NOISE & VIBRATION IMPACT ASSESSMENT FOR PLANNING

PROPOSED STRATEGIC HOUSING DEVELOPMENT AT CARRICKMINES GREAT, GLENAMUCK ROAD SOUTH, DUBLIN 18

Technical Report Prepared For

Carrickmines Great,
Glenamuck Road South
Dublin 18

Technical Report Prepared By

Abe Scheele
Acoustic Consultant

Our Reference

227501.0203NR01b

Date of Issue

2 August 2022

awnconsulting
A Trinity Consultants Company

The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.

T: + 353 1 847 4220
F: + 353 1 847 4257
E: info@awnconsulting.com
W: www.awnconsulting.com

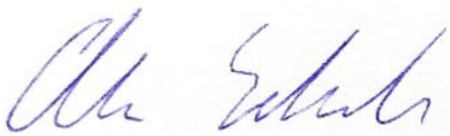
Cork Office
Unit 5, ATS Building,
Carrigaline Industrial Estate,
Carrigaline, Co. Cork.
T: + 353 21 438 7400
F: + 353 21 483 4606

AWN Consulting Limited
Registered in Ireland No. 319812

Document History

Document Reference		Original Issue Date	
227501.0203NR01		2 August 2022	
Revision Level	Revision Date	Description	Sections Affected
b	2 August 2022	Final Site Layout and project Description	All

Record of Approval

Details	Written by	Approved by
Signature		
Name	Abe Scheele	Jennifer Harmon
Title	Acoustic Consultant	Principal Acoustic Consultant
Date	2 August 2022	2 August 2022

EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise and vibration impacts associated with the proposed residential development at the lands at Carrickmines Great, Glenamuck Road South, Dublin 18. The proposal consists of the demolition of existing buildings on site and the provision of 167 no. residential units (comprising of 69 no. houses and 98 no. apartments), a childcare facility, open space, roads infrastructure and all associated development.

A baseline noise survey has been undertaken at the development site to determine the existing environment at the site.

Outward noise impact assessments have been undertaken for both construction and operational phases of the proposed development.

Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that whilst there are a small number of residential properties in close proximity to the site boundary, the nature of the construction activities for the majority of the construction phase will involve standard house construction techniques which can for the majority operate within the construction noise thresholds. Best practice control measures will be employed on site to control noise emissions outside of the site through the use of site hoarding, localised screening, scheduling of works, maintenance of plant items etc. to control noise emissions during this phase. Vibration impacts during the construction phase are not significant.

Once the various best practice control measures during the construction phase are implemented on site, the overall noise and vibration impact during this phase will not be overly intrusive to cause a significant impact.

Once operational, noise emissions will be limited to noise associated with traffic coming to and from the development and plant items serving to the development. With reference to the Transportation Assessment prepared for the scheme, traffic associated with the development is negligible to minor and associated noise levels are expected to be imperceptible to perceptible. Regarding plant noise, suitable noise thresholds have been assigned based on the measured noise levels on the site. It is understood that plant items serving the development will be located internally and therefore it is expected that noise emissions to atmosphere will be minimal. Plant items serving the proposed development will be designed such that the cumulative noise emissions will achieve the noise criteria set out above.

CONTENTS

1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out an assessment in relation to the potential outward noise impact of the proposed residential development at lands at Carrickmines Great, Glenamuck Road South, Dublin 18.

Included within this report is an assessment of the outward noise impact of the construction and operational phases of the development.

The development site is located on the lands at Carrickmines Great, between Glenamuck Cottages, Cairnbrook and Carrickmines Manor. To the north, south, east and west are residential houses.

Figure 1 presents the outline of the proposed development site and the surrounding area.

Figure 1 Location of proposed development

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

The proposed development seeks to demolish existing outbuildings on site and provide for the construction of 167 no. residential units, a childcare facility with a GFA of 188 sq.m., associated internal roads, pedestrian and cycle paths, open space, and all associated site and infrastructural works.

The residential component of the development consists of 98 no. apartments and 69 no. houses, to be provided as follows:

- 30 no. 1-bed apartments;
- 47 no. 2-bed apartments;

- 21 no. 3-bed apartments;
- 43 no. 4-bed (Type A, A1 and D) houses;
- 26 no. 3-bed (Type B, C and E) houses;

The 98 no. apartments are to be provided within 3 no. apartment buildings of 5 no. storeys in height, each over basement level, with adjacent surface car parking. The houses consist of 2 and 3 storey terraced, semi-detached and detached dwellings.

The proposal contains a total of 237 no. car parking spaces, including 173 no. at surface level and 64 no. at basement level, 253 no. bicycle parking spaces, including 34 no. at surface level and 219 no. secure spaces at ground floor level of the apartment buildings, and 6 no. motorcycle parking spaces at basement level. The vehicular access to the development is to be provided from Cairnbrook residential estate to the west, including associated works to facilitate same. A vehicular entrance is also proposed from Springfield Lane to access the house proposed on the northern part of the site. Pedestrian and cycle links are proposed to Springfield Lane to the north and to link to the permitted development (Reg. Ref.: PC/H/01/19) at Rockville Drive / Glenamuck Cottages to the south.

Bin stores, plant rooms and block cores are located at basement and ground floor level of the apartment buildings. The proposed development includes private amenity space, consisting of balconies / terraces for all apartments and private gardens for the houses, public and communal open space, including children's play areas and an ancillary play area for the childcare facility, PV panels and green roofs at roof level of the apartment buildings, public lighting, utilities infrastructure and an ESB Substation. The proposal includes all associated site and infrastructural works, including tie-ins to existing infrastructure in the Cairnbrook residential estate, foul and surface water drainage, attenuation tanks, hard and soft landscaping, boundary treatments, internal roads, cyclepaths and footpaths.

2.0 DESIGN CRITERIA

2.1 Construction Phase Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Dun Laoghaire-Rathdown City Council (DLRCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. It is assumed that construction works in relation to this development are proposed during normal working hours only as set out below: -

- Monday to Friday: 07:00 to 19:00hrs
- Saturdays: 08:00 to 14:00hrs
- Sundays and Bank Holidays: No construction works.

2.1.1 British Standard BS 5228 – 1: 2009+A1:2014

Potential noise impacts during the construction stage of a project are often assessed in accordance with BS 5228-1:2009+A1:2014. Various mechanisms are presented as examples of determining if an impact is occurring, these are discussed in the following paragraphs.

The closest neighbouring noise sensitive properties to the proposed development are houses at Cairnbrook adjacent to the western site boundary, residential receptors including houses located to the north of site and houses at Glenamuck to the south and east of the site. Other residential receptors include houses set back located to the west of site. These noise sensitive receivers are located approximately 10 – 50m from areas of major works.

When considering non-residential receptors, reference is made to BS 5228-1:2009+A1:2014, which gives several examples of acceptable limits for construction noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states: -

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state: -

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed: -*
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
>
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

2.1.2 TII Guidelines

The TII *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (2004) and the *Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes* (2014) specify noise levels that are deemed acceptable in terms of construction noise for national road projects. These limits have been derived for the construction of new national road projects which predominately pass through rural environments with quieter ambient noise levels compared to those in urban

setting. In this instance, these limits are typically lower than those typically used for urban infrastructural projects. These limits are set out in Table 1.

Days and Times	Noise Levels (dB re 2 x 10^{-5} Pa)	
	L_{Aeq}	L_{ASmax}
Monday to Friday 07:00hrs to 19:00hrs	70	80
Monday to Friday 19:00hrs to 22:00hrs	60*	65*
Saturdays 08:00hrs to 16:30hrs	65	75
Sundays and Bank Holidays 08:00hrs to 16:30hrs	60*	65*

Table 1 TII Construction Noise Levels at the Facade of Dwellings during the Construction Phase

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

2.1.3 Proposed Threshold Noise Levels

Taking into account the proposed documents outlined above the following Construction Noise Threshold (CNT) levels are proposed for the construction stage of this development:

- Monday to Friday 07:00 to 19:00hrs: 70 dB(A)
- Saturdays: 08:00 to 14:00hrs: 65 dB(A)

2.1.4 Determination of Significance

In order to assist with interpretation of the significance of construction noise levels, Table 2 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of the Design Manual for Roads and Bridges (DMRB) *LA 111 Noise and Vibration Revision 2 2020* document.

Guidelines for Noise Impact Assessment Significance (DMRB)	CNT per Period	EPA Significance Ratings
Negligible	Below or equal to baseline noise level	Not Significant
Minor	Above baseline noise level and below or equal to CNT	Slight to Moderate
Moderate	Above CNT and below or equal to CNT +5 dB	Moderate to Significant
Major	Above CNT +5 to +15 dB	Significant to Very Significant
	Above CNT +15 dB	Significant to Profound

Table 2 Construction Noise Significance Ratings

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely impacts during the construction stages.

2.2 Construction Phase – Traffic Noise

In order to assist with the interpretation of impacts relating to construction traffic noise, Table 3 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This is taken from Table 3.17 of the DMRB *LA 111 Noise and Vibration (2020)*,

Magnitude of Impact	Increase in Traffic Noise Level (dB)	Initial Significance Rating
Negligible	Less than 1.0	Not Significant
Minor	Greater than or equal to 1.0 and less than 3.0	Not Significant
Moderate	Greater than or equal to 3.0 and less than 5.0	Significant
Major	Greater than or equal to 5.0	Significant

Table 3 Likely Effect Associated with Change in Traffic Noise Level – Construction Phase

In accordance with the DMRB *LA 111 Noise and Vibration* (2020), construction noise and construction traffic noise impacts results in a potential initial significant effect where it is determined that a major or moderate magnitude of change will occur for a duration exceeding:

- Ten or more days or night in any 15 consecutive day or nights;
- A total number of days exceeding 40 in any six consecutive months.

2.3 Construction Phase - Vibration

2.3.1 Building Damage

With respect to vibration, British Standard BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – 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 12.5 mm/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 4 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 4 Recommended Vibration Criteria During Construction Phase

Expected vibration levels from the construction works will be discussed further in Section 4.4.

2.3.2 Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. There are no current standards which provide guidance on typical ranges of human response to vibration in terms of PPV for continuous or intermittent vibration sources.

BS5228-2:2009+A1:2014, provides a useful guide relating to the assessment of human response to vibration in terms of the PPV. Whilst the guide values are used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources.

Table 5 summarises the range of vibration values and the associated potential effects on humans within buildings.

Vibration Level, PPV	Human Response (BS 5228 – 2)	Significance Rating (EPA 2022)
Less than 0.14	Not perceptible	Imperceptible to Not significant
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.	Not significant to Slight
0.3mm/s	Vibration might be just perceptible in residential environments.	Slight to Moderate
1mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Moderate to Significant
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.	Very Significant

Table 5 Guidance on Effects of Human Response to PPV Magnitudes

2.4 Operational Phase – Noise

During the operational phase of the proposed development the primary sources of noise are expected to be mechanical plant items serving the apartments, houses and creche buildings and traffic along the surrounding road network.

2.4.1 Mechanical Services Plant

Reference is made to the typical conditions that would be applied by DLRCC to the development of this nature:

> *"Noise levels from the proposed development should not be so loud, so continuous, so repeated, of such duration or pitch or occurring at such times as to give reasonable cause for annoyance to a person in any premises in the neighbourhood or to a person lawfully using any public space. In particular the rated noise levels from the proposed development shall not constitute reasonable grounds for complaint as provided for in B.S. 4142. Method for rating industrial noise affecting mixed residential and industrial area.*
>
> *Reason: In order to ensure a satisfactory standard of development, in the interests of residential amenity."*

Guidance from DLRCC on noise emissions from mechanical plant items makes reference to the British Standard BS 4142: 2014: *Methods for Rating and Assessing Industrial and Commercial Sound*. This document is the industry standard method for analysing building services plant noise emissions to residential receptors and is the document used by DLRCC in their standard planning conditions and in complaint investigations.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British 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 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB 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 +10 dB 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 +5 dB 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.

2.4.2 Noise due to Additional Traffic Serving the Development

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. In order to assist with the interpretation of the noise associated with additional vehicular traffic on public roads, Table 6 is taken from DMRB *LA 111 Noise and Vibration* (2020) which relate to the long term magnitude of change.

Change in Sound Level (dB)	Subjective Reaction	Magnitude of Impact
10+	Over a doubling of loudness	Major
5 – 9.9	Up to a doubling of loudness	Moderate
3 – 4.9	Perceptible	Minor
0.1 – 2.9	Imperceptible	Negligible
0	None	No Change

Table 6 Significance in Change of Noise Level

The guidance outlined in Table 7 will be used to assess the predicted increases in traffic levels on public roads associated with the proposed development and comment on the likely long-term impacts during the operational phase.

2.4.3 Noise from Creche

For the most part children attending the creche will be indoors. Part of the creche facilities include a secure outdoor play area.

Appropriate guidance on internal noise levels for dwellings is contained within BS 8233:2014 *Guidance on Sound Insulation and Noise Reduction for Buildings*. This British Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as presented in Table 7.

Typical situations	Design Range, $L_{Aeq,T}$ dB	
	Daytime $L_{Aeq,16hr}$ (07:00 to 23:00hrs)	Night-time $L_{Aeq,8hr}$ (23:00 to 07:00hrs)
Living / Dining Rooms	35 - 40	n/a
Bedrooms	35	30

Table 7 Recommended Indoor Ambient Noise Levels from BS 8233: 2014

For the purposes of this assessment, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window. This is nominally deemed to equate to 15 dB for a partially open window. Appropriate periods are 1 hour for daytime (07:00 to 23:00 hours). It is assumed the play area will not be in use between the hours of 23:00 to 07:00hrs.

Taking account of the attenuation afforded by an open window, an external noise level of 50 – 55 dB $L_{Aeq,1hr}$ would apply in order to achieve the internal noise levels within Table 7.

2.5 Operational Phase – Vibration

The proposed development is residential in nature, there are no sources of vibration associated with the operational phase. Operational criteria relating to vibration are not required in this instance.

3.0 BASELINE NOISE SURVEY

Environmental noise surveys have been conducted in order to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise -- Determination of Environmental Noise Levels*. Specific details are set out in the following sections.

3.1 Methodology

An attended environmental noise survey was conducted at the site 14 April 2022 by AWN Consulting in order to quantify the existing noise environment. The approximate noise measurement locations were selected at the proposed site as shown in Figure 2.

Figure 2 Noise Monitoring Locations

NM1 Attended measurement, to the south of the site.

NM2 Attended measurement, located to the west of the site.

NM3 Attended measurement, located to the north east of site.

3.2 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_{AFMax} is the maximum sound pressure level recorded during the sample period.

L_{AFMin} is the minimum sound pressure level recorded during 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.

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.

3.3 Instrumentation

A Rion NL52 sound level meter (SLM) was used in the attended noise survey. Before and after the survey the SLM was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

3.4 Survey Results

3.4.1 Location NM1

Survey results for Location NM1 are summarised in Table 8.

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
13:13	47	60	36	51	40
13:41	47	62	36	51	39
13:57	46	62	35	49	40

Table 8 Summary of Attended Measured Noise Levels – NM1

The noise environment at this location comprised distant road traffic noise from the M50, bird song and rustling vegetation. Ambient noise levels were in the range 46 to 47 dB L_{Aeq}. Background noise levels were in the range 39 to 40 dB L_{A90}.

3.4.2 Location NM2

Survey results for Location NM2 are summarised in Table 9.

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
14:31	52	73	38	56	41
14:48	56	73	38	60	42
15:04	56	71	39	60	43

Table 9 Summary of Attended Measured Noise Levels – NM2

The noise environment at this location comprised distant road traffic noise from the M50, bird song with occasional vehicle pass-by. Ambient noise levels were in the range 52 to 56 dB L_{Aeq}. Background noise levels were in the range 41 to 43 dB L_{A90}.

3.4.3 Location NM3

Survey results for Location NM3 are summarised in Table 10.

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
15:22	48	62	37	52	41
15:37	49	70	37	52	42
15:54	50	72	38	53	42

Table 10 Summary of Attended Measured Noise Levels – NM3

The noise environment at this location comprised distant road traffic noise from the M50, bird song, rustling vegetation and agricultural noise.. Ambient noise levels were in the range 48 to 50 dB L_{Aeq}. Background noise levels were in the range 41 to 42 dB L_{A90}.

3.5 Noise Survey Summary

The baseline noise levels measured across the proposed development site are typical of a suburban noise landscape. Noise levels measured were dictated by distant road traffic noise from the M50, rustling vegetation, birdsong, occasional passing vehicles on the local roads and by animal noise nearby.

Based on measured noise levels, predicted noise levels at facades of development buildings are below a level whereby acoustic mitigation will be necessary.

Noise levels were relatively low and influenced by local vehicle movements, vegetation noise and birdsong – noise sources typical of a residential setting.

4.0 CONSTRUCTION PHASE

4.1 Construction Phase Overview

A variety of items of plant will be in use for the purposes of site clearance/groundworks, and construction. There will be vehicular movements to and from the site that will make use of existing public roads and access via local estate roads through Springfield Lane and or Cainbrook residential estate. Due to the nature of these activities, there is potential for the generation of elevated levels of noise. These are assessed in the following sections.

During the construction phase, there will be a number of HGV's moving to/from site during different phases of work. Excavators and dump trucks will be in use for site clearance and building foundations, and rotary bored piling rigs may be used for foundation work at buildings B.01, B.02 and B.03. Following this standard construction tools and methods will be employed for general construction and landscaping.

Review of aerial imagery and baseline noise surveys have identified the nearest NSLs are houses at Cairnbrook adjacent to the western site boundary, residential dwellings located to the north of site and houses at Glenamuck to the south and east of the site respectively.

4.2 Construction Noise

The closest NSLs to areas where significant works are to take place are located at distances of between 10 and 60m from the site boundaries. The closest NSLs are described below:

NSL1 Houses adjacent to the northern site boundary, some 10m from areas of major works.

NSL2 Houses at Glenamuck some 20m from areas of major works, to the south east of the site.

NSL3 Houses adjacent to the eastern site boundary, some 60m from areas of major works.

NSL4 Houses at Cairnbrook some 10m from areas of major works, to the to the west of site.

The nearest noise sensitive locations are illustrated in Figure 3.

Figure 3 Indication of Sensitive Receptor Locations to Site Boundary

Given that works during the construction phase will be transient in nature and will involve the use of several different plant items at any one time, it is difficult at this stage of the assessment to state accurately what items of plant will be in use and what levels of noise will be experienced during construction works. In order to assess the range of potential noise levels associated with the construction phase, therefore, indicative noise prediction calculations have been prepared in relation to construction activities.

The calculations have been undertaken in line with guidance set out in British Standard BS 5228 (2009 +A1 2014): *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.* Table 11 outlines typical plant items for the main phases of work provided by the design team. The plant items relate to the construction and landscaping of the proposed houses along the site boundaries which are the closest construction activities to NSLs outside of the site.

Phase	Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB $L_{Aeq,1hr}$)
1 – Foundations	Tracked Excavator (C2.15)	75
2 – Substructure	Tracked Excavator (C2.15)	75
	Dump Truck (C4.2)	78
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
	Mobile Telescopic Crane 100T (C4.41)	71
3 - Landscaping	Road Surfacing (D8.25)	68

Table 11 Typical Noise Levels associated with Construction Plant Items (BS5228-1)

The predicted construction noise associated with each of the expected construction activities is presented below for various distances.

Guidance on the approximate attenuation achieved by standard construction hoarding surrounding construction sites 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.

In this scenario it is assumed that partial vision to the site is possible from the nearby receptors. Table 12 presents the potential noise levels calculated at various distances representative of the closest NSLs. The calculated levels are the combined construction plant items in operation during each of the phases noted above and assuming a conservative attenuation provided by the site hoarding of 5 dB.

Location	Construction Phase (dB $L_{Aeq,1hr}$)			
	Foundations	Substructure	General Construction	Landscaping
10m	66	72	62	59
20m	59	64	54	52
30m	54	60	50	47
50m	49	54	44	42
60m	47	52	42	40

Table 12 Potential Construction Noise Levels at Varying Distances

At the closest NSLs (NSL1 and NSL4 at distances of 10m from the closest site boundary), noise levels are calculated in the range of 59 to 72 dB $L_{Aeq,1hr}$ during the different phases of works The highest calculated noise level is associated with sub structure works and is dominated by mobile dump truck activity when operating at the closest distances. Due to the mobile nature of this source, its noise contribution will vary over the course of a typical working phase along the closest boundaries as the source moves within the construction site. The calculated noise levels for the majority of the work phases are within the daytime construction noise threshold of 70 dB $L_{Aeq,1hr}$ at this distance and in accordance with Table 2 the impact is slight to moderate and short term. There is potential for a slight exceedance of the construction noise threshold during the sub structure works, depending on the combination of plant items in operation at any one time. Due to the transient nature of the dominant source, this impact is not considered significant in the overall context of the construction phase.

The construction activities can operate within the Saturday daytime construction noise threshold for the majority of work phases (i.e. 65 dB $L_{Aeq,1hr}$) at the closest distance (10m). Works will be scheduled during Saturday morning periods to avoid exceedance of this noise threshold, particularly during the earlier construction phases where higher noise emissions are indicated.

At all other distances, representative of NSLs beyond 10m from the site boundary, the construction works can operate within the construction noise thresholds for weekday and Saturday periods.

Construction of the apartment blocks are set back at further distances into the site compared to those discussed in Table 12 above and hence construction noise levels associated with these buildings are also within the construction noise thresholds at the closest NSLs.

In order to minimise the impact of construction activity, good practice mitigation measures are detailed in Section 4.5 for review and incorporation into the Construction and Environmental Management Plan (CEMP) being prepared by the design team in support of the application. Measures to reduce the potential impact of construction noise and vibration on sensitive receivers are presented in the relevant sections of the CEMP.

4.3 Construction Vibration

The main potential source of vibration during the construction phase is associated with piling activities associated with buildings B.01, B.02 and B.03 which will be undertaken using rotary bored piles.

For the purposes of this assessment the expected vibration levels during piling have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2*: Vibration*, publishes the measured magnitude of vibration of rotary bored piling using a 600 mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54mm/s at a distance of 5m, for auguring;
- 0.22mm/s at a distance of 5m, for twisting in casing;
- 0.42mm/s at a distance of 5m, for spinning off, and;
- 0.43mm/s at a distance of 5m, for boring with rock auger.

Considering the low vibration levels at very close distances to augured piling rigs, vibration levels at the nearest off-site buildings will be orders of magnitude below those associated with cosmetic or structural damage buildings (Refer to Table 4). Due to the distances involved and magnitudes detailed above, vibration levels will also be below those likely to be perceptible to occupants of buildings adjacent to the site (Refer to Table 5).

4.4 Construction Traffic Noise

The proposed development site is located to the rear of Cainbrook Estate which is located adjacent to Glenamuck Road and which links the site to the M50 to the north of the site. There is also an existing laneway, Springfield Lane, which can provide construction access to the subject site which is located to the north of the site. It is intended that Springfield Lane will be the primary construction access route to the development for Construction Traffic, which will be routed via the M50 and then from the M50 via Glenamuck Road, turning left into the existing Lane and through to the subject site. All construction traffic will exit the site through the existing Springfield lane, turning right onto Glenamuck Road and then onto the M50. However, in the event that Springfield Lane is not available, then the access to the site will be via Cairnbrook Estate although this will be for the minimum period possible.

A traffic noise assessment has been undertaken to determine whether the increase in traffic along both access roads.

Construction traffic volumes to and from the site has been provided by the Traffic Consultant, this allows for assessment of any increase in traffic noise associated with vehicle movements to and from the proposed development. A worst case scenario where all construction traffic would flow through Springfield Lane or Cairnbrook has been assumed for the purpose of this assessment. During the construction phase a total of 12 HGVs are forecast to access the site per day (resulting in a total of 24 vehicle movements over the full day). Up to 40 light vehicles for staff and other small deliveries are expected per day (resulting in a total of 80 vehicle movements).

The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (LAX). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period.

The appropriate formula is given below:

$$L_{Aeq,T} = L_{AX} + 10\log^{10}(N) - 10\log^{10}(T) + 25\log^{10}(r1/r2) \quad dB$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds);
L_{AX} is the "A-weighted" Sound Exposure Level of the event considered(dB);
N is the number of events over the course of time period T;
r1 is the distance at which L_{AX} is expressed;
r2 is the distance to the assessment location.

The assumed mean value of Sound Exposure Level for cars and HGV's is in the order of 68 dB L_{AX} and 85 dB L_{AX} respectively at a distance of 10 metres.

Construction traffic noise has been calculated along the two potential site access roads and also along Glenamuck Road North where it will travel onwards to the M50. Baseline and construction traffic noise levels have been summed and the increase in noise levels determined. The results of the comparison are presented in Table 13.

Location	Calculated Noise Level, baseline traffic dB $L_{Aeq,1hr}$	Total Noise Level (Baseline + Construction) dB $L_{Aeq,1hr}$	Change in Noise Level dB
Springfield Lane Note 1	47	52	+1.9
Cairnbrook Note 1	47	52	+1.9
Glenamuck Road Junction 4 North	63	63	+0.2

Table 13 Predicted Noise Levels due to Development Traffic at 10 from road edge

Note 1: Base traffic along Cainbrook Estate Road and Springfield Road assumed to be nominally equal, i.e. of the order of 100 vehicles per day (as per traffic data provided)

The assessment indicates a potential increase in noise level of up to 2 dB along Springfield Lane or Cainbrook Estate assuming all construction traffic access and egresses the site along either road. With reference to Table 3 this is represents a minor magnitude of change and the overall impact is determined as not significant. The absolute noise level associated with the construction traffic (52 dB $L_{Aeq,T}$ at 10m) is

typical of a suburban environment and would not pose a significant effect over the short term construction period.

With reference to the calculations above, the predicted increase in noise level associated with construction traffic going to and from the proposed development on the Glenamuck Road would be less than 1 dB. With reference to Table 3, this represents a negligible magnitude of change and the overall impact is determined as not significant.

4.5 Construction Mitigation Measures

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites* Parts 1 and 2*.* Whist construction noise and vibration impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive buildings, the contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimised.

The best practice measures set out in BS 5228 (2009) Parts 1 and 2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- noise control at source;
- screening, and;
- liaison with the public.

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise and vibration monitoring, where required.

4.5.1 Selection of Quiet Plant

The potential for any item of plant to generate noise should be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

4.5.2 Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control “at source”. This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Referring to the potential noise generating sources for the works under consideration, the following best practice migration measures should be considered:

- The lifting of bulky items, dropping and loading of materials will be restricted to normal working hours.
- Mobile plant should be switched off when not in use and not left idling.
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site as necessary.
- 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.

4.5.3 Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. The use of a standard 2.4 site hoarding will be included around all noise sensitive boundaries. It is also understood that the existing perimeter walls and fences will remain during the construction process and provide a degree of screening.

In addition, careful planning of the site layout will also be considered. The placement of site buildings such as offices and stores will be used, where feasible, to provide noise screening when placed between the source and the receiver.

4.5.4 Liaison with the Public

A designated environmental liaison officer should be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

4.5.5 Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. While excavation or other high noise generating works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to prevent unacceptable disturbance at any time.

4.5.6 Monitoring

Where required, construction noise monitoring will be undertaken at periodic sample periods at the nearest noise sensitive locations to the development works to check compliance with the construction noise criterion.

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

5.0 OPERATIONAL PHASE

5.1 Plant Noise

The prevailing baseline noise levels have been reviewed so as to set an appropriate noise criteria.

Daytime measured noise levels in the residential areas at Glenamuck and Cairnbrook were in the range 39 to 43 dB L_{A90}. Therefore, with consideration of the criteria set out in Section 2.3.1, plant noise levels during the daytime should be designed so as not to exceed **39 dB L_{A90}** at nearby noise sensitive locations.

With respect to night-time plant noise levels, reference has been made to available EPA noise maps[1] in order to estimate an appropriate noise level for the contribution of proposed plant items.

Night-time noise levels for the area surrounding the site are limited and noise levels are estimated to be < 45 to 49 dB L_{night}. With reference to measured daytime noise levels it is considered appropriate that plant noise levels during the night-time should be designed so as not to exceed **35 dB L_{A90}** at nearby noise sensitive locations.

Taking into account the recommendation from BS 4142 that if the plant noise level does not exceed the background sound level it is an indication of a low impact, it is recommended in this instance that noise emissions from all plant installed on the development site (considered cumulatively) do not exceed the following background noise levels:

- Daytime (07:00 – 23:00hrs) – 39 dB $L_{A90,1hr}$
- Night-time (23:00 – 07:00hrs) – 35 dB $L_{A90,15min}$

It is understood that plant items serving the development will be located internally. The technology has not been selected at this stage however, typically plant items are installed in enclosed plant rooms, or within residential units themselves, therefore it is expected that noise emissions to atmosphere will be minimal. Plant items serving the proposed development will be designed such that he cumulative noise emissions will achieve the noise criteria set out above.

5.2 Additional Traffic on Surrounding Roads

The proposed development provides for 237 no. car parking spaces. Traffic data provided by the Traffic Consultant allows for assessment of any increase in traffic noise associated with vehicle movements to and from the proposed development.

Traffic flows associated with the operational phase of the proposed development have been provided by Waterman Moylan. The relevant table from the Transportation Assessment has been reproduced overleaf.

[1] Source: https://gis.epa.ie/EPAMaps/

Assessed Road Junction	Opening Year 2025 Do Nothing	Opening Year 2025 Base Plus Development	Calculated Change in Noise Levels, dB
	Total Vehicles (AADT)	Total Vehicles (AADT)	
Glenamuck Rd Junction 4 North	10,510	11,264	+0.3
Glenamuck Rd Junction 4 South	9,991	10,126	+0.1
Cairnbrook Access to Proposed Development	725	1,615	+3.5
Glenamuck Rd Junction 5 North	9,777	9,912	+0.1
Glenamuck Rd Junction 5 South	9,573	9,708	+0.1
Glenamuck Rd Junction 4 North	463	463	0.0

Table 14 Calculated Increase in Traffic Noise Along Surrounding Roads Base Year

Assessed Road Junction	Opening Year+5 2030 Do Nothing	Opening Year+5 2030 Base Plus Development	Calculated Change in Noise Levels, dB
	Total Vehicles (AADT)	Total Vehicles (AADT)	
Glenamuck Rd Junction 4 North	11,242	11,996	+0.3
Glenamuck Rd Junction 4 South	10,679	10,814	+0.1
Cairnbrook Access to Proposed Development	786	1,676	+3.3
Glenamuck Rd Junction 5 North	10,447	10,583	+0.1
Glenamuck Rd Junction 5 South	10,226	10,361	+0.1
Glenamuck Rd Junction 4 North	502	502	0.0

Table 15 Calculated Increase in Traffic Noise Along Surrounding Roads Opening Year+5

Assessed Road Junction	Opening Year+15 2040 Do Nothing	Opening Year+15 2040 Base Plus Development	Calculated Change in Noise Levels, dB
	Total Vehicles (AADT)	Total Vehicles (AADT)	
Glenamuck Rd Junction 4 North	11,683	12,437	+0.3
Glenamuck Rd Junction 4 South	11,093	11,229	+0.1
Cairnbrook Access to Proposed Development	823	1,713	+3.2
Glenamuck Rd Junction 5 North	10,851	10,986	+0.1
Glenamuck Rd Junction 5 South	10,619	10,755	+0.1
Glenamuck Rd Junction 4 North	525	525	0.0

Table 16 Calculated Increase in Traffic Noise Along Surrounding Roads Opening Year+15

With reference to the calculations above, the predicted increase in noise level associated with traffic going to and from the proposed development on the Glenamuck Road would be less than +1 dB. With reference to Table 6, this represents an imperceptible change and therefore a negligible impact.

The predicted increase in noise level associated with traffic going to and from the proposed development in Cairnbrook estate would be in the range of +3 to +4 dB, representing a perceptible change with minor impact.

5.3 Noise from Creche

The nearest noise sensitive receivers to the creche play area, outside of the proposed development, are located some 40m to the west.

Measurement of noise levels generated by children playing outdoors at several creches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,1hr}$ at distance of 5 metres.

At the larger distances to the nearest NSLs outside the site, noise levels from the creche are predicted to be below the criterion set out in Section 2.3.4 and therefore no significant impact is predicted in association with this noise source.

6.0 CONCLUSION

Planning Permission is being sought for a proposed residential development at the lands at Carrickmines Great, Glenamuck Road South, Dublin 18. The proposal consists of the demolition of existing buildings on site and the provision of 167 no. residential units (comprising of 69 no. houses and 98 no. apartments), a childcare facility, open space, roads infrastructure and all associated development.

A baseline noise survey has been undertaken at the development site to determine the existing environment.

The potential impact during the short-term construction phase has been assessed. Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that whilst there are a small number of residential properties in close proximity to the site boundary, the nature of the construction activities for the majority of the construction phase will involve standard house construction techniques which can operate within the construction noise thresholds. Best practice control measures will be employed on site to control noise emissions outside of the site through the use of site hoarding, localised screening, scheduling of works, maintenance of plant items etc. Vibration impacts during the construction phase are not significant.

Once operational, it is expected that noise emissions will be limited to noise associated with traffic coming to and from the development and plant items serving to the development. With reference to the Transportation Assessment prepared for the scheme, traffic associated with the development is negligible to minor and associated noise levels are expected to be imperceptible to perceptible. Regarding plant noise, suitable noise thresholds have been assigned based on the measured noise levels on the site. During detailed design stage plant and noise mitigation options should be selected so that the noise emissions at nearby sensitive receptors do not exceed the recommended thresholds. Noise from the childcare facility has been assessed and determined that no significant impact at nearby houses outside the site will result as a result of this noise source.

Once the various best practice control measures during the construction phase are implemented on site, the overall noise and vibration impact during this phase will not be overly intrusive to cause a significant impact.

There are no significant impacts associated with the operational phase.

APPENDIX A
GLOSSARY OF ACOUSTIC TERMINOLOGY

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

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

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

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

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

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

L_{AFN} — The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

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

L_{AF10} — Refers to those A-weighted noise levels in the upper 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting.

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

PPV — Peak Particle Velocity (PPV) is defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is measured in mm/s.