CHAPTER 10:

NOISE AND VIBRATION

10

CHAPTER CONTENTS

10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report assess the potential noise and vibration impacts associated with the proposed development at 1 North Wall Quay, Dublin 1.

The Proposed Development comprises the demolition of the existing office building and the construction of a new 17 storey landmark office development over 2 no. levels of basement with an overall gross floor area of c. 87,244 sq. metres.

A full description of the development can be found in Chapter 2.

This chapter considers both the noise and vibration impacts associated with the short-term construction phase and the long-term operational phase impacts on the surrounding environment. 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

10.2.1 Assessment Overview

This impact assessment has been undertaken using the following methodology:

- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- A baseline noise survey has been undertaken surrounding the development site to establish the prevailing noise environment across the site and at the nearest noise sensitive locations (NSLs). Review of published noise maps in the vicinity of the proposed development site have been reviewed to provide further baseline noise data to describe the prevailing noise environment.
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the proposed development at the nearest NSLs to the site;
- Predictive calculations have been performed to assess the potential effects associated with the operation of the proposed development at NSLs surrounding the site; and
- An assessment has been completed of potential cumulative effects that may arise as a result of the proposed development and other existing or proposed plans and projects;

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out in the following sections. In addition to specific noise and vibration guidance documents, the Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022) were considered and consulted in the preparation of this Chapter.

10.2.2 Assessment Criteria – Construction Phase

There are no statutory standards in Ireland relating to noise and vibration limit values for construction works or for environmental noise relating to the operational phase. In the absence of specific statutory Irish guidelines, the assessment has made reference to non-statutory national guidelines, where available, in addition to international standards and guidelines relating to noise and / or vibration impact for environmental sources.

Dublin City Council typically control construction activities by imposing limits on the hours of construction and recommended construction noise limits based on a risk based approach which considers the nature and extent of the works and the surrounding environment. Construction noise sources include construction plant and machinery and construction related traffic on surrounding roads. Reference is made to the following guidelines and standards to inform the most appropriate construction noise and vibration significance thresholds and assessment methodologies:

- Dublin City Council's (DCC) "Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition" (hereinafter referred to as DCC GPG)
- British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +A1 2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228–1) (BSI 2014a);
- BS 5228-2:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228 – 2) (BSI 2014b);
- BS 7385: 1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as BS 7385–2). (BSI 1993);
- BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting (hereafter referred to as BS 6472–1) (BSI 2008);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability and Environmental Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA 2020); and
- International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation (hereafter referred to as ISO 9613 – 2) (ISO 1996).

10.2.2.1 Construction Noise Criteria

The proposed Project has been classed as a high-risk category site based on the DCC GPG risk assessment factors as detailed below:

- Duration of the works;
- Distance to NSLs;
- Ambient noise levels;
- Site operating hours;
- Location of works;
- Duration of demolition, and

- Intrusive noise activities, including vibration generating activities.

The duration, nature and extent of construction activities associated with the Construction Phase of the proposed Project would categorise it within the high-risk category. The monitoring section (S.6) of the DCC GPG document notes the following for high-risk category sites: -

'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.'

British Standard BS 5228 – 1: 2009+A1:2014 – ABC Method

The ABC method detailed in Paragraph E.3.2 of BS 5228 – 1 (BSI 2009 +A1 2014a) designates a noise-sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities, depending on context.

This document sets out guidance on Construction Noise Thresholds (CNTs) relative to the existing noise environment. Residential and Other Noise Sensitive Receptors

Table 10.1 sets out the threshold values which, when exceeded, signify a potential significant effect at the facades of residential receptors as recommended by BS5228-1:2009+A1:2014.

Residential and Other Noise Sensitive Receptors

Table 10.1 *Example CNT of Potentially Significant Effect at Dwellings*

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

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

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

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

It should be noted that this assessment method is only valid for residential properties and if applied to commercial premises without consideration of other factors may result in an excessively onerous thresholds being set.

Commercial Receptors

BS 5228--1:2009+A1:2014 gives several examples of acceptable limits for construction noise, the most simplistic being based upon the exceedance of fixed noise limits. Section E.2 notes

"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".

Given the environment in which the site is located and the nature and proximity of the surrounding building uses, the following construction noise thresholds (CNT) are proposed for the development:

- Residential Unit North and east of site: 65 dB LAeq,T
- All other locations (offices and commercial buildings): 75 dB LAeq,T

Exceedance of the above CNTs are deemed to result in a potentially significant effect, depending on the duration or the impact and margin above the threshold level is calculated.

10.2.2.2 Significance of Construction Noise Levels

In order to assist with interpretation of significance, **Table 10.2** includes guidance as to the likely magnitude of noise impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of *Design Manual for Roads and Bridges (DMRB), LA111 Noise and Vibration: Highways England, Transport Scotland, The Welsh Government and The Department of Infrastructure, May 2020* (DMRB 2020) and adapted to include the relevant significance effects from the EPA *Guidelines* on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022) using professional expertise and judgment.

In accordance with the DMRB Noise and Vibration (UKHA 2020), construction noise and construction traffic noise impacts shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

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

Table 10.2 *Construction Noise Significante Ratings*

Location	DMRB Magnitude of Impact	EPA Mapped Impacts	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration & baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate Note 1	
Above CNT and below or equal to CNT +5dB	Moderate	Moderate	
Above CNT +5 and below or equal to CNT +15dB Note 2	Major	Significant, to Very Significant	
Above +15dB		Very Significant to Profound Note 3	

Note 1: CNLs at the upper end of this range will result in higher potential impacts, therefore this range is `categorised as slight to moderate, acknowledging that values approaching the CNT are greater than slight. In accordance with DMRB, noise levels below the CNT are deemed 'Not Significant'.

Note 2: The DMRB does not distinguish beyond a 'Major' impact. For the purposes of distinguishing a Very Significant and Profound Impact, CNLs exceeding the CNT by +20dB are categorised as Profound.

The adapted DMRB Noise and Vibration (UKHA 2020) guidance is used to assess the overall significance of construction noise at NSLs across the proposed Project.

10.2.2.3 Construction Vibration Criteria

Vibration standards are generally split into two categories, those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

Building Response

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- British Standard BS 7385-2:1993 Evaluation and Measurement for Vibration In Buildings - Guide to Damage Levels from Ground Borne Vibration, and;
- British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Vibration.

BS7385:1993 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50 % or less for more critical buildings.

BS7385-2 and BS5228-2 advise that, for soundly constructed residential properties and similar light-framed 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 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above for transient vibration. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table B.2 of BS5228-2 might need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges. For buildings or structures that are structurally unsound, lower vibration magnitudes will apply, typically 50% of those for structurally sound buildings. Protected or historic buildings are not automatically assumed to be more vulnerable to vibration unless they have existing structural defects. The values are summarised in **Table 10.3**.

Table 10.3 Transient Vibration Threshold values for Buildings

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Unreinforced or light framed structures.	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

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential or light commercial buildings.		
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s	

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.

BS 5228-2 and BS 7485-2 state that minor structural damage can occur at vibration magnitudes greater than twice those in **Table 10.3** and major structural damage can occur at vibration magnitudes greater than four times those in **Table 10.3.**

Human Response

Humans are sensitive to vibration stimuli, and perception of vibration at magnitudes significantly lower than those related to building response may cause concern to building occupants. BS5228-2 (BSI 2014b) notes that vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. Higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin of vibration is known.

Table 10.4 presents the significance table relating to potential effects to building occupants during construction based on guidance from BS5228-2 the DMRB Noise and Vibration (UKHA 2020) document and the associated EPA EIAR significant ratings.

Table 10.4 *Guidance on effects of human response to PPV magnitudes*

PPV range	BS 5228-2 (Note A, B, C)	DMRB Impact Magnitude	EPA Significance Ratings
≥10 mm/s PPV	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.	Very High	Very Significant
≥1 mm/s PPV	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	High	Moderate to Significant
≥0.3 mm/s PPV	Vibration might be just perceptible in residential environments.	Medium	Slight to Moderate
≥0.14 mm/s PPV	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.	Low	Not significant to Slight
<0.14 mm/s PPV	Not perceptible	Very Low	Imperceptible to Not significant

Notes from BS5228-2

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 (BS1 2008), 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.

10.2.2.4 Construction Traffic Noise Criteria

Vehicular movement to and from the construction site for 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 DMRB Noise and Vibration (UKHA 2020) and the EPA EIAR Guidelines (EPA, 2022). For construction traffic, due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the 'short term' period in accordance with the DMRB Noise and Vibration (UKHA 2020) document.

Table 10.5 sets out the classification of changes in noise level to impact on human perception based on the guidance contained in these documents.

Table 10.5 *Classification of Magnitude of traffic noise changes for Construction Traffic*

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant
3 – 4.9	Perceptible	Moderate	Slight, Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

10.2.3 Operational Phase Assessment Criteria

The main potential source of outward noise from the proposed development will be limited to traffic flows to and from the development site onto the public roads and mechanical and electrical plant required to service the new office buildings. The relevant guidance documents used to assess potential operational noise and vibration impacts on the surrounding environment are summarised below.

- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (hereafter referred to as BS 8233) (BSI 2014c);
- BS 4142: 2014 +A1 2019 Methods for Rating and Assessing Industrial and Commercial Sound (hereafter referred to as BS 4142) (BSI 2019);
- ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as ISO 1996 – 1) (ISO 2016);

- The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as the CRTN) (UK Department of Transport 1988).
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability and Environmental Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA 2020);
- International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation (hereafter referred to as ISO 9613 – 2) (ISO 1996);

10.2.3.1 Building Services Plant Noise

Building services required for ventilation, heating or other active process have the potential to emit noise to the surrounding environment. For the proposed development these items of plant have the potential to operate on a 24/7 basis depending on the end users in different areas of the building. To assess any noise impacts from these sources, reference is made here to the British Standard BS 4142 (BSI 2019).

Dublin City Council (DCC) refer to the BS 4142 document as a means of controlling noise emissions from new developments. Typical planning conditions relating to the control of noise from new commercial development state the following:

Noise levels from the proposed development shall 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 place. 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 areas.

The method of assessing plant noise set out in BS 4142 (BSI 2019) 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.

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 receptors.

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 (as referred to in BS 4142 (BSI 2019)), depending on the context.

For office and commercial areas within and external to the proposed development, acceptable noise levels both internally and externally, can be determined by referring to the British Standard BS 8233 (BSI 2014c). The following guidance, summarised in **Table 10.6**, is provided in this standard for internal ambient noise levels in the spaces noted.

Table 10.6 *Guidance on Indoor Ambient Noise Levels for Development Building*

Activity	Location	Internal Noise Design Range	Derived External Levels
Office	Executive office	35 – 40 dB $L_{Aeq, T}$	50 – 55 dB $L_{Aeq, T}$
	Open Pan	45 – 50 dB $L_{Aeq, T}$	60 – 65 dB $L_{Aeq, T}$
	Staff areas/ meeting rooms	35 – 45 $L_{Aeq, T}$	50 – 65 dB $L_{Aeq, T}$
Commercial Spaces	Shops, cafes, etc	50 – 55 $L_{Aeq, T}$	65 – 70 L_{Aeq}

The derived external levels are based on the approximate attenuation provided by a partially open window of 15 dB, as advised in BS 8233 (BSI 2014c), and represent the appropriate noise level at the external façade of the building. For mechanically ventilated buildings, higher external noise levels will achieve the same internal noise levels with closed windows.

10.2.3.2 Additional Traffic on Surrounding Roads

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 DMRB Noise and Vibration (UKHA 2020) and the EPA Guidelines (EPA, 2022).

Table 10.7 relates to changes in noise to impact on human perception based on the guidance contained in these documents.

Table 10.7 *Classification of magnitude of changes in traffic noise 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	Not Significant to Slight
5 – 9.9	Up to a doubling of loudness	Moderate	Slight to Moderate

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Long-term)	EPA Significance of Effect
10+	Doubling of loudness and above	Major	Significant to Very significant

10.2.3.3 Operational Phase – Vibration

The development is commercial and mixed use in nature. There are no vibration sources associated with the proposed development, therefore there are no outward impact associated with vibration for the operational phase, and accordingly such impacts have been scoped out.

10.2.4 Forecasting Methods and Difficulties Encountered

Construction noise calculations have been conducted generally in accordance with BS 5228: 2009+A1:2014: *Code of practice for noise control on construction and open sites - Noise.*

Prediction calculations for building services noise, car park activity and vehicle movements on site have been conducted generally in accordance with ISO 9613 (1996): *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation.*

No difficulties were encountered in the preparation of this chapter

10.3 RECEIVING ENVIRONMENT

The site is bound by North Wall Quay to the south and Commons Street to the west. Existing commercial and residential buildings adjoin the site to the north and east. Clarion Quay runs immediately adjacent to the northern boundary of the site.

The nearest noise sensitive locations (NSLs) have been identified as residential units to the north of the proposed development along Alderman Way and Clarion Quay, residential units to the east of the development along Clarion Quay and Excise Walk and commercial units to the north and west of the proposed development along Common Street.

An environmental noise survey has been conducted 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*. The following section reviews the existing noise environment surrounding the site.

10.3.1 Baseline Noise Survey

10.3.1.1 Monitoring Locations

Four attended noise measurements were conducted at Locations AT1, AT2, AT3 and AT4. **Figure 10.1** indicates the noise monitoring locations surveyed. The survey locations are described below.

Figure 10.1 Noise Monitoring Locations (Background Imagery Google earth, Red Line Indicative)

AT1 Located along the west site boundary outside a commercial office building. This location was chosen to represent noise levels to the west of the building.

AT2 Located along the northern site boundary, an attended noise survey was undertaken at this location outside a residential apartment building.

AT3 Located along the northeastern site boundary, an attended noise survey was undertaken at this location to measure noise levels of the eastern side of the building representing the rear facades of the adjacent apartment buildings to the east.

AT4 Located along the southern site boundary, an attended noise survey was undertaken at this location to measure noise levels along the quay side boundary.

10.3.1.2 Monitoring Equipment

AWN personnel conducted all noise measurements. Attended noise measurements were undertaken using a Larson Davis LxTI sound level meter (S/N 6260). The measurement apparatus was check calibrated both before and after each survey using a Brüel & Kjær (4231) Sound Level Meter Calibrator.

10.3.1.3 Survey Periods

Attended noise measurements were conducted at Locations AT1, AT2, AT3 and AT4 between 11:00 hrs and 15:00 hrs 29 August 2023

Survey periods for all measurements were 15 minutes. The measurements represent typical periods that were selected in order to provide a snapshot of the existing noise climate.

10.3.1.4 Noise Measurement Parameters

The 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. It is typically used as a descriptor for ambient noise.

L_{AFMax} is the maximum sound level that is exceeded during the survey period measured using fast weighting of 1 second.

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

10.3.1.5 Noise Survey Results

Location AT1

The survey results for Location AT1 are presented in **Table 10.8**.

Table 10.8 Summary of Survey Results for Location AT1

Date / Time (hrs)		Measured Noise Levels (dB re. 2x10-5 Pa)			
		LAeq.15min	LAmax	LA10,15min	LA90,15min
29/08/2023	11:00	67	88	70	55
	12:12	66	83	70	55
	13:30	66	85	69	56

Road traffic passing along the adjacent road was the main source observed during the survey. Construction noise was audible in the background during the first and second measurement period. Ambient noise levels were in the range of 66 to 67 dB $L_{Aeq,15min}$ with background noise levels (i.e. L_{A90} values) in the range of 55 to 56 dB $L_{A90,15min}$.

Location AT2

The survey results for Location AT2 are presented in **Table 10.9**

Table 10.9 Summary of Survey Results for Location AT2

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
		$L_{Aeq.15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
29/08/2023	11:17	58	74	60	55
	12:30	58	73	59	56
	13:47	59	80	60	56

Local road traffic along the adjacent road was the main sources observed during the survey. Construction activity was audible at low level during the first and second measurement period. During the third measurement period delivery vehicles passing along the adjacent road were source of the maximum noise level. Ambient noise levels were in the range of 58 to 59 dB $L_{Aeq,15min}$ with background noise levels (i.e. L_{A90} values) in the range of 55 to 56 dB $L_{A90,15min}$.

Location AT3

The survey results for Location AT3 are presented in **Table 10.10**.

Table 10.10 Summary of Survey Results for Location AT3

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
		$L_{Aeq.15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
29/08/2023	11:36	61	81	63	55
	12:47	61	76	63	55
	14:04	60	82	62	55

Local road traffic along the adjacent road was the main sources observed during the survey. Construction activity was audible at low level during the first and second measurement period. Ambient noise levels were in the range of 60 to 61 dB $L_{Aeq,15min}$ with background noise levels (i.e. L_{A90} values) in the range of 55 to 55 dB $L_{A90,15min}$.

Location AT4

The survey results for Location AT4 are presented in **Table 10.11**.

Table 10.11 Summary of Survey Results for Location AT4

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
		$L_{Aeq.15min}$	L_{Amax}	$L_{A10,15min}$	$L_{A90,15min}$
29/08/2023	11:55	69	89	72	58
	13:06	68	74	71	58
	14:24	68	85	71	57

Road traffic and Pedestrian noise were the main sources observed during the survey. During the first measurement period buses passed nearby to the monitoring location. Ambient noise levels were in the range of 68 to 69 dB $L_{Aeq,15min}$ with background noise levels (i.e. L_{A90} values) in the range of 57 to 58 dB $L_{A90,15min}$.

10.3.2 Review of Noise Maps

A desktop review of publicly available data has been undertaken to further characterise the baseline noise environment in the study area. Reference has been made to the most recent Round 4 noise maps published by the Environmental Protection Agency (EPA) (http://gis.epa.ie) for road traffic and rail noise within the Dublin Agglomeration. The published noise maps are provided for the overall day-evening-night period in terms of L_{den} and the L_{night} parameters. For the purposes of this report, the mapped night-time noise levels are presented here. The L_{night} parameter is defined below:

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The eight-hour night-time period is between 23:00hrs and 07:00hrs.

Figure 10.2 presents the mapped agglomeration noise levels in the vicinity of the development site. For this site, the mapped noise levels relate to road traffic noise.

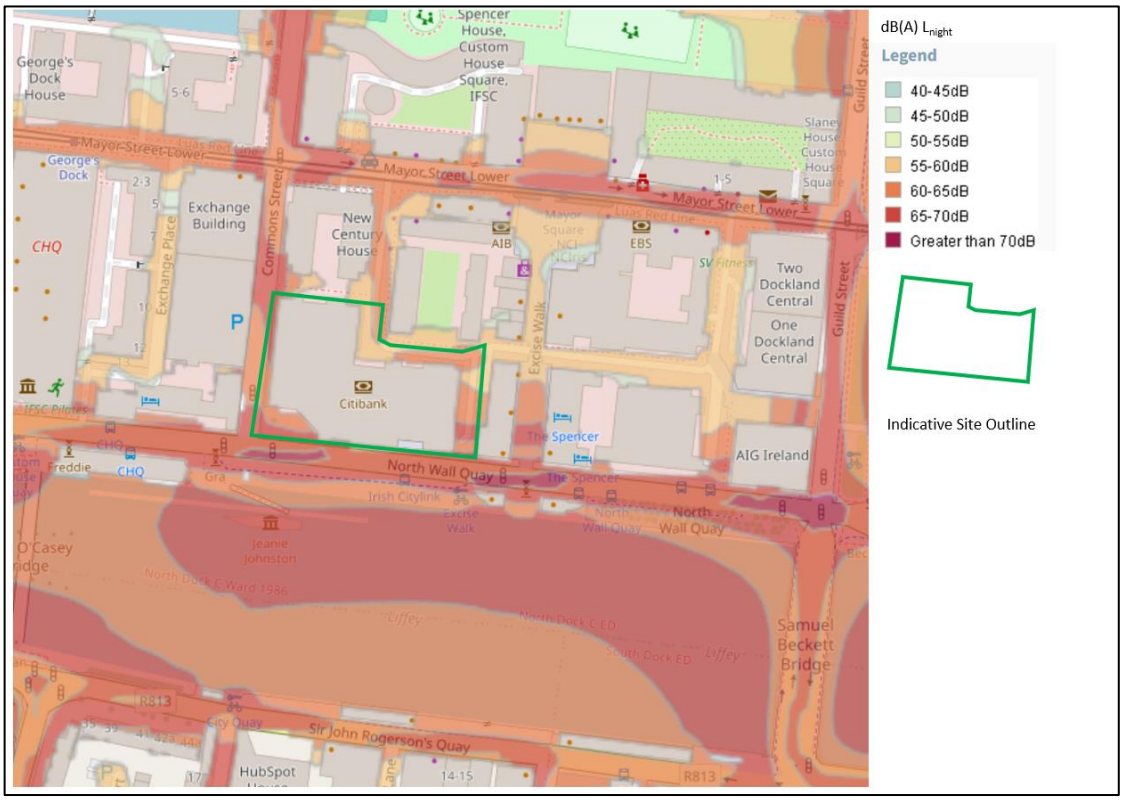

Figure 10.2 *Mapped L_{night} Traffic Noise Level (Source: http://gis.epa.ie)*

Night-time noise levels surrounding the site is dominated by traffic along the local road networks including North Wall Quay, Commons Street and Mayor Street Lower. Noise levels are mapped in the range of 55 to 60 dB L_{night} along Clarion Quay on the northern and eastern site boundaries. Noise levels to the south and west of the site along Common Street and North Wall Quay are mapped within the 60 to 65 dB L_{night} contour.

10.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The information presented in this section is informed by the project design, but it is not a complete description of the Proposed Development. Therefore, it should be read in conjunction with the full development package. For a more comprehensive understanding of the Proposed Development, please refer to Chapter 2 (Description of the Proposed Development) of the EIA Report. Chapter 2 provides a detailed overview of the lifecycle of the project, including reference to the architectural and civil engineering, drawings, plans, reports, and other relevant document in order to define the proposed development.

When considering a development of this nature, the potential noise and vibration impact on the surroundings are considered for each of two distinct stages:

- Construction Phase; and
- Operational Phase

10.4.1 Construction Phase

During the short-term construction phase, construction works will involve demolition of the existing building, basement excavation, basement slab construction, concrete works, steel works and construction of the superstructure and fit out works. In addition to the construction activities on site there will be construction traffic including movement of machinery and materials within and to and from the construction site.

A variety of items of plant will be in use during these construction work all of which have the potential to generate high levels of noise potential levels of perceptible vibration. These will include breakers, excavators, loaders, cranes and static plant such as generators, compressors and pumps.

10.4.2 Operational Phase

Once operational the potential noise sources associated with the development relate to any external operational mechanical and electrical plant items required to serve the building uses These are likely to include water pumps, air handling systems, condensers, etc. Depending on the operational hours and occupancy of the various spaces within the building, some of these will operate on a 24/7 basis depending on the specific use. The location of external plant items with potential to emit noise to the surrounding environment are located on various roof levels of the proposed development and enclosed at basement level.

Traffic flows to and from the development via public roads have the potential to increase the surrounding noise environment. The vehicular site access to the proposed development is located along Clarion Quay. The development will include 32 no. carparking spaces, with 30 spaces located internally at basement level -1.

10.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

10.5.1 Construction Phase

10.5.1.1 Construction Plant and Equipment Noise

The highest potential noise and vibration impact of the proposed development will occur during the construction phase due to the different phases of work requiring a

range of construction plant and equipment with high noise levels. The Proposed Development is anticipated to be completed over a 3.5 year period. The demolition phase duration is approximately 6 months, and the construction phase including basement excavations, structural works and fit out duration is approximately 36 months for construction. The overall construction phase is less than 7 years and hence is categorised as a short-term impact. Specific phases of work will occur over a number of months and less than 1 year and hence are described as temporary impacts, where relevant.

The nearest NSLs to the site are residential units along the northern and eastern boundaries and commercial units to the northern and western boundaries. The relevant NSLs are outlined below and highlighted within Figure 10.2:

- NSL 1: Residential Units to the North and North- East of the site (15m)
- NSL 2: Residential Units to the East of the site (15m)
- NSL 3: Commercial Units to the North of the site (15m)
- NSL 4: Commercial Units to the East of the site (15m)

Figure 10.2 Noise Sensitive Locations (Background Imagery Google earth, Red Line Indicative)

The construction phase is highly transient in nature and involves a number of various stages which will encompass a range of different activities on a day to day and week to week basis. Given the transient nature of the works it is not possible to calculate with a high degree of accuracy the specific levels of noise associated with each stage. The construction stage will be undertaken over a number of stages from demolition, ground excavation through to building construction and internal fit out. In terms of the

potential noise and vibration impacts, the key stages and activities are expected to involve:

- Building Demolition;
- Piling and Basement excavation;
- Foundation construction;
- Site Services Installations (drainage, power, water)
- Construction of building frame and envelope; and
- Fit out of interior and exterior landscaping

The impact at nearby NSLs will depend upon a number of variables, the most notable of which are:

- the amount of noise generated by plant and equipment being used at any one time, expressed in terms of sound pressure or sound power;
- the periods of operation of the plant at the development site, known as the "on-time";
- the distance between the noise source and the receptor; and
- the attenuation due to ground absorption or barrier screening effects from walls, buildings, site hoarding etc.

Indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228-1. This standard sets out sound power / sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels. These have been used to derive typical construction noise levels associated with different phases of work.

Demolition and Piling

It is proposed that the existing 6-storey building will be demolished utilising a system of back-propping and mini-pulverisers (Brokk or similar). The existing building would be back-propped to allow the pulveriser to locally demolish the structure carefully.

To construct the new pile wall to facilitate the proposed 3no. floors below ground level, it is anticipated that the existing basement will be backfilled with demolition material to work as a piling mat. It is anticipated that the existing concrete structure will be piled through with rotary cored piles and back filled with stone or lean-mix concrete.

For construction works associated with such activities as rotary piling and demolition works including pulverisers and concreting works etc. noise levels are typically in the range of 80 to 85 dB L_{Aeq} at 10m. A total construction noise level of 90 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations for these activities representing a variety of plant items and activities over this stage. This would include, for example three items of plant at 83 dB L_{Aeq} and two items of plant at 80 dB L_{Aeq} operating simultaneously within one work area resulting in a total noise level of 90 dB L_{Aeq}.

Utilities and Structural Works, Basement Excavation, Retaining Structures, Basement Foundation and Concreting Works

For construction works associated with activities such as mechanical excavation, basement construction and structural works including excavators, loaders, dozers, cranes, generators, and concreting works etc. noise levels are typically in the range of 70 to 80 dB L_{Aeq} at 10m. Rock breaking may be required at the lower basement levels

where is likely to be present from 10+ below ground level. This will be confirmed during site investigations which will take place post-demolition Given the depth of excavation at which this activity will occur the noise levels discussed above are also relevant for this activity at surface level due to the screening effect.

For ongoing construction activity associated with the above activities, a total construction noise level of 85 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations for these activities representing a variety of plant items and activities over this stage. This would include, for example two items of plant at 80 dB L_{Aeq} and three items of plant at 75 dB L_{Aeq} operating simultaneously within one work area resulting in a total noise level of 85 dB L_{Aeq}.

Superstructure and Lower Noise Activities

For construction work areas with lower noise levels such as those associated with superstructure works including site compounds (for storage, offices and material handling, generators etc.), smaller items of mobile plant (excavators, cranes, dozers), landscaping and concreting works with lower noise emissions, a total construction noise level of 78 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations. This would include, for example one item of plant at 75 dB L_{Aeq} and three items of plant at 70 dB L_{Aeq} operating simultaneously within a work area.

Indicative Construction Noise Calculations at Varying Distances

The closest NSLs to the proposed development are directly adjacent to the site boundaries to the north, east and west within 15 to 20m, with other buildings at distances beyond 25m and screened by the immediately adjacent buildings.

The calculations assume that plant items are operating for 66% of the time. For the purpose of the assessment, due to the height of the existing receptors at upper floor levels, calculations do not include any screening attenuation from basic site hoarding.

Table 10.12 presents the calculated noise levels at the closest NSLs along the boundary of the site. To represent the various working distances and ground level of activities that will take place from all boundaries, noise levels are calculated at various distances from the site. The works are likely to be transient in nature and noise levels will vary as they increase or decrease in distance from NSLs.

Table 10.12 *Indicative Construction Noise Calculations at Distances*

Construction Activity	Cumulative Predicted Construction Noise Level at a Specific Distance (dB $L_{Aeq,T}$)					
	15m	25m	40m	80m	100m	Daytime CNT $L_{Aeq,T}$ (dB)
Demolition and Piling	85	80	76	70	68	65
Structural Works: (basement excavation, foundation and concrete works)	80	77	71	65	63	65
General Construction: (superstructure works, fit out)	73	68	64	58	56	65

Reference to 10.12 indicates that during the most intrusive early stage activities relating to demolition and piling works the CNT has the potential to be exceeded when works are occurring up to 100m from NSLs without mitigation. The calculated noise level in this table will not occur during all periods of these construction phases as there will be periods where the assumed plant items (i.e. pulverisers, piling rigs etc) will not be in operation or will be in use for intermittent periods of time. In this regard, the noise levels presented here are considered a reasonable worst case scenario.

During structural works including those associated with basement excavation and foundation works the CNT has the potential to be exceeded when works are typically occurring within 80m of NSLs without mitigation.

Once the most intrusive ground works have been completed on site, noise levels associated with the general construction of the superstructure will be significantly reduced. During this phase the CNT has the potential to be exceed up to 40m at the closest NSLs without mitigation.

Overall, a ***negative***, ***very significant to profound*** and ***temporary*** potential impact is forecast as a worst case for the closest residential NSLs to the construction boundary during the most noise intrusive activities relating to demolition and piling. However, the highest noise levels predicted relating to the demolition phase are only likely to occur for a maximum of 6 months within the working hours outlined within the construction management plan.

For the structural construction works the predicted noise levels will result in a ***negative***, ***moderate to significant*** and ***short term*** potential impact. The impact will reduce to within the CNT whilst works are taking place further into the site at distances beyond 80m during these works the predicted impact is likely to be ***negative, slight to moderate*** and ***short term.***

During the general construction phases relating to the superstructure the predicted impact will be ***negative, moderate*** *and* ***short term***, reducing to ***negative***, ***slight to moderate*** and ***short term*** beyond 25m from the construction works.

Noise mitigation measures will be required to reduce construction noise levels along all boundaries.

10.5.1.2 Construction Phase Traffic Noise

During the construction phase, traffic associated with the proposed development would consist of a mix of Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs) travelling to and from the site. Chapter 12 (Traffic and Transportation) includes information relating to traffic generated and traffic management during this phase.

HGV traffic to and from the site will follow a designated route, ensuring that heavy construction vehicles avoid sensitive streets to the greatest extent possible and travel as little as possible within the city centre.

The major construction items include demolition, excavation, construction, and fit out. HGV construction traffic to and from the site shall reach a peak during reduced level excavation, which will require the removal of spoil from the site. Under a ‘worst-case’ scenario, however, it is possible that up to 4 no. such HGV trips may be made to the site each hour (one HGV arrival and one HGV departure every 15 minutes).

In addition to HGV traffic, periodic deliveries of materials to site shall be made by LGVs. To the extent possible, these shall be scheduled to take place outside of the background peak traffic hours. For the purposes of estimating a worst-case construction traffic generation scenario, 6 LGV arrivals and 6 LGV departures are assumed in each of the background peak hours.

For the purposes of assessing the potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the proposed development, given that traffic from the development will make use of the existing road network. Figure 10.3 illustrates the road links assessed and highlights the proposed vehicular access during the construction phase.

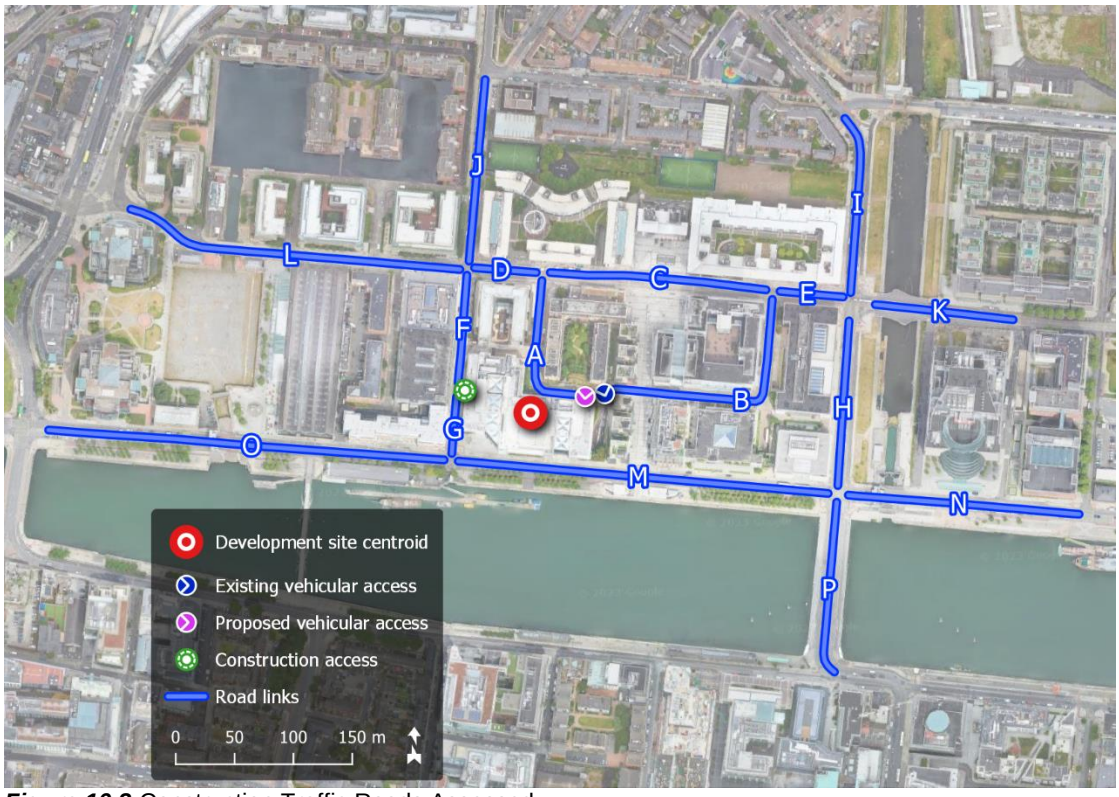

Figure 10.3 Construction Traffic Roads Assessed

Peak hour traffic flows have been factored over an Annual Average Daily Traffic (AADT) period by the traffic engineers to allow comparison against a typical daytime period. Traffic data along the adjacent roads and junctions where traffic will travel from the site for the assumed construction year of 2026 have been reviewed to calculate the change in traffic noise. Traffic flows during both the Do Nothing Scenario and the Do Something Construction Worst Case scenario for 2026 have been reviewed to calculate the change in traffic noise. **Table 10.13** presents the results of this assessment. The calculations take account of the LGV and HGV traffic associated with each scenario.

Table 10.13 *Construction Traffic Noise Impacts*

Road Link	AADT (Do Nothing)	AADT (Do Something)	Change in Noise Level, dB
Link A - Clarion Quay (west of proposed development access)	853	631	-0.8

Road Link	AADT (Do Nothing)	AADT (Do Something)	Change in Noise Level, dB
Link B Clarion Quay (east of existing development access)	1,185	963	-0.7
Link C - Mayor Street Lower (between Clarion Quay Junctions)	1,685	1,701	0.0
Link D - Mayor Street Lower (between Commons Street and Clarion Quay)	2,110	1,904	-0.3
Link E - Mayor Street Lower (between Guild Street and Clarion Quay)	2,241	2,035	-0.3
Link F - Commons Street (between North Wall Quay and construction access)	4,648	4,607	0.0
Link G - Commons Street (between North Wall Quay and construction access)	4,980	5,015	+0.5
Link H - Guild Street (between Mayor Street and North Wall Quay)	13,181	13,106	0.0
Link I - Guild Street (between Mayor Street and Sherriff Street Upper)	10,075	9,960	0.0
Link J - Commons Street (between Mayor Street and Sherriff Street Lower)	4,497	4,442	0.0
Link K - Mayor Street Upper (east of Guild Street)	2,076	2,059	0.0
Link L - George's Dock (west of Commons Street)	2,120	2,120	0.0
Link M - North Wall Quay (between Commons Street and Guild Street)	14,564	14,615	0.1
Link N - North Wall Quay (between Guild Street and Park Lane)	11,963	12,022	+0.1
Link O - Custom House Quay (west of commons street)	13,572	13,550	0.0
Link P - Beckett Bridge (south of North Wall Quay)	17,648	17,576	0.0

The calculated change in traffic noise associated with the addition of construction related traffic is less than 1 dB (A) along all site access roads. Reference to Table 10.5 confirms the potential related impact is ***negative, imperceptible*** and ***short-term.***

10.5.1.3 Construction Phase Vibration

Ground Breaking / Rock Breaking Activities

The main potential source of vibration during the construction programme is associated with excavation activities into hard ground. The proposed building formation level and

basement slab of 11 to 12m below ground level will require made ground and overburden to be excavated down to basement level. During excavation below ground level in soil, there are no significant vibration sources expected due to the ground conditions.

As the depth to bedrock within the site has been established at approximately 10+ m below ground level, rock breaking may be necessary. This will be confirmed by site investigations post-demolition.

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

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

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 to 0.25 PPV (mm/s) at distances of 10 to 50m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.49 to 0.24 PPV (mm/s) at distances of 10 to 50m respectively. Whilst these measurements relate to a solid concrete slab, the range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity.

Vibration magnitudes associated with this activity are well below those associated with any form of cosmetic damage to buildings as per the guidance values in **Table 10.3**. In terms of human response, there is potential for a ***negative, moderate, brief impact*** for building occupants within 20m of this activity using a 6 Tonne Breaker or equivalent.

Piling

There is potential for vibration impacts during piling of the building perimeter and foundations.

For the purposes of this assessment, the expected vibration levels during piling, assuming augured or bored piles, 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 in line with the site conditions experienced at the proposed development site:

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

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the nearest off-site buildings (>15m from apartment buildings) will be orders of magnitude below those associated with building response or human response to vibration referred to in **Table 10.3**. and **Table 10.4**.

The predicted vibration effect during this phase of works is Neutral, Not Significant and Short Term.

10.5.2 Operational Phase

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, and mechanical and electrical plant used to service the buildings. The review of standards and guidelines in Section 10.2.1 will be used here to assess the potential impact of the proposed development during the operational phase.

10.5.2.1 Building Services Plant Noise

There will be a variety of mechanical and electrical (M&E) items required to serve the proposed development once it becomes operational. These are likely to include water pumps, air handling systems, condensers, etc. Depending on the operational hours and occupancy of the various spaces within the building, some of these will operate on a 24/7 basis depending on the specific use.

The M&E plant requirements for the building have not yet been progressed to detailed design stage, however indicative plant requirements and their location on site have been identified. The location of external plant items with potential to emit noise to the surrounding environment are located within the proposed plant areas located at roof level. All other plant items will be enclosed within basement plant areas.

The key design criteria for the proposed development for operational plant noise relates to the achievement of acceptable noise levels at NSLs adjacent to the site and to ensure an acceptable internal noise environment is achieved within the office areas of the proposed development. As the final specifics in terms of plant selection and operational noise levels has not yet been established, the choice, location and number of items during detailed design will be reviewed to control noise from the development.

BS 4142 (BSI 2019) sets out a method for assessing the impact of a new continuous noise source to a residential environment such as the plant items used to service the office and commercial elements from the proposed development. During the detailed design, the location and operation of plant items serving the building with potential to emit noise to the surrounding environment will be reviewed and operational noise levels determined at the closest sensitive façades, including the façade of the proposed development.

Based on a review of the baseline noise environment and the BS 4142 assessment methodology, cumulative plant noise associated with the development shall be designed to not exceed 45 dB $L_{Aeq,15min}$ at the façade of the closest residential buildings at night and do not contain audible tones at NSLs outside of the site. This is set to ensure no significant increase in the prevailing background noise level occurs at existing residential NSLs. At commercial facades, an operational noise limit of 50 dB $L_{Aeq,15min}$ is proposed.

The above limits are set to ensure the operational impact associated with plant items serving the proposed development are ***neutral, not significant*** and ***long-term***.

10.5.2.2 Traffic and Vehicle Noise

The vehicular site access to the proposed development is located along Clarion Quay. The development will include 32 no. carparking spaces, with 30 spaces located internally at basement level -1. Hence, most office staff will utilise alternative means of travel to the proposed development during the operational phase.

For the purposes of assessing the potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the proposed development, given that traffic from the development will make use of the existing road network.

Traffic data along the adjacent roads/ junctions highlighted in Figure 10.3 where traffic will travel from the site for the Do Nothing and Do Something scenarios in terms of the AADT have been reviewed to calculate the change in traffic noise The calculated change in noise levels during the Opening Year (2030) and Design Year (2045) are summarised in **Table 10.14** and **Table 10.15**

Table 10.14 *Operational Phase Traffic Noise Changes on Adjacent Roads Opening Year 2030*

Road Link	AADT (Do Nothing 2030)	AADT (Do Something 2030)	Change in Noise Level, dB
Link A - Clarion Quay (west of proposed development access)	915	978	+0.4
Link B Clarion Quay (east of existing development access)	1,268	1,331	+0.4
Link C - Mayor Street Lower (between Clarion Quay Junctions)	1,803	1,803	0.0
Link D - Mayor Street Lower (between Commons Street and Clarion Quay)	2,260	2,323	+0.2
Link E - Mayor Street Lower (between Guild Street and Clarion Quay)	2,396	2,459	+0.2
Link F - Commons Street (between North Wall Quay and construction access)	4,977	5,010	0.0
Link G - Commons Street (between North Wall Quay and construction access)	5,345	5,378	0.0
Link H - Guild Street (between Mayor Street and North Wall Quay)	14,075	14,099	0.0
Link I - Guild Street (between Mayor Street and Sherriff Street Upper)	10,775	10,812	0.0
Link J - Commons Street (between Mayor Street and Sherriff Street Lower)	4,814	4,846	0.0
Link K - Mayor Street Upper (east of Guild Street)	2,219	2,224	0.0
Link L - George's Dock (west of Commons Street)	2,267	2,267	0.0

Road Link	AADT (Do Nothing 2030)	AADT (Do Something 2030)	Change in Noise Level, dB
Link M - North Wall Quay (between Commons Street and Guild Street)	15,750	15,769	0.0
Link N - North Wall Quay (between Guild Street and Park Lane)	12,877	12,890	0.0
Link O - Custom House Quay (west of commons street)	14,703	14,719	0.0
Link P - Beckett Bridge (south of North Wall Quay)	18,849	18,875	0.0

Table 10.15 *Operational Phase Traffic Noise Changes on Adjacent Roads Design Year 2045*

Road Link	AADT (Do Nothing 2045)	AADT (Do Something 2045)	Change in Noise Level, dB
Link A - Clarion Quay (west of proposed development access)	994	1,057	0.4
Link B Clarion Quay (east of existing development access)	1,371	1,434	0.3
Link C - Mayor Street Lower (between Clarion Quay Junctions)	1,951	1,951	0.0
Link D - Mayor Street Lower (between Commons Street and Clarion Quay)	2,447	2,510	0.2
Link E - Mayor Street Lower (between Guild Street and Clarion Quay)	2,593	2,656	0.2
Link F - Commons Street (between North Wall Quay and construction access)	5,416	5,449	0.0
Link G - Commons Street (between North Wall Quay and construction access)	5,813	5,846	0.0
Link H - Guild Street (between Mayor Street and North Wall Quay)	15,208	15,232	0.0
Link I - Guild Street (between Mayor Street and Sherriff Street Upper)	11,639	11,676	0.0
Link J - Commons Street (between Mayor Street and Sherriff Street Lower)	5,237	5,269	0.0
Link K - Mayor Street Upper (east of Guild Street)	2,409	2,414	0.0
Link L - George's Dock (west of Commons Street)	2,455	2,455	0.0
Link M - North Wall Quay (between Commons Street and Guild Street)	17,354	17,373	0.0

Link N - North Wall Quay (between Guild Street and Park Lane)	14,244	14,257	0.0
Link O - Custom House Quay (west of commons street)	16,247	16,263	0.0
Link P - Beckett Bridge (south of North Wall Quay)	20,361	20,387	0.0

The calculated change in traffic noise associated with the addition of operational phase traffic is less than 1 dB (A) along the site access roads for both assessment years. Reference to **Table 10.7** confirms the potential related impact is ***neutral, imperceptible*** and ***long-term***.

10.6 MITIGATION MEASURES

10.6.1 Construction Phase

Best practice noise and vibration control measures will be employed by the contractor during the construction phase in order to avoid significant impacts at the nearest sensitive buildings.

The following construction noise thresholds (CNT) are proposed for the development to avoid significant impacts:

- Residential Units North and East of site: 65 dB $L_{Aeq,T}$
- All other locations (offices and commercial buildings): 75 dB $L_{Aeq,T}$

The best practice measures set out in *BS 5228-1:2009+A1:2014* and *BS 5228-2:2009+A1:2014*, will be complied with. In addition, the specific noise and vibration mitigation called up in the DCC GPG for construction and demolition sites will be required at this site. The above documents include guidance on several aspects of construction site mitigation measures, which include:

- Selection of quiet plant;
- Noise control at source;
- Screening;
- Liaison with the public, and;
- Monitoring.

Noise control measures that will be considered include the selection of quiet plant, use of enclosures and screens around noise sources and site boundaries, limiting the hours of work and noise and vibration monitoring.

10.6.1.1 Selection of Quiet Plant

The potential for any item of plant to result in exceedance of construction noise thresholds will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever practicable (e.g. plant items with sound attenuation incorporated). Should a particular item of plant already on the site be found to exceed the construction noise thresholds, the first action will be to identify whether the item can be replaced with a quieter alternative.

The appointed contractor will evaluate the choice of excavation, breaking, piling or other working method taking into account various ground conditions and site

constraints. Where alternative lower noise generating equipment are available that will provide equivalent structural / excavation / breaking results, these will be selected to control noise within the relevant thresholds, where it is practicable to do so.

The decision regarding the type of excavation technique or other construction activity to be used on a site will normally be governed by a range of engineering and environmental constraints. In these instances, it may not be possible for technical reasons to replace an item of plant with a quieter alternative. In some instances, the adoption of a quieter method may prolong the overall process, with the net result being that the overall disturbance to the community will not necessarily be reduced.

10.6.1.2 Noise Control at Source

The following measures will be implemented, if required, by the appointed contractor to control noise at source. These measures relate to specific site considerations:

- For mobile plant items such as dump trucks, cranes, excavators and loaders, the installation of an acoustic exhaust, utilising an acoustic canopy to replace the normal engine cover and / or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB;
- For percussive tools such as pneumatic breakers and tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed;
- Use of rotary drills and 'bursters' activated by hydraulic or electrical power to facilitate quieter methods for excavation of hard material.
- Removal of larger sections of demolished buildings by lifting out and breaking at areas away from noise sensitive boundaries;
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover;
- Mobile and stationary plant will be switched off or throttled back to a minimum when not in use (engines, motors and generators). Lorries, trucks and concrete vehicles will not be permitted to queue outside site compounds with engines left idling;
- Where compressors, generators and pumps are located in proximity to NSLs and have the potential to exceed the construction noise thresholds, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation;
- Resonance effects in panel work or cover plates can be reduced through stiffening or the application of damping compounds, while other noise nuisance can be controlled by fixing resilient materials in between the surfaces in contact;
- For all materials handling, ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials;
- 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;
- Where practicable, equipment powered by mains electricity or battery shall be used in preference to equipment powered by internal combustion engines or locally generated electricity; and
- Plan the site layout to ensure that reversing is kept to a minimum.

10.6.1.3 Screening

Screening is an effective method of reducing construction noise levels at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver. BS 5228–1 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material.

The site will incorporate a solid site hoarding line of minimum 2.4m in height around its perimeter which will be maintained in situ for the duration of the construction phase. Where necessary, this hoarding height will be increased in height to assist in reducing noise levels at adjacent noise sensitive buildings.

Erection of localised demountable enclosures or screens will be used around breakers or drill bits when in operation in proximity to NSLs with the potential to exceed the construction noise thresholds. Annex B of BS 5228–1 (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on-site from standard materials. A well placed and designed mobile temporary screen around a breaker or excavation can effectively reduce noise emissions by 10 dB(A).

In addition, careful planning of the construction site layout will also be considered. The placement of site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening.

10.6.1.4 Hours of Work

Standard working hours for construction will be 7.00am to 7.00pm Monday to Friday and 7.00am to 14.00pm on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency.

10.6.1.5 Liaison with the Public

For the proposed development, the duration of demolition, piling and excavation and any required ground breaking will be short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period.

The contractor will establish clear forms of communication between the contractor and adjacent NSLs to the works, so that residents or building occupants are aware of the likely duration of activities likely to generate noise or vibration that are potentially significant.

A community Liaison Plan will be developed by the developer in liaison with the local residents and businesses and a single point of contact nominated to engage with DCC.

10.6.1.6 Monitoring

During the construction phase, the contractor will carry out noise and vibration monitoring at representative sensitive locations to evaluate and inform the requirement and / or implementation of noise and vibration management measures.

Noise and vibration monitoring systems will be installed at the site prior to any works taking place and will be maintained in continuous operation throughout the construction period. The system will be configured to trigger alerts in the event that the set limit values relating to the control of significant noise effects are approaching, as per Section 9.2.1.3 and for the avoidance of any cosmetic damage to buildings as per **Table 10.3**.

As a minimum, a vibration monitor will be installed be installed along the northern site boundary, adjacent to the protected structure.

10.6.1.7 Vibration Control

On review of the likely vibration levels associated with construction activities, construction activities associated with the proposed development will not give rise to vibration that is either significantly intrusive or capable of giving rise to structural or cosmetic damage to buildings.

Vibration from construction activities will be limited to the values set out in **Table 10.3** to avoid any form of potential cosmetic damage to buildings and structures.

In the case of vibration levels giving rise to human response, impacts are significantly reduced once the source of vibration is known and good communications are in place. As such, in order to minimise any potential impacts to adjacent building occupants, the following measures shall be implemented during the Construction Phase.

- A clear communication programme will be established by contractor to inform adjacent building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to result in significant effects as per **Table 10.4**. The nature and duration of the works will be clearly set out in all communication circulars as necessary; and
- Appropriate vibration isolation shall be applied to plant (such as resilient mounts to pumps and generators), where required and where feasible.

10.6.2 Operational Phase

10.6.2.1 Building Noise Services

At the detailed design stage, best practice measures relating to building services plant will be taken to ensure there is no significant noise impact on NSLs adjacent to the development. Best practice measures in this context include the following:

- The selection and design of operational plant items with potential to emit noise to atmosphere will be designed to comply with the noise control guidance from BS 4142 (BSI 2014) for residential dwellings, as discussed in Section 10.2.3.1.
- Where ventilation is required for plant rooms, consideration will be given to acoustic louvers or attenuated acoustic vents, where required, to reduce noise breakout to within relevant design criteria at NSLs;
- Ventilation plant serving plant rooms and car parks will be fitted with effective acoustic attenuators to reduce noise emissions to the external environment to within relevant design criteria at NSLs;
- The use of attenuators or silencers will be installed on external air-handling plant, pumps and heating and cooling systems, where required, to reduce noise breakout to within relevant design criteria at NSLs;
- The use of acoustic louvres or solid plant screens will be sited around roof top plant area perimeters to control noise to the surrounding environment;

- 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, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document; and
- Installed plant will have no tonal or impulsive characteristics when in operation.

10.6.2.2 Traffic Around Surrounding Road Network

Changes to traffic flows will not result in a perceptible increase in noise level in the surrounding environment. Therefore, no mitigation measures are necessary in this case.

10.7 MONITORING OR REINSTATEMENT MEASURES

10.7.1 Construction Phase

During the construction phase the contractor will carry out noise monitoring at representative NSLs to evaluate and inform the requirement and / or implementation of noise and or vibration management measures. Monitoring will be undertaken in line with Section 10.6.1.6.

10.7.2 Operational Phase

No monitoring is proposed during the operational phase of the development.

10.8 RESIDUAL EFFECTS OF THE PROPOSED DEVELOPMENT

The Residual Effects are the final or intended effects which occur after the proposed mitigation measures have been implemented.

10.8.1 Construction Phase

10.8.1.1 Construction Plant and Equipment Noise

The use of best practice noise control measures, hours of operation, scheduling of works within appropriate time periods, and noise monitoring during this phase will be implemented. With the inclusion of the various noise and vibration control measures on site discussed in Section 10.6.1, it is expected that calculated noise levels in Table 10.12 can be reduced by 5 to 10 dB.

With the inclusion of the various available noise and vibration control measures, noise levels can be controlled to within the CNTs at the closest NSLs for the majority of the Construction Phases, thus resulting in a ***negative, moderate to significant*** and ***short term impact*** (Reference to **Table 10.2**).

For early stage demolition and piling phases, there is potential for construction noise levels to remain above the CNT. Whilst the adopted CNT has the potential to be exceeded, the residual noise levels can be controlled to below the upper construction noise limit of 75 dB $L_{Aeq,T}$ typically applied for urban sites. Given the potential for elevated periods of construction noise will be experienced over temporary periods, this can be tolerated with good public liaison and monitoring programmes.

10.8.1.2 Construction Phase Traffic Noise

The calculated change in traffic noise associated with the addition of construction related traffic is less than 1 dB (A) along the site access roads. Reference to **Table 10.5** confirms the potential related impact is ***negative, imperceptible*** and ***short-term.***

10.8.1.3 Construction Phase Vibration

Vibration magnitudes associated with this activity are well below those associated with any form of cosmetic damage to buildings as per the guidance values in **Table 10.3** and hence vibration impacts to buildings are ***neutral, not significant*** and ***short-term***.

In terms of human response, with clear communication protocols in place, vibration impacts during the construction phase are limited to ***negative, not significant to slight, and brief to temporary impact*** for closest building occupants.

10.8.2 Operational Phase

10.8.2.1 Building Services Plant Noise

Once operational, residual noise levels associated with building services plant from the proposed development will be designed to not exceed 45 dB $L_{A,rT}$ at the closest residential NSLs and 50 dB $L_{A,rT}$ at the closest façade of office buildings. The residual effect is ***neutral, not significant,*** and ***long-term***.

10.8.2.2 Traffic and Vehicle Noise

Traffic along the surrounding road network will not lead to a change in noise level that would pose any significant effect. The resultant impact is ***neutral, imperceptible,*** and ***long-term.***

10.9 CUMULATIVE IMPACTS OF THE PROPOSED DEVELOPMENT

The cumulative impact of the proposed development with any relevant other planned or permitted developments are discussed below. For details on the developments considered refer to Chapter 2 of this EIA Report.

10.9.1 Construction Phase

In the event that demolition/construction activities at nearby sites are taking place concurrently with the demolition/construction of the proposed development, there is potential for cumulative noise impacts to occur. Due to the nature of demolition/construction works associated with the proposed development, noise levels from this site will dominate the noise environment when occurring in proximity to the noise sensitive locations along its immediate boundary. The noise contribution from other construction sites would need be equal to those associated with the proposed development in order to result in any cumulative effect.

In the event of the two construction phases of the proposed development overlapping predicted construction noise levels within Section 10.5.1 may rise by the order of +3 dB.

10.9.2 Operational Phase

There are no cumulative noise impacts associated with the proposed development and other developments in the areas. The noise limits set for off-site noise sensitive locations are designed to avoid any significant increase in the prevailing background noise environment. Operational noise limits included in this report refer to cumulative noise from all fixed installations on site. The design of plant and other fixed installations will be progressed during the design stage to ensure the noise limits at off-site noise sensitive locations are not exceeded.

10.10 INTERACTIONS AND INTERRELATIONSHIPS

This chapter has used information from the Traffic chapter and the architectural drawings to inform the assessment of noise and vibration impacts. With increased traffic movements, the noise levels in the surrounding area increase. The impacts of the proposed development on the noise environment are assessed by reviewing the change in traffic flows on roads close to the site. In this assessment, the impact of the interactions between traffic and noise are considered to be imperceptible due to the low-level changes in traffic flows associated with the proposed development.

10.11 REFERENCES

- British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +A1 2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise
- BS 5228-2:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration
- BS 7385: 1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration
- BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings;
- BS 4142: 2014 +A1 2019 Methods for Rating and Assessing Industrial and Commercial Sound
- Environmental Protection Agency (EPA) Guidelines the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022)
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability and Environmental Appraisal LA 111 Noise and Vibration Revision 2, 2020
- Dublin Local Authorities including Dublin City Council (DCC), Fingal County Council (FCC), South Dublin County Council (SDCC) and Dún Laoghaire Rathdown County Council (DLRCC) Dublin Agglomeration Third Environmental Noise Action Plan December 2018 – July 2023
- Dublin City Council (DCC) Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition
- S.I. No. 549/2018 – European Communities (Environmental Noise) Regulations 2018 (hereafter referred to as the Noise Regulations).
- S.I. No. 241/2006 - European Communities Noise Emission by Equipment for Use Outdoors (Amendment) Regulations 2006
- International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation

- ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures;
- ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels
- The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as the CRTN) (UK Department of Transport 1988)