CHAPTER 10

NOISE AND VIBRATION

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10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

10.1 This chapter of the EIAR has been prepared by AWN Consulting Limited (AWN) to assess the potential noise and vibration impact of the proposed residential development in support of a planning application. The assessment considers both the short-term construction phase and the long-term operational phase on the surrounding environment. The site is located to the north-west corner of the Omni Park Shopping Centre, Santry and at Santry Hall Industrial Estate, Dublin 9.

10.2 Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated with minimal impact on the receiving noise environment.

10.2 METHODOLOGY

10.3 The study has been undertaken using the following methodology:

- Environmental noise surveys have been conducted at various locations across the site to assess the existing baseline noise environment;
- A review of the most applicable standards and guidelines has been carried out in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed to determine the noise and vibration effect on the nearest sensitive locations during the construction phase;
- Predictive calculations have been performed to determine the noise effect on the nearest noise-sensitive locations during the operational phase;
- A schedule of mitigation measures has been proposed for both the construction and operational phases to reduce, where necessary, the outward noise and vibration from the development.

10.2.1 Construction Phase Assessment Criteria

10.2.1.1 Construction Noise

10.4 There is no Irish statutory guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local Authorities typically control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

The British Standard BS 5228-1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise is referenced here for the purposes of setting appropriate construction noise limits for the development. This document sets out a method whereby construction noise thresholds are determined based on ambient noise level. This method is summarised in

Table 10.1.

Table 10.1 Threshold of Potential Significant Effect at Dwellings

Assessment Category and Threshold Value Period	Threshold value (dB)		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

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.

D) 19:00–23:00 weekdays, 13:00–23:00 Saturdays and 07:00–23:00 Sundays.

10.5 Ambient noise levels should be rounded to the nearest 5 dB before being compared to Category A values. This determines the appropriate category. Construction noise limits are then set according to the category definitions above. This method is commonly referred to as the 'ABC' Method.

10.6 In relation to this, the Dublin City Council Document, *Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition*, states that:

10.7 *"The 'ABC' Method detailed in Paragraph E.3.2 of BS 5228-1:2009 shall be used to determine acceptable noise levels for day, evening and night time work."*

10.2.1.2 Construction Vibration

10.8 There are two aspects to the issue of vibration that are addressed in the standards and guidelines: the risk of cosmetic or structural damage to buildings; and human perception of vibration. The following standards are referenced here in relation to cosmetic or structural damage to buildings:

- British Standard BS 5228-2: 2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*;
- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings. Part 2: Guide to damage levels from ground borne vibration*.

10.9 In the case of this development, vibration levels used for the purposes of evaluating building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

10.10 BS 5228-2 and BS 7385 define the following thresholds for cosmetic damage to residential or light commercial buildings: PPV should be below 15 mm/s at 4 Hz to

avoid cosmetic damage. This increases to 20 mm/s at 15 Hz and to 50 mm/s at 40 Hz and above. At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded. This is summarised in Table 10.2 below.

Table 10.2 Transient vibration guide values for cosmetic damage

Type of building range of predominant pulse	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Values referred to are at the base of the building.

Note 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

10.11 Furthermore, BS 5228-2 and BS 7385 state that minor structural damage can occur at vibration magnitudes greater than twice those in Table 10.2 and major structural damage can occur at vibration magnitudes greater than four times those in Table 10.2.

10.12 BS 5228-2 also provides guidance relating to the human response to vibration. Guidance is again provided in terms of PPV in mm/s since this parameter is routinely measured when monitoring the structural effects of vibration. The potential human response at different vibration levels, as set out in BS 5228-2, is summarised in Table 10.3.

Table 10.3 Guidance on human response to vibration levels

Vibration level Note A) B) C) (mm/s)	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available.

C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

10.2.2 Operational Phase Assessment Criteria

10.2.2.1 Building Services Plant Noise

10.13 In the case that heating, cooling or other active process is carried out on site, there is the potential for additional plant noise to be introduced to the environment. To assess this, reference is made here to the British Standard BS 4142: 2014: *Methods for Rating and Assessing Industrial and Commercial Sound*. This standard can be used to assess the impact of a new continuous source to a residential environment and is used commonly by local authorities in their standard planning conditions and also in complaint investigations.

10.14 The method for assessing plant noise set out in BS 4142 is based on the following definitions:

"Specific noise level, $L_{Aeq,\ T}$"	is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.;
"Rating level, $L_{Ar,\ T}$"	is the specific noise level plus adjustments for the character features of the sound (if any);
"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;
"Background noise level, $L_{A90,\ T}$"	is the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T. This level is expressed using the L_{A90} parameter. These levels were measured as part of the baseline survey.

10.15 Adjustments to the rating level are appropriate where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention. In these cases, penalties are applied of either an additional 2 dB, 4 dB or 6 dB depending on how perceptible the tone is at the noise receptor.

10.16 The background level should then be subtracted from the rating level. The greater this difference, the greater the magnitude of the impact will be, in general. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, while a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

10.2.2.2 Deliveries and Waste Collection

10.17 In a residential development, such as the one under consideration, there is the potential for noise sources relating to deliveries and waste collection. Acceptable noise limits for these sources, both internally and externally, can be determined by referring to the British Standard BS 8233: 2014: *Guidance on Sound Insulation and Noise Reduction for Buildings*. The following guidance, summarised in Table 10.4, is provided in this standard for internal ambient noise levels in dwellings:

Table 10.4 Guidance on Indoor Ambient Noise Levels for Dwellings

Activity	Location	Daytime (07:00 to 23:00hrs)	Night (23:00 to 07:00hrs)	Derived External Levels
Resting	Living room	35 dB $L_{Aeq,\ 16hr}$	-	50 dB $L_{Aeq,\ 16hr}$
Dining	Dining room	40 dB $L_{Aeq,\ 16hr}$	-	55 dB $L_{Aeq,\ 16hr}$
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16hr}$	30 dB $L_{Aeq,\ 8hr}$	50 dB $L_{Aeq,\ 16hr}$ (45 dB $L_{Aeq,\ 8hr}$ at night)

10.18 The derived external levels are based on the approximate attenuation provided by a partially open window of 15 dB, as advised in BS 8233, and represent the appropriate noise level at the external façade of the building.

10.2.2.3 Additional Traffic on Surrounding Roads

10.19 Vehicular movement to and from the proposed development will make use of the existing road network. In order to assess the potential impact of additional traffic on the human perception of noise, the following two guidelines are referenced: Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (UK Highways Agency et al, 2020); and Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022). Table 10.5 relates changes in noise level to impact on human perception based on the guidance contained in these documents.

Table 10.5 Classification of magnitude of noise impacts in the long term

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Long-term)	EPA Significance of Effect
0	Inaudible	No impact	Imperceptible
0.1 – 2.9	Barely Perceptible	Negligible	Not significant
3 – 4.9	Perceptible	Minor	Slight, Moderate
5 – 9.9	Up to a doubling of loudness	Moderate	Significant
10+	Doubling of loudness and above	Major	Very significant

10.2.2.4 Operational Vibration

10.20 The development is largely residential in nature, therefore it is not anticipated that there will be any outward effect associated with vibration for the operational phase.

10.3 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

10.21 The site is located to the north west corner of the Omni Park Shopping Centre, Santry and at Santry Hall Industrial Estate. The proposed development comprises a mixed-use residential (457 apartments) and commercial development in four blocks, with childcare facility, community building and two retail/café/restaurant units.

10.22 The proposed development is described in further detail in Chapter 2 (Description of the Proposed Development).

10.4 RECEIVING ENVIRONMENT

10.23 Environmental noise surveys have been conducted at the site in order to quantify the existing noise environment. The surveys were conducted in general accordance with ISO 1996: 2017 *Acoustics – Description, measurement and assessment of environmental noise*.

10.4.1 Baseline Noise Survey Locations

10.24 The measurement locations were selected to represent the noise environment at noise-sensitive locations surrounding the proposed development. The selected locations are shown in Figure 10.1 and described as follows:

AT01 Attended survey location intended to capture the daytime noise environment at the properties to the west of the site.

AT02 Attended survey location intended to capture the daytime noise environment at the commercial premises to the south of the site.

AT03 Attended survey location intended to capture the daytime noise environment at the commercial premises to the east of the site.

UN01 Unattended survey location intended to capture the daytime and night-time noise environment at the properties to the west of the site and the commercial premises to the north of the site.

UN02 Unattended survey location intended to capture the daytime and night-time noise environment at the commercial premises to the south and east of the site.

Figure 10.1 Baseline noise survey locations

10.4.2 Survey Periods

10.25 Attended noise measurements were conducted between 11:30 and 14:30 on Monday 29 March 2021.

10.26 Unattended noise measurements were conducted between 12:00 on Monday 29 March and 12:00 on Wednesday 31 March 2021.

10.27 Weather conditions during the attended survey periods were dry and clear with 60% cloud cover. Temperatures were between 14°C and 16°C. Wind speeds were below 5 m/s, the maximum wind speed at which the microphone windshield is effective.

10.4.3 Personnel and Instrumentation

10.28 AWN installed and collected the noise monitoring equipment. The following instrumentation was used in conducting the noise surveys:

Table 10.6 Instrumentation details

Equipment	Type	Serial Number	Calibration Date
Sound Level Meter	Brüel & Kjaer 2250L	3008402	04/11/2019
Sound Level Meter	Rion NL-52	386771	17/02/2021
Sound Level Meter	Rion NL-52	1076328	21/08/2020

10.4.4 Noise Measurement Parameters

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

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

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

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

L_{AFmax} is the instantaneous maximum sound level measured during the sample period using the 'F' time weighting.

L_{AFmin} is the instantaneous minimum sound level measured during the sample period using the 'F' time weighting.

10.30 The "A" suffix for the noise parameters denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

10.4.5 Survey Results

10.31 The results of the attended daytime noise surveys at AT01, AT02 and AT03 are summarised in Table 10.7, Table 10.8 and Table 10.9, respectively. It should be noted that a logarithmic average is used for the L_{Aeq} parameter, while an arithmetic average is used for the L_{A10} and L_{A90} parameters.

AT01

Table 10.7 Summary of attended daytime noise measurements at AT01

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
11:47	52	70	43	52	45
12:43	52	68	44	54	47
13:35	52	63	44	55	47
Average	**52**	**-**	**-**	**54**	**47**

10.32 Noise contributors at this location included faint road traffic from Swords Road and residential roads to the west, high wind and birdsong. The average noise levels at this location were measured at 52 dB $L_{Aeq,15min}$. The background noise levels were measured at between 45 and 47 dB $L_{A90,15min}$.

AT02

Table 10.8 Summary of attended daytime noise measurements at AT02

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
12:04	48	64	43	50	45
12:59	51	71	42	52	46
13:53	50	68	44	53	46
Average	**50**	**-**	**-**	**52**	**46**

10.33 Noise contributors at this location included faint road traffic from Swords Road and residential roads to the west, noise from nearby bottle bank, high wind and birdsong. The average noise levels at this location were in the range 48 to 51 dB $L_{Aeq,15min}$. The background noise levels were measured at between 45 and 46 dB $L_{A90,15min}$.

AT03

Table 10.9 Summary of attended daytime noise measurements at AT03

Start Time	Measured Noise Levels (dB)				
	L_{Aeq}	L_{AFmax}	L_{AFmin}	L_{A10}	L_{A90}
12:24	54	72	45	57	48
13:18	53	78	45	53	47
14:11	56	80	46	57	49
Average	**55**	**-**	**-**	**56**	**48**

10.34 The noise environment at this location was characterised by noise from adjacent supermarket entrance, (trolley noise and pedestrian chatter), slow vehicle movement in the carpark, faint noise from Swords Road and surrounding road network, wind and birdsong. The average noise levels at this location were in the range 53 to 56 dB $L_{Aeq,15min}$. The background noise levels were measured at between 47 and 49 dB $L_{A90,15min}$.

10.35 The results of the unattended noise surveys at UN01 and UN02 are plotted in Figure 10.2 and Figure 10.3 and are summarised in Table 10.10 and Table 10.11, respectively. Once again, a logarithmic average is used for the L_{Aeq} parameter, while an arithmetic average is used for the L_{A10} and L_{A90} parameters.

UN01

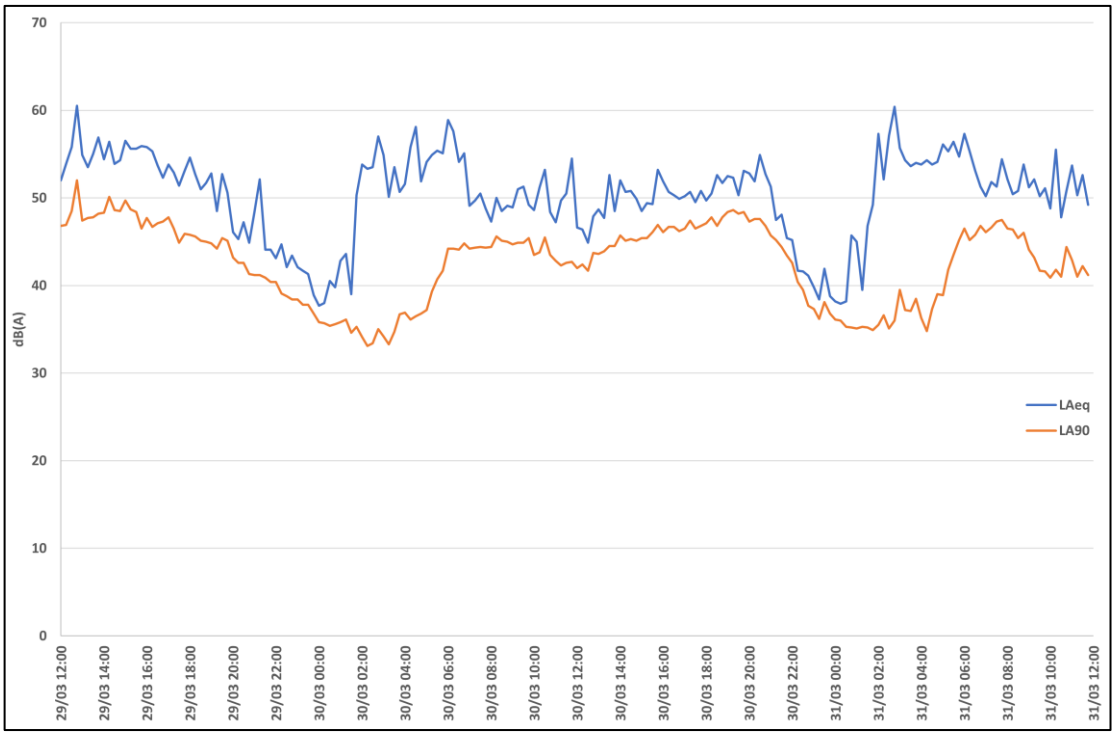

Figure 10.2 Time history plot of L_{Aeq} and L_{A90} at UN01

Table 10.10 Summary of unattended noise measurements at UN01

Date	Average Daytime Level	Background Daytime Level	Average Night-time Level	Background Night-time Level
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
29/03/2021	53	45	53	37
30/03/2021	51	45	54	38
Average	**52**	**45**	**53**	**38**

10.36 Daytime noise levels at UN01 were relatively steady and showed a typical decrease into the evening and night periods. The average daytime level was 52 dB $L_{Aeq,16hr}$. The night-time levels at UN01 were affected by a loose section of metal barrier which made a significant contribution in the windier conditions during both nights of the survey. Therefore, the measurements at UN01 are not considered representative of the night-time noise environment and reference should be made to UN02 instead in relation to night-time levels.

UN02

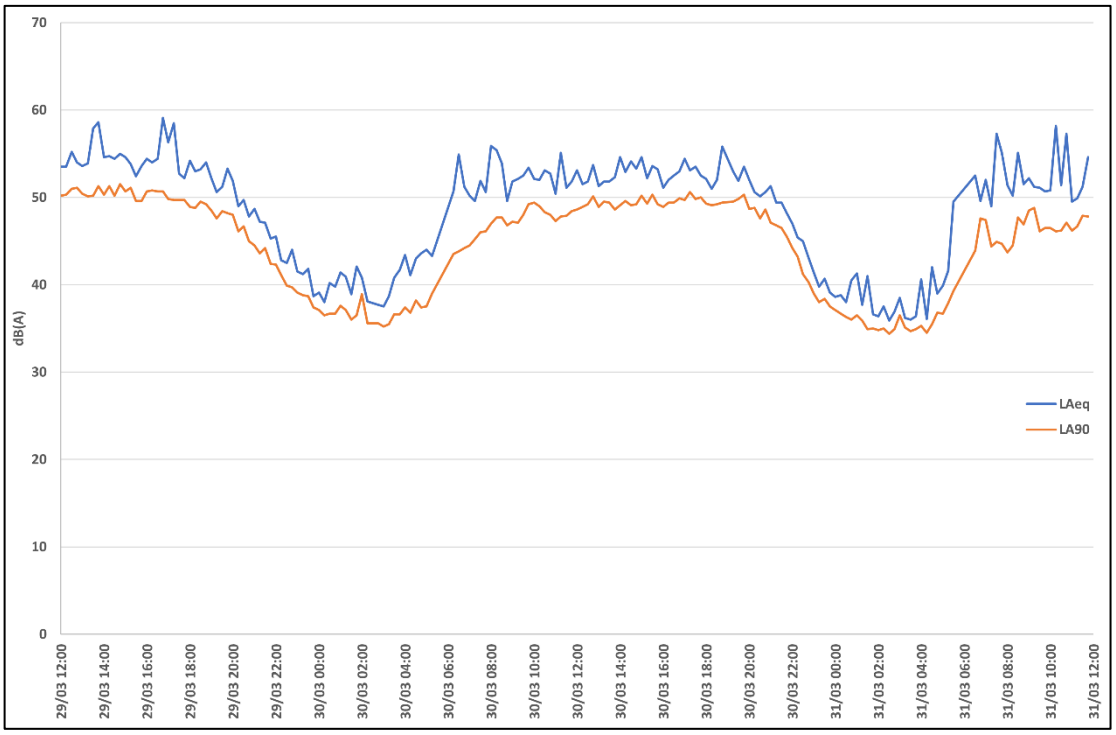

Figure 10.3 Time history plot of L_{Aeq} and L_{A90} at UN02

Table 10.11 Summary of unattended noise measurements at UN02

Date	Average Daytime Level	Background Daytime Level	Average Night-time Level	Background Night-time Level
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	$L_{Aeq,8hr}$	$L_{A90,8hr}$
29/03/2021	53	48	45	38
30/03/2021	52	48	43	37
Average	**53**	**48**	**44**	**37**

10.37 Both the average and background noise levels at UN02 followed a typical pattern with steady levels throughout the daytime, decreasing into the evening and night periods before increasing steadily through the early morning. As mentioned in the preceding paragraph, the measurements at UN02 should be referred to in relation to night-time noise levels at the site. This is due to interference at UN01 during the night. UN02 is considered to provide a worst-case scenario due to its location at the closest point of the site to the Swords Road and busy commercial areas. Furthermore, the background level was shown to be 48 dB $L_{A90,16hr}$ during the day compared with 45 dB $L_{A90,16hr}$ at UN01.

10.5 POTENTIAL EFFECTS OF THE PROPOSED DEVELOPMENT

10.5.1 Construction Phase

10.5.1.1 Construction Noise

10.38 The largest noise and vibration impact of the proposed development will occur during the construction phase due to the operation of various plant machinery and HGV movement to, from and around the site. However, the construction phase can be classed as a short-term phase (two to three years in duration).

The nearest noise-sensitive locations to the site are the residential properties to the west, the nearest of which is 20 m from the closest point of the site boundary. Based on the results of the baseline noise surveys undertaken, the ambient daytime noise level at these properties was found to be between 50 and 52 dB $L_{Aeq,T}$. There are also commercial premises adjacent to the site boundary on the north, east and south sides.

10.39 Table 10.1 (BS 5228-1) and the baseline ambient noise levels, as outlined in the assessment criteria section. These thresholds are shown in Table 10.12. A night-time threshold is not included as construction work will not be taking place at night. Note that the BS 5228-1 method is only valid for residential properties, therefore, the higher threshold of 75 dB $L_{Aeq,T}$ is deemed appropriate for commercial premises.

Table 10.12 Significance thresholds for construction noise

Location	Period	Significance Threshold
Noise-sensitive locations (residential properties to the west)	Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65 dB $L_{Aeq,T}$
Commercial premises	Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	75 dB $L_{Aeq,T}$

10.40 BS 5228-1 contains noise level data for various construction machinery. The noise levels relating to site clearance, ground excavation and loading lorries (dozers, tracked excavators and wheeled loaders) reach a maximum of 81 dB $L_{Aeq,T}$ at a distance of 10 m. For this assessment, a worst-case scenario is assumed of 3 no. such items with a sound pressure level (SPL) of 81 dB at 10 m operating simultaneously along the closest works boundary. This would result in a total noise level of 86 dB at 10 m and an equivalent combined sound power level of 114 dB L_w(A). This worst-case scenario is the typical assumption made for developments of this size, on the basis that it is unlikely that more than 3 no. items of such plant/equipment would be operating simultaneously in such close proximity to each other.

10.41 Guidance on the approximate attenuation achieved by barriers surrounding the site is also provided in BS 5228-1. It states that when the top of the plant is just visible to the receiver over the noise barrier, an approximate attenuation of 5 dB can be assumed, while a 10 dB attenuation can be assumed when the noise screen completely hides the sources from the receiver.

10.42 The latter scenario can be assumed in this case due to the proximity of the noise-sensitive locations, i.e. a barrier height will be chosen so as to completely hide the source. Table 10.13 shows the potential noise levels calculated at various distances

based on the assumed sound power level and attenuation provided by the barrier of 10 dB.

Table 10.13 Potential construction noise levels at varying distances assuming attenuation of 10 dB from site barrier

Description of Noise Source	Sound Power Level (dB L_w(A))	Calculated noise levels at varying distances (dB $L_{Aeq,T}$)				
		10	20	30	50	100
3 no. items each with SPL of 81 dB at 10 m operating simultaneously.	114	76	70	66	62	56

10.43 The calculated noise levels in Table 10.13 show that there is potential for the maximum permissible daytime noise level to be exceeded at distances up to 30 m. This indicates that additional mitigation measures may be required to prevent likely significant effects at the residential properties to the west.

10.44 In order to increase traffic noise levels by 3 dB, traffic volumes would need to approximately double along the local road network. The assumption is that sound intensity increases proportionally with the number of vehicles. Therefore, a doubling of traffic results in a doubling of sound intensity which corresponds to +3 dB. An increase in noise level of less than 3 dB is considered negligible or not significant (DMRB and EPA, see Section 10.3). Based on the proposed scale of construction activity, the number of workers on site each day and the existing level of traffic on the Swords Road, the additional traffic introduced onto the local road network due to the construction phase of the proposed development will not result in sufficient changes in traffic to double traffic volumes along the local road network. It is therefore considered that increased traffic during the construction phase will not result in a significant noise effect.

10.5.1.2 Construction Vibration

10.45 In terms of the potential vibration impact during the construction phase, site activities will be managed so as not to exceed the vibration limits set out in British Standard BS 5228-2 and summarised in Table 10.2 of this report. Furthermore, the mitigation measures set out in Section 10.6 of this report will be employed to further reduce the likelihood of significant effects. The contractor will be required to follow the Dublin City Council guidance, Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition.

10.5.2 Operational Phase

10.46 The main potential sources of outward noise from the development during the operational phase will be traffic flows to and from the development via public roads, childcare facilities (crèche), mechanical and electrical plant used to service the buildings and deliveries and waste collection. The review of standards and guidelines in Section 10.3 will be used here to assess the potential effect of the proposed development during the operational phase.

10.5.2.1 Building Services Plant

10.47 BS 4142: 2014: *Methods for Rating and Assessing Industrial and Commercial Sound* sets out a method for assessing the impact of a new continuous noise source to a residential environment such as plant items used to service the apartments and amenity areas. Residential units are the most sensitive to this source, therefore, control of impacts at these units ensures control elsewhere. It states that if the rating level of the item exceeds the background noise level by 5 dB, an adverse impact is likely to occur, while an exceedance of 10 dB is likely to cause a significant adverse impact, depending on the context.

10.48 The background noise level at the boundaries of the site were determined through baseline noise surveys. Background noise levels during the day were in the range of 45 to 48 dB $L_{A90,16hr}$. During the night, background noise levels were in the range of 37 to 38 dB $L_{A90,8hr}$.

10.49 Based on the above, it is recommended that cumulative plant noise from mechanical plant associated with the development does not exceed 35 dB $L_{Aeq,15min}$ and does not contain audible tones at any noise sensitive locations.

10.50 The location or type of building services plant has not yet been established, therefore it is not possible to calculate the potential noise levels. In this instance, it is best practice to use the above guidance (BS 4142) to inform the detailed design during the selection and layout of building services for the development.

10.51 Plant items will be selected, designed and located so that there is no negative effect on sensitive receivers within the development itself.

10.5.2.2 Childcare Facilities

10.52 The proposed development includes a crèche located at the ground floor of Core C2 and this includes an outdoor play area and also a young children's playground between Blocks A and B and an older children's playground to the north west of the site.

10.53 There is a potential noise source from children playing in these outdoor areas. The facades that are considered likely to experience a significant effect are highlighted in red in Figure 10.4 and Figure 10.5. Due to the location of the outdoor play areas, it is considered there will be no effect on locations outside of the proposed development.

10.54 A value of 56 dB $L_{Aeq,1hr}$ at a distance of 5 m has been adopted to calculate noise levels from the external areas of the crèche and other playgrounds. This value has been arrived at from a number of measurements taken by AWN of noise generated by children playing outdoors and is considered to represent the worst case scenario.

10.55 In order to adhere to the guidance on indoor ambient noise levels in BS 8233, it is advisable to install windows with a sufficient sound reduction index (R_w) to ensure the noise level within the apartments is acceptable. Based on the façade area, window area and volume of the nearest rooms, a sound reduction index of at least 35 dB R_w will be required in the worst-case scenario to achieve an internal noise level of 35 dB, as recommended in BS 8233.

Figure 10.4 Locations impacted by outdoor play areas (ground floor)

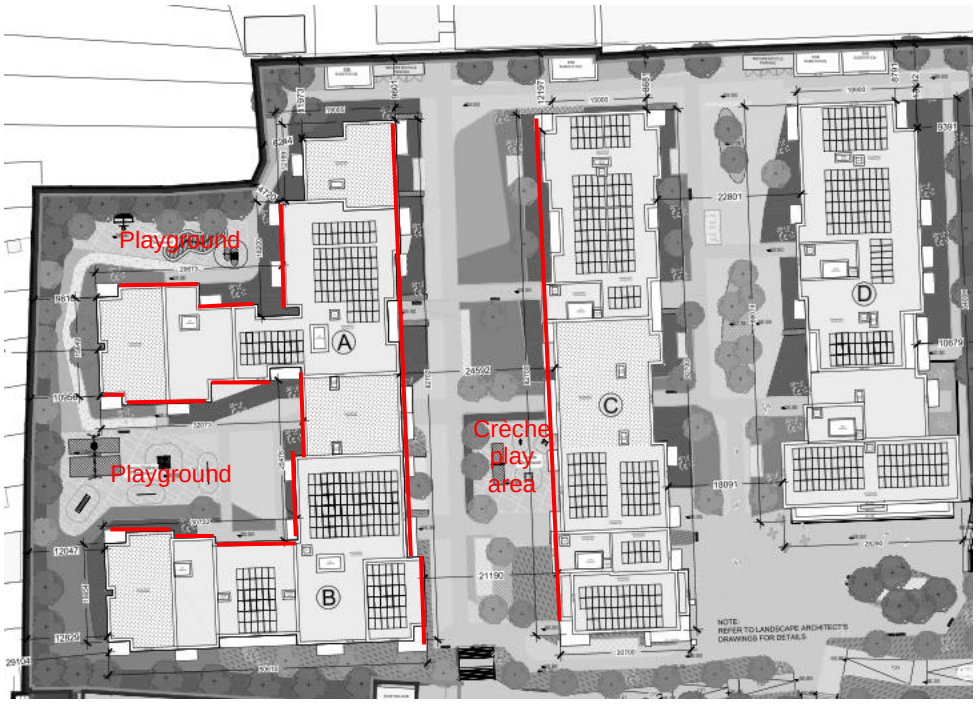

Figure 10.5 Locations impacted by outdoor play areas (roof level)

10.5.2.3 Deliveries and Waste Collection

10.56 Section 2.0 of the Transportation Assessment Report states that the development will be serviced using regular weekly refuse lorries within the site as required, with small vans or small-wheelbase trucks for day-to-day servicing of the apartments, which do not have onerous swept-paths and can easily be facilitated on the site. Servicing is possible from the existing surface car park plus the basement has 2.6 m high zone at the bottom of the access ramp which can also accommodate deliveries and servicing

by vehicles such as transit vans or similar. This will be managed by the Management Company in conjunction with the other users on site.

10.57 Due to the expected frequency of deliveries and waste collection to the proposed development, based on the number of residents, and since the proposed waste collection area is to the south of the plaza adjacent to the car park of Omni Park, deliveries and waste collection will not result in a significant noise effect on the surrounding area.

10.5.2.4 Additional Traffic on Surrounding Roads

10.58 A key objective of the Travel Plan for the development, as stated in the Transportation Assessment Report (Chapter 14), is to promote and improve the attractiveness of using public transport, cycling, walking, car-sharing, flexible working or a combination of these as alternatives to single-occupancy car journeys to work.

10.59 The Transportation Assessment predicts the following changes to Annual Average Daily Traffic (AADT) in the opening year (2024). This is shown in Table 10.14 along with approximate corresponding changes to noise level. Note that the 'without development' column includes local committed developments but does not include the subject development. The 'with development' column includes both local committed and subject developments.

Table 10.14 Predicted changes to AADT with and without the development in place

Road Link	24 Hour AADT for Opening Year (2024)		
	Without Development	With Development	Increase
Swords Road North	19224	19785	2.9% (+0.1 dB)
Santry Avenue	12094	12369	2.3% (+0.1 dB)
Santry Villas	317	317	0.0% (+0.0 dB)
Swords Road Middle North	18462	19299	4.5% (+0.2 dB)
Santry Hall/Ind Est	2522	2522	0.0% (+0.0 dB)
Swords Road Middle South	18644	19481	4.5% (+0.2 dB)
Omni Park SC	11291	12753	12.9% (+0.5 dB)
Lorcan Road	1603	1603	0.0% (+0.0 dB)
Swords Road South	16932	17558	3.7% (+0.2 dB)

10.60 An increase in noise level of less than 3 dB is considered negligible or not significant (DMRB and EPA, see Section 10.3). In order to increase traffic noise levels by 3 dB, traffic volumes would need to approximately double along the local road network. The assumption is that sound intensity increases proportionally with the number of vehicles. Therefore, a doubling of traffic results in a doubling of sound intensity which corresponds to +3 dB. Based on the small increases to AADT presented in Table 10.14, it is considered that additional traffic on surrounding roads as a result of the proposed development will not have a likely significant effect.

10.5.3 Cumulative Effect

10.61 There is potential for the construction phase of the proposed development to coincide with that of other proposed developments in the area as detailed in Section 2.10. All of

these proposed developments are to the north and east of the subject development. The noise-sensitive locations of concern to the subject development are directly to the west. Considering the proximity of the subject development and the distance from the other proposed developments to the noise-sensitive locations, there will not be likely significant effects due to cumulative effects during the construction phase.

10.62 In relation to the operational phase, the assessment of additional traffic in Section 10.5.2 took account of traffic due to committed developments in the area and no likely significant effects were identified.

10.6 REMEDIAL AND MITIGATION MEASURES

10.6.1 Construction Phase

10.63 In Section 10.5.1, a likely significant effect was identified at the residential properties to the west of the proposed development. The following measures will be employed to mitigate this. These measures are also best practice regardless of identified significant effects.

10.64 BS 5228-1: 2009+A1:2014: *Code of practice for noise and vibration control on* construction *and open sites Parts 1 and 2* provide guidance on noise and vibration control in the context of construction. The control of noise from construction works can be divided into two categories:

- Controlling the noise at source, and;
- Controlling the spread of noise.

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

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

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

- The distance between noise sources and noise-sensitive areas will be increased as much as is reasonably practicable;
- Where noise control at source is insufficient and the distance between source and receiver is restricted, screening will be implemented. The location of barriers providing screening is an important consideration. Barriers will be located either close to the source of noise (as with stationary plant) or close to the listener. The height of the barrier must also be considered. BS 5228-1 states that an approximate attenuation of 5 dB is achieved when the top of the plant is just visible to the receiver over the noise barrier, while an attenuation of 10 dB is achieved when the noise screen completely hides the sources from the receiver. A barrier height will be chosen so as to completely hide the source. Furthermore, where the noise source is 1 m from the façade of a building, an allowance of +3 dB will be made for reflection.

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

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

10.68 The contractor will be required to follow the Dublin City Council guidance, *Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition*.

10.6.2 Operational Phase

10.6.2.1 Building Services Plant

10.69 At the detailed design stage, best practice measures relating to building services plant will be taken to ensure there is no significant noise effects on noise-sensitive locations within the development. Due to the relative proximity of the NSLs within the development, this will also prevent a negative effect on NSLs in the surrounding area. Best practice measures in this context include the following:

- Where ventilation is required for plant rooms, consideration will be given to acoustic louvers or attenuated acoustic vents, where required, to reduce noise breakout;
- Ventilation plant serving plant rooms and car parks will be fitted with effective acoustic attenuators to reduce noise emissions to the external environment;
- The use of perimeter plant screens will be used, where required, for roof-top plant areas to screen noise sources;
- The use of attenuators or silencers will be installed on external air-handling plant;
- All mechanical plant items, e.g. fans, pumps etc., shall be regularly maintained to ensure that excessive noise generated by worn or rattling components is minimised;
- Any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document;
- Installed plant will have no tonal or impulsive characteristics when in operation.

10.6.2.2 Childcare & Play Facilities

10.70 In terms of crèche & play facilities, particularly in the outdoor play areas, in addition to the issue of appropriate window glazing discussed in Section 10.5.2, the following mitigation measures are recommended:

- The play area surface should be a soft porous rubber to provide some additional sound absorption;
- Vegetation or fencing should be retained along the boundaries to discourage children from playing in the closest areas to the residential units.

10.6.2.3 Deliveries and Waste Collection

10.71 Based on the assessment in Section 10.5.2, it is not expected that deliveries and waste collections are likely to cause a significant effect. Therefore, no mitigation measures are necessary in this case.

10.6.2.4 Additional Traffic on Surrounding Roads

10.72 As explained in Section 10.5.2, it is considered that the changes to traffic flows will not result in a significant increase in noise level in the surrounding environment. Therefore, no mitigation measures are necessary in this case.

10.7 RESIDUAL EFFECTS OF THE PROPOSED DEVELOPMENT

10.73 Provided that the relevant mitigation measures are employed during the construction phase, it is anticipated that effect will be short-term, negative and slight.

10.74 During the operational phase, provided that the appropriate glazing is incorporated into the design for facades exposed to noise from the outdoor crèche area and provided that the mitigation measures are employed, it is anticipated that effects will be long-term, neutral and imperceptible. When compared to the haulage depot use of the site currently it is expected that the noise effect of the proposed development will be positive to the surrounding area.

10.7.1 Cumulative Effect

10.75 As discussed in Section 10.5.3, it is not anticipated that any likely significant effects will result from cumulative effects.

10.8 MONITORING OR REINSTATEMENT

10.76 There are no requirements for ongoing monitoring or reinstatement.

10.9 REFERENCES

- BS 5228-1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise.
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes. Transport Infrastructure Ireland. 2014.
- BS 5228-2: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Vibration.
- BS 7385: 1993: Evaluation and measurement for vibration in buildings. Part 2: Guide to damage levels from ground borne vibration.

- BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound.
- BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings.
- Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2. UK Highways Agency et al. 2020.
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Environmental Protection Agency. 2022.
- ISO 1996: 2017 Acoustics – Description, measurement and assessment of environmental noise.
- Transportation Assessment Report for Proposed Residential Development at Omni Park Shopping Centre. NRB Consulting Engineers. 2021