact may occur at the surrounding noise sensitive receptors (both NSL1 and NSL2).

For all other activities it is predicted that, when taking into consideration of the recommended mitigation measures, the noise levels from the construction works will not exceed the adopted 70 dB $L_{Aeq,1hr}$ threshold.

Note that the predicted noise levels referred to in this section are indicative only and are intended to demonstrate that it will be possible to comply with current best practice guidance. It should also be noted that the predicted noise levels are expected to occur for only short periods of time at a limited number of properties. Once consideration is given to the mitigation measures discussed in Section 10.7.1, construction noise levels will be lower than these levels for the majority of the time at the majority of properties in the vicinity of the proposed development.

10.4.2 Construction Phase - Vibration

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

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

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

The range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity likely required on the proposed site. The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings noted in Figure 10.3 are likely to be below the limits set out in Table 10.2 to avoid any cosmetic damage to buildings.

In terms of disturbance to building occupants, works undertaken within close proximity to the residential receptors on the site perimeter have the potential to emit perceptible vibration levels.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Tables 10.2 during all activities. Mitigation and management of these works are discussed in Section 10.7.1.

10.4.3 Operational Phase – Additional Vehicular Traffic on Public Roads

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development. Traffic flow data in terms of the AADT figures has been assessed and the calculated change in noise levels during these two periods are summarised in Table 10.8. Road link locations are presented in Figure 10.5.

The results of the predictions indicate that, prior to the implementation of mitigation measures, only route A will have an impact greater than negligible. The impact on this route is rated as Minor in the opening year of 2023. The impact is rated as a Major in 2038, however, the reason for the Major impact is that the proposed Glenamuck District Distributor Road is expected to open before 2038 which will decrease the amount of traffic for both the Do Nothing and the Do Something scenarios in 2038. As a result, there will be a larger difference in traffic flow noise between the Do Nothing and Do Something scenarios for that year, and subsequently a larger difference in noise level. Consequently, the DMRB assessment indicates a Major impact, however, the actual noise emissions from the road will be lower than in previous years for both scenarios due to a decrease in traffic overall. In these circumstances, the rated impact for Route A is considered to be negative, slight and permanent. The impact for all other routes, prior to the mitigation of implementation, is considered to be neutral, imperceptible and permanent.

Reference	Change in Noise Level (dB)	DMRB Impact
Year 2023		
A	3.7	Minor
B	0.5	Negligible
C	-	-
D	0.2	Negligible
E	0.1	Negligible
F	0.0	Negligible
G	0.2	Negligible
H	0.1	Negligible
I	0.1	Negligible
J	0.1	Negligible
K	0.1	Negligible
L	0.1	Negligible
M	0.1	Negligible
N	0.1	Negligible
O	0.0	Negligible
Year 2038		
A	5.5	Major
B	0.0	Negligible
C	0.1	Negligible
D	0.2	Negligible
E	0.1	Negligible
F	0.0	Negligible
G	0.2	Negligible
H	0.1	Negligible
I	0.1	Negligible
J	0.1	Negligible
K	0.1	Negligible
L	0.0	Negligible
M	0.1	Negligible
N	0.0	Negligible
O	0.0	Negligible

Table 10.8 : Calculated change in traffic noise levels for Do Something scenario for years 2023 and 2038

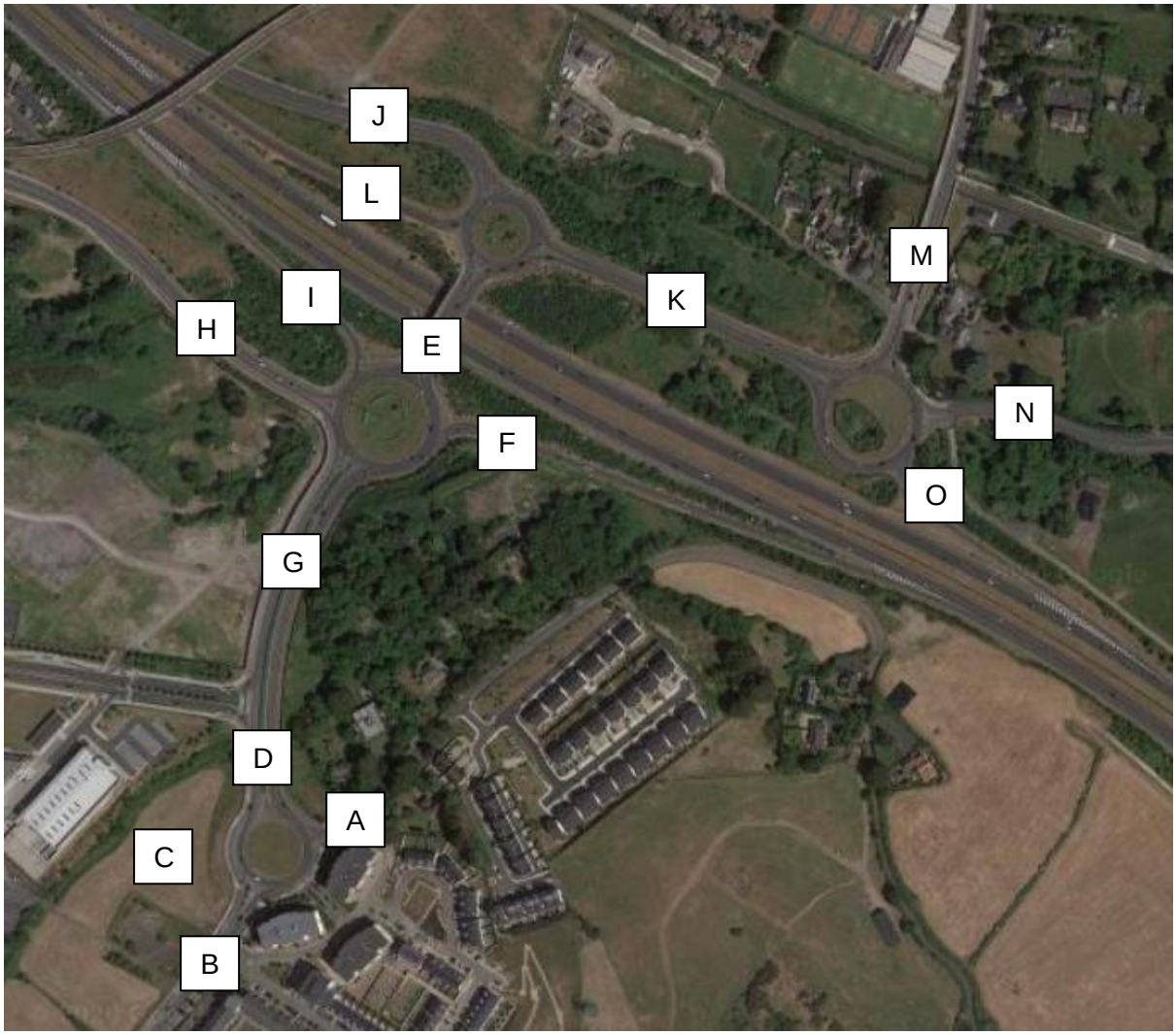

Figure 10.6: Route References

10.4.4 Operational Phase – Mechanical and Electrical Plant

Once operational, there will be building services plant items required to serve the development. These items of plant will be designed and located so that there is no negative impact on sensitive receivers within the development itself or on nearby sensitive receptors. The cumulative operational noise level from building services plant at the nearest noise sensitive locations external to the development will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods provided in Table 10.9 below. The criteria has been selected so that the noise from items of plant does not exceed background noise levels during the day and is 5 dB below background noise level during the more sensitive night period, and hence, as per BS4142 “this is an indication of the specific sound source having a low impact”.

Day, dB $L_{Aeq,1hr}$	Night, dB $L_{Aeq,15min}$
55	38

Table 10.9 : Proposed Noise Criteria for Plant Noise

10.4.5 OPERATIONAL PHASE - ProPG Stage 1 – Noise Risk Assessment

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 1 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."*

In this instance a 3D computer noise model of the development site has been developed to predict the noise levels across the entire site in order to investigate the initial noise risk. The noise model will use the measured noise levels during the survey, discussed in Section 10.3.6, to validate the model.

Model Validation

Noise levels recorded during the baseline noise survey were used to calibrate the noise model. It is considered that a strong correlation in respect of predicted noise levels has been achieved. Noise levels are calculated over daytime periods, (07:00 to 19:00 hrs) and night-time periods (23:00 to 07:00 hrs). Table 10.10 details the results of the noise model predictions and compares them to the measured values at the survey location. The results indicate that there is a good correlation between measured noise levels and the noise model.

Location	Period	Measured (dB L_{Aeq})	Predicted (dB L_{Aeq})
1	Daytime	59	61
	Night-time	52	54

Table 10.10 Noise Model Validation

Noise Model Output

To assess the initial noise risk assessment across the development site the noise model has been used to prepare noise contour maps for both daytime and night-time periods at 4m and 20m height above ground, this is to give an indication of expected noise levels at various levels of the development. These maps are presented in Figures 10.7 to 10.10.

***Figure 10.7*: L_{day} Noise Contours (4m above ground)**

Figure 10.8: L_{night} Noise Contours (4m above ground)

Figure 10.9: L_{day} Noise Contours (20m above ground)

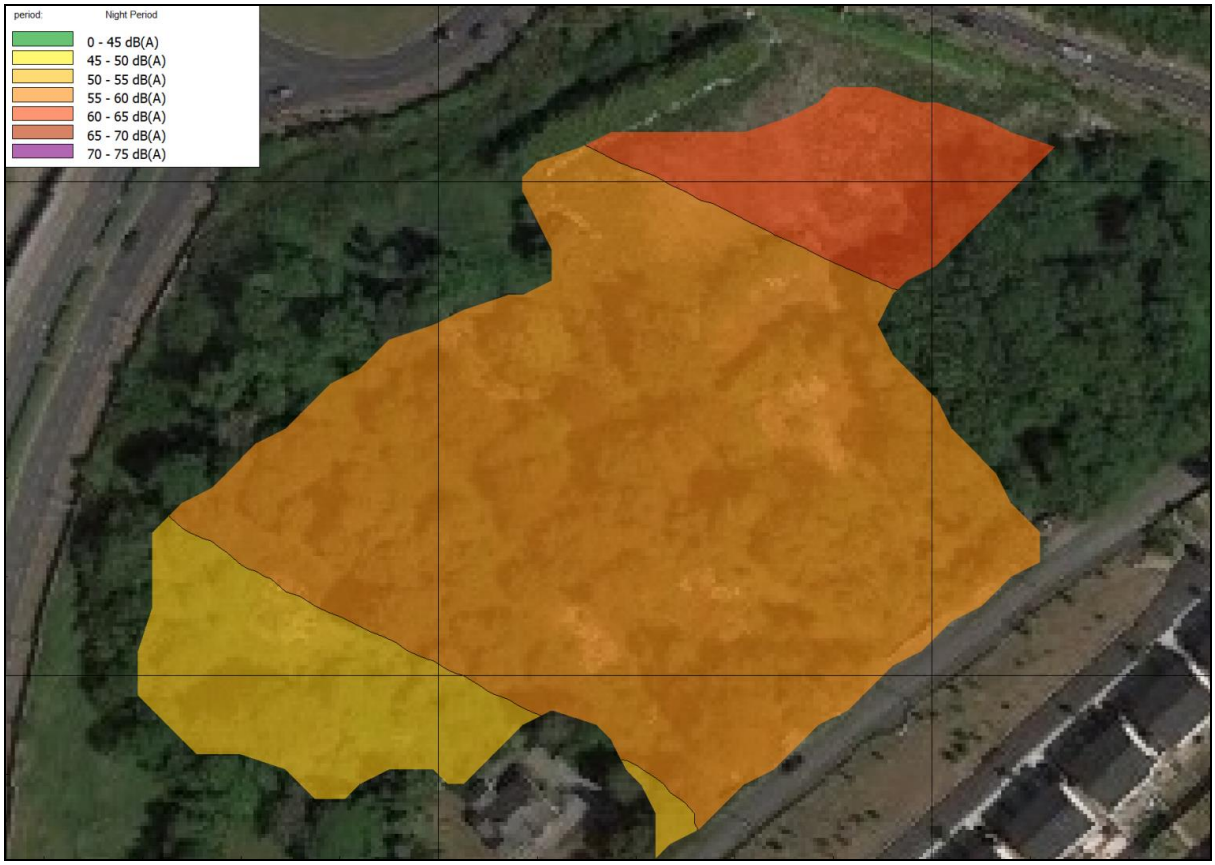

Figure 10.10: L_{night} 20m Noise Contours (20m above ground)

ProPG Stage 1 - Noise Risk Assessment Conclusion

Giving consideration to the measured and predicted noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site varies from medium to high noise risk.

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

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.*

Given the above it can be concluded that the development site may be categorised as Medium to High Risk and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used,

> *"2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."*

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or high-risk noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are 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.

Façade Noise Levels

Noise levels have been predicted across the site during day and night-time periods with the proposed buildings in place. It's noted that there is the future potential for the M50 to be widened with a 3rd lane added, to account for this a 50% uplift in traffic has been applied to the model – this accounts for an increase of 1 or 2 dB in noise levels.

Where façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night it is possible to achieve reasonable internal noise levels while also ventilating the dwellings with open windows. Therefore, for those properties where the façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night no further mitigation is required.

Where façade levels are above these levels the sound insulation performance of the building façade becomes important and a minimum sound insulation performance specification is required for windows and vents to ensure that the internal noise criteria are achieved.

Figure 10.11 identifies those facades where the noise levels are higher and where mitigation in the form of enhanced glazing and ventilation will be required. The specification of this enhanced façade is discussed in Section 10.7.3.

Figure 10.11: Facades Requiring Enhanced Acoustic Façade Specification

External Noise Levels

Balcony areas in Block B (the building that is closest to the M50) are enclosed and hence are predicted to meet the recommended external guideline noise levels of 55 dB $L_{Aeq,16hr}$. Other balcony areas facing into the development are all predicted to meet the external recommended noise levels. Where balconies are not enclosed along the north-western facades of blocks A1-A3 and the north-eastern façade of block D they are expected to exceed the recommended noise levels, however, the ProPG document allows for the impact of higher than desirable external noise levels to be offset through assessment of a hierarchy of measures including *"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" or *"a relatively quiet, protected, publicly 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)".* In this instance each block has a dedicated rooftop garden area which is predicted to meet the external noise thresholds. In addition, whilst external noise levels in areas closest to the M50 will experience higher than desirable noise levels, it can be seen in Figure 10.12 that external areas from Block A3 and further into the development will be within the recommended external noise thresholds, these areas are accessible to all residents. It is considered that the objective of achieving suitable external noise levels is achieved within the overall site

Figure 10.12: Predicted Noise Levels Across External Areas (1.5m above ground)

10.5 DO NOTHING IMPACT

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations and across the development site itself will remain largely unchanged. The noise levels measured/noted during the baseline studies are considered representative of the Do-Nothing scenario. The Do-Nothing scenario is therefore considered neutral impact.

10.6 REMEDIAL AND MITIGATION MEASURES

10.6.1 Construction Phase - Noise

N&V CONST 1: With regard to construction activities, best practice control measures from construction sites within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2 will be used to control noise and vibration impacts.

The implementation of all best practice noise and vibration control methods will ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during excavation and foundation construction which are likely to be the activities to have the highest potential noise and vibration impact.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in BS 5228-1:2009+A1 2014. Part 1 – Noise;
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise and vibration control measures will be employed. These will include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of good quality site hoarding to the site perimeters which will act as a noise barrier to general construction activity at ground level;
- Erection of barriers as necessary around items such as generators or high duty compressors, and;
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.
- Where practicable, localised screening should be used during breaking activities to obscure line of site to the closest sensitive receptors.

10.6.2 Operational Phase – Mechanical and Electrical Plant

N&V OPER 1: As part of the detailed design of the development, plant items with appropriate noise ratings and, where necessary, appropriately selected remedial measures (e.g. enclosures, silencers etc.) will be specified in order that the adopted plant noise criteria is achieved at the façades of noise sensitive properties, including those within the development itself.

10.6.3 Operational Phase – Inward Noise

N&V OPER 2: As is the case in most buildings, the glazed elements and ventilation paths of the building envelope are typically the weakest element from a sound insulation perspective. In general, all wall constructions (i.e. blockwork or concrete and spandrel elements) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the

wall construction will be minimal. It's also noted that the ventilation strategy will be for Mechanical Ventilation Heat Recovery units which are expected to provide strong sound insulation to external noise, hence ingress of noise through the ventilation systems is considered to be negligible for this assessment.

In this instance the facades highlighted in Figure 10.11 will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 10.11. Other facades in the development have no minimum requirement for sound insulation. Note that the calculations to determine these requirements have taken into account a potential increase in noise due to traffic along the facades facing directly onto the road.

Ref	SRI (dB) per Octave Band Centre Frequency (Hz)						dB R_w
	125	250	500	1k	2k	4k	
RED	29	30	37	44	44	44	41
BLUE	26	27	34	40	38	46	38
GREEN	23	23	30	39	36	43	35

Table 10.11: Sound Insulation Performance Requirements for Glazing, SRI (dB)

The overall Rw and Dn,e outlined above are provided for information purposes only. The over-riding requirements are the octave band sound insulation performance values which may also be achieved using alternative glazing and ventilation configurations. Any selected system will be required to provide the same or greater level of sound insulation performance as that set out in Tables 10.11 and 10.12.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing and ventilation systems. 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.

The assessment has demonstrated that the recommended internal noise criteria can be achieved through consideration of the proposed façade elements at the design stage. The calculated glazing and ventilation specifications are preliminary and are intended to form the basis for noise mitigation at the detailed design stage. Consequently, these may be subject to change as the project progresses.

10.7 PREDICTED RESIDUAL EFFECTS

10.7.1 Construction Noise

It is predicted that during the foundations activity when works take place at the closest distances to the receptors a significant impact will occur, hence when the foundation activity is on-going the impacts are predicted to be:

Quality	Significance	Duration
Negative	Significant	Temporary

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 operational simultaneously.

For all other construction activities the impact is predicted to be:

Quality	*Significance*	*Duration*
Negative	Moderate	Temporary

10.7.2 Construction Vibration

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Negative	Not Significant	Temporary

10.7.3 Additional Traffic on Roads

On Route A the impacts are predicted to be:

Quality	*Significance*	*Duration*
Negative	Slight	Permanent

All other routes are predicted to be:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Permanent

10.7.4 Operational Outward Noise Impact

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

10.7.5 Operational Inward Noise Impact

The impacts are predicted as follows:

Quality	*Significance*	*Duration*
Neutral	Not Significant	Permanent

10.8 CUMULATIVE EFFECTS

The closest developments with the potential to cause a cumulative effect are the development of Quadrant 3 at The Park, Carrickmines (planning ref. D18A/0257) and the Glenamuck District Roads Scheme (planning ref. PL06D.303945).

In terms of construction, given the layout of the nearby receptors in comparison with the proposed construction sites, it is expected that the Golf Lane development will dominate the noise levels and there is unlikely to be any significant cumulative effect given that The Park is approximately 100 m from the closest receptors.

Cumulative impacts have been incorporated into the traffic data supplied for the operational phase modelling predictions where such information was available. The results of the assessment show that there is a long-term, negative and slight impact to due to noise on dwellings located off Route A due to the operation of the Glenamuck District Roads Scheme.

10.9 MONITORING

There is a requirement to ensure that construction activities operate within the noise and vibration limits set out in the EIAR. There is also a requirement to undertake regular noise and vibration monitoring at locations representative of the closest sensitive locations to ensure the relevant criteria are not exceeded.

Noise monitoring shall be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

Vibration monitoring shall be conducted in accordance with BS 6472 for human disturbance and BS ISO 4866:2010 for building damage.

10.10 REINSTATEMENT

Not applicable to noise and vibration.

10.11 INTERACTIONS

In compiling this impact assessment, reference has been made to the project description provided by the project co-ordinators, project drawings provided by the project architects and traffic flow projections associated with the development provided by the traffic consultants. There is also an impact with Human Health, which has informed Chapter 3- Population and Human Health of this EIAR.

10.12 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered when compiling this assessment.

10.13 REFERENCES

British Standard BS 4142: 2014+A1:2019: Methods for Rating and Assessing Industrial and Commercial Sound

Design Manual for Roads & Bridges – Volume 11 Section 3.

British Standard BS 5228 (2009 +A1 2014): Code of Practice for Control of Noise and Vibration on Construction and Open Sites Part 1: Noise & Part 2: Vibration.

British Standard BS 7385 (1993): Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration.

Calculation of Road Traffic Noise, Department of Transport Welsh Office, HMSO, 1988.

ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

ISO 9613 (1996): Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.

EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002).

EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (EPA, 2003).

EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017).

EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

Professional Guidance on Planning & Noise (ProPG), (IoA, 2017).

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