9 NOISE AND VIBRATION

9.1 Introduction

This section of the EIAR has been prepared by AWN Consulting to assess the noise and vibration impact of the proposed development in the context of current relevant standards and guidance. This assessment has been prepared by Leo Williams BAI MAI PgDip MIOA, Acoustic Consultant at AWN Consulting who has over 5 years' experience as an environmental consultant specialising in Acoustics and Environmental Impact Assessment. Please refer to Chapter 1 for further details of his relevant experience and qualifications.

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

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

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

- EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002);
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (EPA, 2003);
- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017); and,
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

9.2 Assessment Methodology

9.2.1 Overview

The assessment has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken across the development site to determine the range of noise levels at varying locations across the site;
- 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;
- Predictive calculations have been performed to estimate the likely noise emissions during the construction phase of the project at the nearest sensitive locations (NSLs) to the site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the development site;
- An inward noise impact assessment has been undertaken considering the existing road and tram noise impact on the proposed development; and,
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development.

9.2.2 Criteria – Construction Phase

9.2.2.1 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. Local Authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

DCC – Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition

Dublin City Council's *"Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition*" (hereinafter referred to as DCC GPG) outlines a risk assessment methodology directly applicable to the specific construction activities on the proposed site.

The proposed development 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.
- Intrusive noise activities, including vibration generating activities.

As the proposed development is in the high risk category, the monitoring section (S.6) of the DCC GPG document identifies that:

> *"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."*

Construction works in relation to this development are proposed during normal working hours only as set out below:

- Monday to Friday: 08:00 to 18:00hrs
- Saturdays: 08:00 to 14:00hrs
- Sundays and Bank Holidays No construction works.

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

DCC GPG refers to British Standard BS *5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise* (hereinafter referred to as BS 5228-1:2009+A1:2014) as appropriate criteria relating to permissible construction noise threshold levels for a development of this scale may be found in 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.

ABC Method

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 9.1 sets out the values which, when exceeded, signify a potential significant effect at the facades of residential receptors as recommended by BS 5228-1:2009+A1:2014.

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings & Weekends [D]	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Table 9.1: Maximum Permissible Noise Levels at the Façade of Dwellings during the Construction Stage

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

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

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

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

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 excessively onerous thresholds being set. On this basis it is more appropriate to consider fixed noise limits with respect to commercial receptors.

Fixed Limits

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. 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".*

Proposed Threshold Levels for Noise

Taking into account the proposed documents outlined above and making reference to the baseline noise environment monitored around the development site (see Section 9.3.5), BS 5228-1:2009+A1:2014 has been used to inform the assessment approach for construction noise in line with the DCC GPG.

The following values are therefore considered appropriate for the noise sensitive locations identified below:

- NSL1 (Residential - Apartments, Parkgate Place) 65 dB $L_{Aeq,1hr}$
- NSL2 (Commercial - Offices, Parkgate Place) 75 dB $L_{Aeq,1hr}$
- NSL3 (Residential - Houses, Parkgate Street) 75 dB $L_{Aeq,1hr}$
- NSL4 (Residential - Houses, Parkgate Street) 75 dB $L_{Aeq,1hr}$

Figure 9.1: Identified Noise Sensitive Locations

9.2.2.2 Vibration

Vibration standards address two aspects: those dealing with cosmetic or structural damage to buildings and those with human comfort. For the purpose of this scheme, the range of relevant criteria used for surface construction works for both building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Building Damage

Guidance relevant to acceptable vibration in order to avoid damage to buildings is contained within *BS 7385-2 (1993)* The guidance values contained within *BS 7385* are also reproduced in *BS 5228-2 (2014).*

These standards differentiate between transient and continuous vibration. Surface construction activities are considered to be transient in nature as they occur for a limited period of time at a given location. The standards note that the risk of cosmetic damage to residential buildings starts at a Peak Particle Velocity (PPV) of 15mm/s at 4Hz. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero.

Typically, the most significant sources of transient vibration during the construction phase of the development are likely to be from the following activities or similar:

- Piling for foundations, and;
- Breaking of concrete during excavation works.

Both standards note that important buildings that are difficult to repair might require special consideration on a case-by-case basis but buildings of historical importance should not (unless it is structurally unsound) be assumed to be more sensitive. If a building is in a very unstable state, then it

will tend to be more vulnerable to the possibility of damage arising from vibration or any other ground borne disturbance. For the protected buildings near the works there is a greater potential for these to be more vulnerable than other adjacent modern structures.

As outlined in Chapter 12 'Architectural Heritage', the overall development site (including the lands benefitting from planning permission Ref. ABP-306569-20) contains four protected structures and a number of other structures of heritage significance. Therefore, on a precautionary basis, the guidance values for structurally sound buildings are reduced by 50% in line with the guidance documents referred to above. In addition, measures proposed to prevent damage to protected structures have been detailed the EIAR associated with planning permission Ref. ABP-306569-20.

Table 9.2 summarises the proposed vibration criteria below which there is no risk of damage to buildings. These limits apply to vibration frequencies below 15Hz where the most conservative limits are required.

Category of Building	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
Structurally sound and non-protected buildings	12 mm/s	20 mm/s	50 mm/s
Protected and /or potentially vulnerable buildings	6 mm/s	10 mm/s	25 mm/s

Table 9.2: Recommended Thresholds for Transient Vibration During Construction Phase

Human Perception

It is acknowledged that humans are sensitive to vibration stimuli and that perception of vibration at high magnitudes may lead to concern. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, 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. For example, piling can typically be tolerated at vibration levels up to 6 mm/s respectively if adequate public relations are in place. These values refer to the day and evening time periods only.

During surface construction works (piling, breaking etc.) the vibration limits set within Table 9.1 will be perceptible to building occupants and have the potential to cause subjective impacts. The level of impact is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication and information circulars relating to planned works and their duration can significantly reduce vibration impacts to the neighbouring properties.

Expected vibration levels from the construction works will be discussed further in **Section 9.5.2.**

9.2.3 Criteria – Operational Phase

9.2.3.1 Noise

Mechanical Plant

Guidance from Local Authorities on noise emissions from mechanical plant items typically makes reference to the British Standard BS 4142:2014+A1:2019 *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 typically used by Local Authorities in their standard planning conditions and also 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, i.e. the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound, 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.

Making the assumption that certain items of mechanical plant serving the development will operate 24/7 the mechanical plant noise emissions must be designed to achieve the BS4142 requirements during the night-time period.

Therefore, in order to limit the noise impact of mechanical plant serving the proposed development, during the detailed design of the development the specific plant noise levels will be designed to be equal or lower to the prevailing background noise level at the nearest off-site NSLs.

Due to the fact that there is the potential for short periods of noise to cause a greater disturbance at night-time, a shorter assessment time period (T) is adopted. Appropriate periods are 1hr for daytime (07:00 to 23:00 hours) and 15 minutes for night-time (23:00 to 07:00 hours).

Additional Vehicular Traffic

Residential traffic to and from a given proposed development will make use of existing roads already carrying traffic volumes, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development.

The subject development does not provide car parking spaces (26no. car parking space are already permitted under ref. ABP-306569-20) and therefore does not meet the threshold for a Traffic Consultant's traffic assessment.

Similarly, for noise, on this basis there is no potential for additional noise associated with private vehicles.

Inward Noise Impact

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

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

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

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 9.2 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

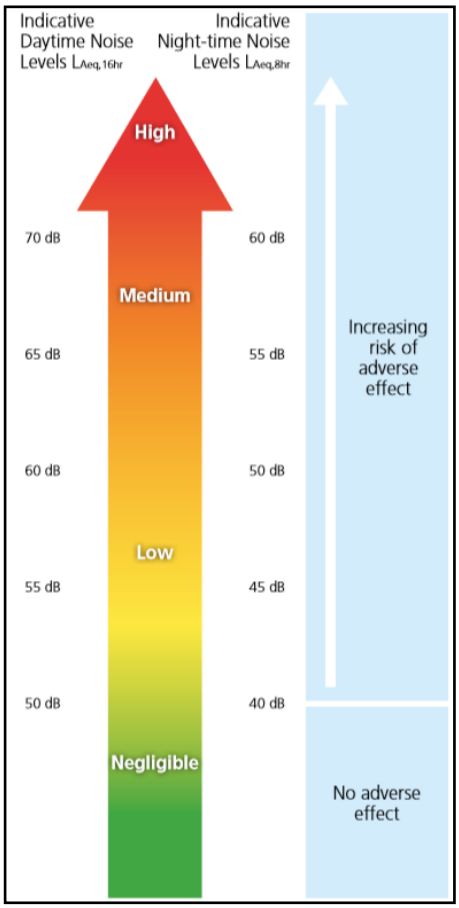

Figure 9.2: ProPG Stage 1 – Initial Noise Risk Assessment

Further, if more than 20 no. L_{AFmax} events exceed 80 dB during the night period, the site should be considered a high noise risk.

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in Table 9.3 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

Activity	Location	Day (07:00 to 23:00hrs) dB $L_{Aeq,16hr}$	Night (23:00 to 07:00hrs) dB $L_{Aeq,8hr}$
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

***Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded no more than 10 times per night without a significant impact occurring.**

Table 9.3: ProPG Internal Noise Levels

In addition to these absolute internal noise levels ProPG provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

ProPG provides the following advice with regards to external noise levels for amenity areas in the development:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

9.2.4 Vibration

Taking into account the expected activities associated with the operational phase of the proposed development, it is not anticipated that there will be any outward vibration impact associated. No further assessment of operational vibration is presented.

9.3 Receiving Environment (Baseline Situation)

This section will describe the baseline situation of the site at present. Noise surveys undertaken on site are described below and the monitoring locations illustrated on the aerial image in Figure 9.3. The indicative area subject to this planning application is illustrated in a dashed line.

9.3.1 Survey Periods

The noise survey was conducted at three locations over the following periods:

- 13:00hrs to 16:00hrs on 2 February 2019;
- 14:30hrs to 16:00hrs on 25 March 2019; and,
- 23:00hrs on 26 March to 00:10hrs on 27 March 2019.

For the purpose of this assessment, daytime is taken to be between 07:00hrs and 23:00hrs, whilst night-time is between 23:00hrs and 07:00hrs. The weather during the daytime survey period was dry and calm with wind speeds of less than 5m/s. Temperatures were in the range of 9 to 11°C. The weather during the night-time survey period was dry and calm with wind speeds less than 3m/s. Temperatures were in the range of 4 to 5°C.

9.3.2 Survey Procedure and Instrumentation

Attended noise monitoring was undertaken using a Brüel and Kjaer 2250 Type 1 Sound Level Meter. Measurements were conducted at the three monitoring locations on a cyclical basis. Sample periods for the noise measurements were 15 minutes in duration. The equipment was field calibrated before and after the survey using a Brüel and Kjaer 4321 sound level calibrator.

Unattended noise monitoring was undertaken using a Brüel and Kjaer 2250 Type 1 Sound Level Meter. The monitoring equipment was set to log for 5-minute periods. The equipment was field calibrated before and after the survey using a Brüel and Kjaer 4321 sound level calibrator.

9.3.3 Measurement Parameters

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

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

L_{Amax} is the maximum sound pressure level recorded during the sample period.

L_{Amin} 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 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.

9.3.4 Survey Locations

Four attended locations were selected as shown in Figure 9.3 and described below. Unattended measurements were also made at location NM1.

NM1 This monitoring location was situated on north site boundary. The position was chosen to represent baseline noise levels associated with proposed facades exposed to traffic noise on Parkgate Street.

NM2 This monitoring position was located at the southern boundary of the proposed development.

NM3 This location was chosen in order to obtain representative noise levels in the vicinity of noise sensitive buildings adjacent to the western boundary of the proposed development

NM4 This monitoring position was located at a position representative of the proposed residential dwellings in the north east of the site across from the Luas tram line.

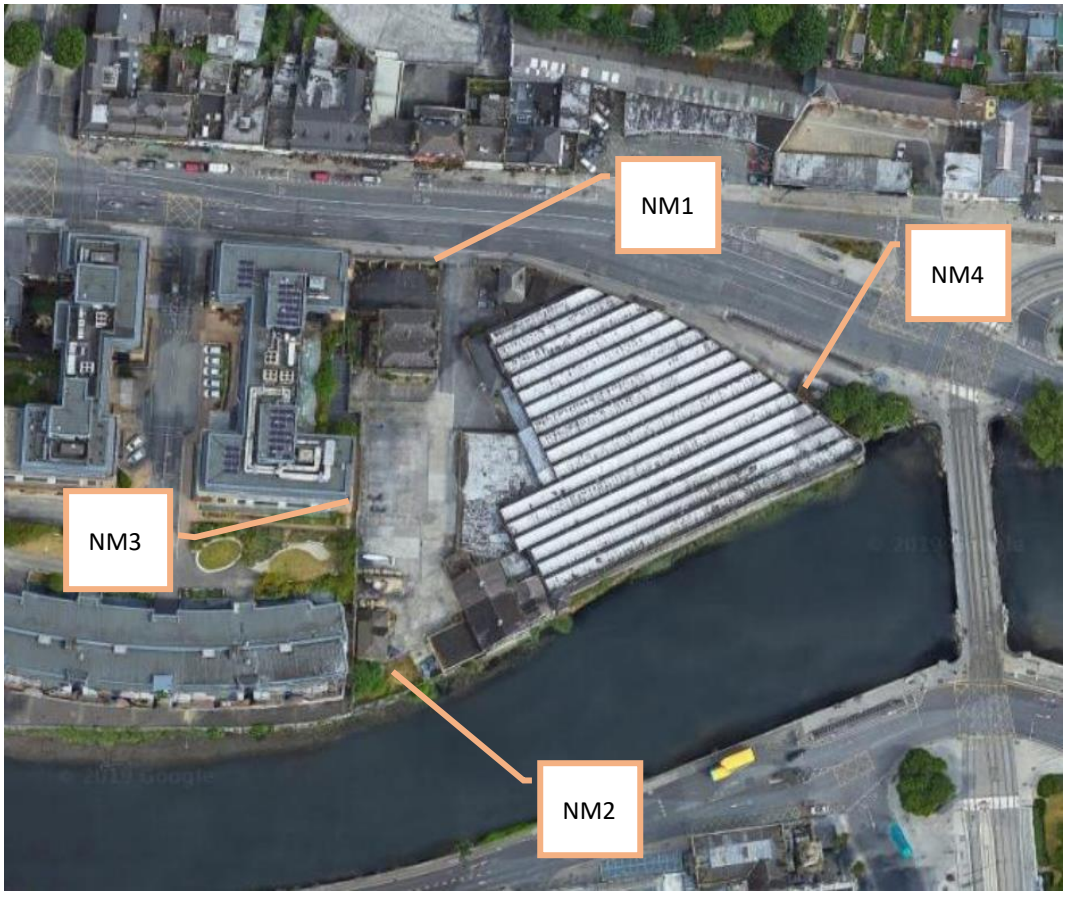

Figure 9.3: Baseline Noise Survey Locations (Source: Google Earth Pro)

9.3.5 Survey Results

9.3.5.1 Location NM1

Attended Measurements

Date	Period	Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
			L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
6th February	Day	15:15	69	85	50	73	54
25th March		14:23	71	88	51	75	57
		15:42	72	87	52	76	56

Date	Period	Time	Measured Noise Levels (dB re. 2x10^{-5} Pa)				
			L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
26th March	Night	23:19	69	83	46	74	52
		23:53	69	83	44	73	47

Table 9.4: Attended Survey Results – Location NM1

The noise environment at this measurement location was dominated by traffic noise on Parkgate Street. The noise environment also comprised pedestrian activity, car horns and Luas movements. Daytime noise levels were in the range from 69 to 72dB $L_{Aeq,15min}$ and 54 to 57dB $L_{A90,15min}$. Night-time noise levels were of the order of 69dB $L_{Aeq,15min}$ and 47 to 52dB $L_{A90,15min}$.

Unattended Measurements

Date	Period	Measured Noise Levels (dB re. 2x10^{-5} Pa)		
		L_{Aeq}	L_{Amax}	L_{A90}
6th February 2019	Day	70	84	55
	Night	66	82	48
7th February 2019	Day	70	84	55
	Night	66	82	50
8th February 2019	Day	70	83	57
	Night	66	81	53
9h February 2019	Day	69	81	54
	Night	67	82	47
10th February 2019	Day	72	82	53
	Night	65	82	46
11th February 2019	Day	69	82	56
Average	Day	70	83	55
	Night	66	82	49

Table 9.5: Unattended Survey Results – Location NM1

9.3.5.2 Location NM2

Date	Period	Time	Measured Noise Levels (dB re. 2x10^{-5} Pa)				
			L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
2nd February	Day	14:41	57	67	50	59	54
25th March		14:49	55	80	50	58	52
		16:00	56	81	50	58	51

Table 9.6: Attended Survey Results – Location NM2

The noise environment at this measurement location comprised distant traffic noise on Parkgate Street and occasional distant train movements. It was observed that announcements on the Heuston Station PA system were audible intermittently. Daytime noise levels were in the range from 55 to 57dB $L_{Aeq,15min}$ and 51 to 54dB $L_{A90,15min}$. The site was not accessible at night-time, the unattended measurements from NM1 have been used for assessment purposes at this location.

9.3.5.3 Location NM3

Date	Period	Time	Measured Noise Levels (dB re. 2x10^{-5} Pa)				
			L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
2nd February	Day	15:34	54	75	47	57	49
25th March		15:07	54	71	45	57	48
		16:18	50	64	44	52	46

Table 9.7: Attended Survey Results – Location NM3

The noise environment at this measurement location comprised distant traffic noise on Parkgate Street and occasional faint distant train movements. Delivery vans were observed accessing and exiting the car park. Daytime noise levels were in the range from 50 to 54dB $L_{Aeq,15min}$ and 46 to 49dB $L_{A90,15min}$. The site was not accessible at night-time, the unattended measurements from NM1 have been used for assessment purposes at this location.

9.3.5.4 Location NM4

Date	Period	Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
			L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
2nd February	Day	14:59	68	87	54	72	59
25th March		15:25	66	80	53	71	57
		16:37	68	86	53	71	57
26th March	Night	23:02	66	80	48	71	51
		23:36	64	77	46	69	51

Table 9.8: Attended Survey Results – Location NM4

The noise environment at this measurement location was dominated by traffic noise on Parkgate Street. Other sources included pedestrian activity and Luas movements.

Daytime noise levels were in the range from 66 to 68dB $L_{Aeq,15min}$ and 57 to 59dB $L_{A90,15min}$. Night-time noise levels were in the range of 64 to 66dB $L_{Aeq,15min}$ and of the order of 51 dB $L_{A90,15min}$.

9.4 Characteristics of the Proposed Development

A full description of the development can be found in Chapter 3: Description of the Proposed Development. Characteristics of the development that are relevant in terms of noise and vibration are summarised below.

The proposed development is predominantly a residential development that connects with the consented application ABP Ref. 306569-20, which entails the construction of a mixed-use development comprising of retail, café, and residential units, along with residents' amenities, office space and works to Parkgate Street at 42A Parkgate Street, Dublin 8.

9.4.1 Construction Phase

The construction phase will involve site clearance, excavation over the development site, the formation of the basement levels, construction of the new buildings and landscaping.

It is important to note that demolition of existing structures within the proposed development is consented under application ABP Ref. 306569-20 and the associated impacts relating to demolition are assessed in the Environmental Impact Assessment Report prepared in support of this consented application.

9.4.2 Operational Phase

The primary sources of outward noise that are deemed long term are mechanical plant items that will serve the development. Inward noise from road sources will also be incident on the development buildings.

9.5 Potential Effect of the Proposed Development

9.5.1 Construction Phase – Noise

The construction programme will create typical construction activity related noise onsite. During the construction phase of the proposed development, a variety of items of plant will be in use, such as breakers, excavators, lifting equipment, dumper trucks, compressors and generators.

The construction strategy has been reviewed in order to account for anticipated construction activities. It is possible to predict typical noise levels using guidance set out in BS 5228-1:2009+A1:2014. Table 9.9 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at 10m Distance (dB $L_{Aeq,1hr}$)
Site Preparation	Wheeled Loader Lorry (D3.1)	75
	Track Excavator (C2.22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Substructure/Foundations	Track Excavator (C2.22)	72
	Large Rotary Bored Piling Rig (C3.14)	83
	Concrete Pump (C3.25)	78
	Compressor (D7.6)	77
	Poker Vibrator (C4 33)	78
	Dump Truck (C4.2)	78
General Construction	Hand tools	81
	Tower Crane (C4.48)	76
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68
Drainage Upgrade Works	Track Excavator (C2.22)	72
	Compressor (D7.6)	77
	Telescopic Handler (C4.54)	79

Table 9.9: Typical Noise Levels Associated with Construction Plant Items

For the purposes of the assessment it has been assumed that standard good practice measures for the control of noise from construction sites will be implemented.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. Appropriate mitigation measures are provided in Section 9.6.

The noise levels associated with mobile plant items such as concrete mixer trucks, loaders etc. operational on site have been included as part of the construction noise assessment and calculated noise levels in Table 9.10.

Consideration should also be given to the addition of construction traffic along the site access routes. Access to the development site for construction traffic will be via Parkgate Street.

It is possible to calculate the noise levels associated with the passing vehicle traffic using the following formula.

$$L_{Aeq,T} = L_{AX} + 10\log_{10}(N) - 10\log_{10}(T) + 20\log_{10}(r_1/r_2)dB$$

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;

r_1 is the distance at which L_{AX} is expressed;

r_2 is the distance to the assessment location.

A calculation distance of 5m from the road has been used to assess noise levels at the closest buildings along the construction routes. The mean value of Sound Exposure Level for trucks moving at low to moderate speeds (i.e. 15 to 45km/hr) is of the order of 82 dB L_{AX} at a distance of 5 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions.

The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard site hoarding, typically 2.4m height will be erected around the perimeter of the construction site for the duration of works. It is assumed that construction works will take place during normal working hours only. It is assumed that the existing wall along the western boundary of the overall development site will be retained and will therefore off a certain amount of screening.

The predictions have been prepared for the worst case nearest residential noise sensitive locations illustrated in Figure 9.4 and summarised as follows:

- NSL1 at a distance of some 80m from the nearest significant site works;
- NSL2 at a distance of some 75m from the nearest significant site works;
- NSL3 at a distance of some 40m from the nearest significant site works; and,
- NSL4 at a distance of some 15m from drainage upgrade works on Parkgate Street.

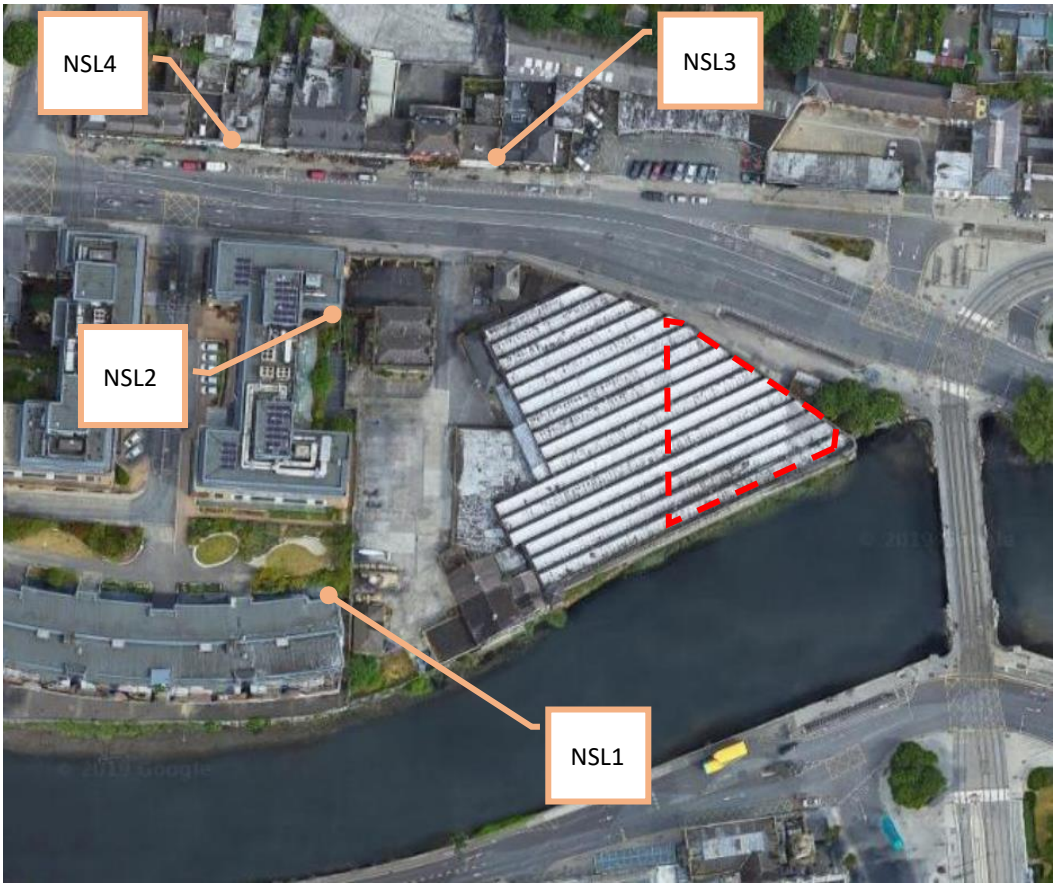

Figure 9.4: Identified Noise Sensitive Receivers

The predicted construction noise associated with each of the expected construction activities is presented below for various distances from areas of major works. Not all work types are anticipated to take place across the site, distances between activities and sensitive receivers are taken into account.

Distance to NSL	Phase	Predicted Construction Noise Level $L_{Aeq,1hr}$ (dB)
40m	Site Preparation	64
	Foundations	68
	General Construction	64
	Landscaping	62
	Drainage Upgrade Works	62
60m	Site Preparation	60
	Foundations	64
	General Construction	61
	Landscaping	59
	Drainage Upgrade Works	59
80m	Site Preparation	58
	Foundations	62
	General Construction	58
	Landscaping	56
	Drainage Upgrade Works	56

Table 9.10: Predicted Noise Levels Associated with Construction Plant Items

At distances of 40m, representative of the nearest noise sensitive location (NSL3), the predicted construction noise levels associated with construction activities are below the 75 dB(A) criteria and therefore it is expected that there will be a ***negative, moderate*** and ***short-term*** impact, in the absence of mitigation.

At a distance of 60m and greater from the works, the predicted construction noise levels are below the construction noise criteria and therefore the expected impact will be ***negative, slight to moderate*** and ***short-term.***

Appropriate mitigation measures and recommended good practices have been presented in **Section 9.5** to reduce any impact.

Construction Traffic

Construction vehicle numbers have been provided by Arup Consulting Engineers. Traffic volumes will vary for the various phases of construction. The highest volume of construction traffic is anticipated during the excavation phase, which would comprise, at maximum, approximately 28 no. trucks per day.

The calculated noise levels associated with this level of traffic is 58 dB $L_{Aeq,1hr}$. Measured ambient noise levels measured at the northern site boundary facing onto Parkgate Street were in the range 69 – 72 dB $L_{Aeq,15min}$. The noise associated with construction traffic is predicted to be greater than 10 dB below the ambient noise levels. Therefore, it is expected that there will be a ***negative***, ***not significant***, ***short term*** impact.

9.5.2 Construction Phase – Vibration

The main potential source of vibration during the construction programme is associated with piling and ground-breaking activities.

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 600mm 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.

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

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

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

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the adjoining buildings are not expected to pose any significance in terms of cosmetic or structural damage to any of the protected structures in proximity to the development works or any of the other adjacent buildings. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of adjacent buildings.

During any breaking within the site, there is also potential for vibration to be generated through the ground. Empirical data for this activity is not provided in the BS 5228-2 standard, however the likely levels of vibration from this activity are expected to be significantly below the lower adopted criteria for building damage based on experience from other sites.

The range of values discussed above provides some context in relation typical ranges of vibration generated by construction breaking activity likely required on the proposed site. The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings noted are likely to be orders of magnitude below the limits set out in Table 9.1 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants.

Due to the distances between sensitive locations and anticipated major works and considering the low vibration levels predicted in the vicinity of piling rigs, etc., it is expected that the vibration impact will be ***negative***, ***not significant*** and ***short-term***.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Section 9.2.2.2**.**

9.5.3 Operational Phase

9.5.3.1 Outward Noise

During the long-term operational phase of the development there is a potential impact associated with noise emissions from mechanical plant items and from an increase in traffic coming to and from the proposed site.

Mechanical Plant

During the operational phase of the proposed development there will be mechanical and electrical services plant required to service the building. Depending on the plant items involved, there may be a requirement to operate over both day and night-time periods.

The majority of plant items are located at basement level within enclosed plant rooms. At this stage of the development, specific details of the type and number of plant items required for the development are not available. In this instance, it is best practice to set appropriate emission limits relating to plant items which will be used during the detailed design stage.

Making reference to the background noise levels measured during the baseline noise survey and reference to the guidance from BS 4142 and BS 8233 as described in Section 9.2.3.1, the cumulative noise levels associated with building services plant items at the façade of the nearest noise sensitive buildings external to the development site will be designed to not exceed the following level:

- Daytime - 50dB $L_{Aeq,1hr}$, and;
- Night-time - 43dB $L_{Aeq,15min}$.

These limits have been set in order to preserve the existing noise environment and to set appropriate limits at noise sensitive buildings and amenity space within the development site.

Noise levels associated with mechanical plant are expected to be within the adopted day and night-time noise limits set out above, at the nearest noise sensitive properties taking into account the site layout, the nature and type of units proposed and distances to nearest residences. Assuming the operational noise levels do not exceed the adopted design goals, the resultant residual noise impact from this source will be a neutral, imperceptible, long term impact.

9.5.3.2 Inward Noise

An inward noise impact assessment has been carried out in order to address noise impacts inward on the subject development from nearby noise sources, in particular road and tram traffic noise.

In order to establish noise levels across the development site an acoustic noise model was developed and calibrated against noise levels measured during the baseline study.

Noise Model of Study Area

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels on the proposed site. The selected software, Brüel & Kjær Type 7810 Predictor, calculates noise levels in accordance with the Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) issued by the UK Department of Transport in 1988. This is the standard recognised for the prediction of road traffic noise by Transport Infrastructure Ireland (TII) and the Environmental Noise Regulations 2006 SI/140 2006.

The following information was included in the model:

- Site layout drawings of proposed development;
- OS mapping of surrounding environment; and
- Annual Average Daily Traffic (AADT) along adjacent roads estimated from site calibration results.

Noise Model Validation

Noise levels recorded during the unattended survey were used to calibrate the noise model to within 1 dB of the calculated values. This is regarded as very strong correlation in respect of predicted noise levels. Noise levels are calculated over daytime periods, i.e. 07:00 to 23:00hrs and night-time periods, 23:00 to 07:00 hrs.

The results of the modelling exercise demonstrate that highest noise levels are experienced along the northern boundary of the site in proximity to the road edges and reduce considerably towards the central part of the site, in the absence of any development buildings.

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the L_{AFmax} noise levels. In the case of this survey the L_{AFmax} noise levels were typically in the range of 78 to 83dB L_{AFMax} during the night, with occasional instances of higher levels. The number of L_{AFMax} events above 80dB is greater than 20, indicating that the site can be considered High Risk in terms of L_{AFmax} events.

Giving consideration to the noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site lies within the low to medium noise risk categories.

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

Medium Risk As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.

High Risk High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Given the above it can be concluded that the development site may be categorised as *Medium to High Risk* and as such an Acoustic Design Strategy will be required to demonstrate that suitable care and

attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

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

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

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or high-risk noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitable designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

The Proposed Development

The traffic noise model was updated to incorporate the proposed buildings in order to determine noise levels across the site taking into account the screening effect of the new buildings and to determine specific noise levels at the most exposed residential facades.

The results of the assessment indicate that during daytime periods, noise levels are highest along the northern boundary of the site at the units / apartments facing Parkgate Street. The predicted daytime noise levels at the most exposed facades are between 60 and 66 dB $L_{Aeq,16hr}$ along this section of the development. Night-time noise levels are between 57 and 63 dB $L_{Aeq,8hr.}$

Along the eastern boundary levels at the façades overlooking the tram line predicted daytime noise levels of 58 to 64 dB $L_{Aeq,16hr}$ depending on the façade orientation. Night-time noise levels are between 54 and 59 dB $L_{Aeq,8hr.}$

To assess the predicted impact along the eastern boundary a cumulative level has been calculated to account for traffic noise and tram noise. The table below presents the predicted cumulative noise levels at the most exposed facades of Block A.

Location	Period	Traffic Noise (dB $L_{Aeq,T}$)	Tram Noise (dB $L_{Aeq,T}$)	Predicted Noise Level at Closest Façade
Block A	Day	66	52	66 dB $L_{Aeq,16hr}$
	Night	63	40	65 dB $L_{Aeq,8hr}$

Table 9.11 : Predicted Cumulative Noise Levels

Acoustic Design Statement – Part 1

Façade Noise Levels

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

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

Predicted noise levels on the north east and south east facades are above a level whereby internal noise levels are achieved with standard double glazing and therefore mitigation in the form of enhanced glazing will be required. The specification of this enhanced façade is discussed in Section 9.6.2.

External Noise Levels

External amenity spaces are located to the rear of the building and on rooftops and are therefore screened and located at set back distances from local noise sources such as road and tram traffic noise.

External noise levels within the communal open spaces are within the recommended range of noise levels from ProPG of between 50 – 55 dB $L_{Aeq,16hr}$. It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site, therefore no further mitigation is required to control external noise levels across amenity areas.

9.5.3.3 Vibration

There is no source of vibration associated with the operational phase of the proposed development.

9.5.4 Do-Nothing Impact

In the absence of the proposed development, the prevailing noise levels would be dictated by the consented development located within the larger site boundary.

9.6 Mitigation Measures (Ameliorative, Remedial or Reductive Measures)

9.6.1 Construction Phase

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Code of Practice for Noise and Vibration Control on Construction and Open Sites* Parts 1 and 2. Whilst construction noise and vibration impacts are expected to 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;
- liaison with the public; and,
- monitoring.

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.

Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will 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.

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:

- Site compounds will be located in excess of 30m from noise sensitive receptors within the site constraints. The lifting of bulky items, dropping and loading of materials within these areas should be restricted to normal working hours.
- For mobile plant items such as dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. 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 steady continuous noise, such as that generated by diesel engines, it may be 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.
- For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- For compressors, generators and pumps, these can be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site as necessary.
- All items of plant should 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.

Piling

Piling is the construction activity which is most likely to cause disturbance. General guidance in relation to piling is outlined in the following paragraphs.

Piling programmes should be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling works are in progress on a site at the same time as other works of construction or demolition that themselves may generate significant noise and vibration, the working programme should be phased so as to prevent unacceptable disturbance at any time.

During consultation the planner, developer, architect and engineer, as well as the local authority, should be made aware of the proposed method of working of the piling contractor. The piling contractor should in turn have evaluated any practicable and more acceptable alternatives that would economically achieve, in the given ground conditions, equivalent structural results.

On typical piling sites the major sources of noise are essentially mobile and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling works are typically of the order of 6 weeks which is relatively short in relation to the length of construction work as a whole, and the amount of time spent working near to noise sensitive areas can represent only a part of the piling period.

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 may be 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.

Screening by barriers and hoardings is less effective than total enclosure but can be a useful adjunct to other noise control measures. For maximum benefit, screens should be close either to the source of noise (as with stationary plant) or to the listener. Removal of a direct line of sight between source and listener can be advantageous both physically and psychologically. In certain types of piling works there will be ancillary mechanical plant and equipment that may be stationary, in which case, care should be taken in location, having due regard also for access routes. When appropriate, screens or enclosures should be provided for such equipment.

Contributions to the total site noise can also be anticipated from mobile ancillary equipment, such as handling cranes, dumpers, front end loaders etc. These machines may only have to work intermittently, and when safety permits, their engines should be switched off (or during short breaks from duty reduced to idling speed) when not in use.

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. Construction site hoarding will be constructed around the site boundaries as standard. The hoarding will be constructed of a material with a mass per unit of surface area greater than 7 kg/m2 to provide adequate sound insulation.

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.

Liaison with the Public

A designated environmental liaison officer will 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.

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*.

Project Programme

Where possible, 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. During excavation/ piling 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.

9.6.2 Operational Phase

9.6.2.1 Mechanical Plant Noise

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

The assessment outlined earlier in this Chapter has specified cumulative plant noise limits at the nearest noise sensitive properties that must be achieved in order to ensure the impact is acceptable. To achieve these noise limits consideration will be given, at the detailed design stage, to a variety of mitigation measures and forms of noise control techniques. Some example of these measures are as follows:

- Reduced/quiet modes;
- duct mounted attenuators on the atmosphere side of air moving plant;
- splitter attenuators or acoustic louvres providing free ventilation to internal plant areas;
- solid barriers screening any external plant; and
- anti-vibration mounts on reciprocating plant.

In addition to the above, it is proposed that the following practices are adopted to minimise potential noise disturbance for neighbours.

- All mechanical plant items e.g. motors, pumps etc. shall be regularly maintained to ensure that excessive noise generated any worn or rattling components is minimised; and
- Any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document.

9.6.2.2 Noise associated Customer Use of Retail and Food & Beverage Facilities

Ground floor retail and cafés spaces are proposed within the development. The following 'good practice' measures are advised for the site:

- doors between indoor and outdoor dining/smoking areas should be kept closed in order to minimise the noise transfer from internal sources to the outside;
- a "Respect your Neighbours" campaign should be initiated within all outdoor and smoking areas, including signage indicating that it is a residential area and noise levels should be kept to a minimum;
- brief and train all staff on the requirement to keep noise levels to a minimum and to actively discourage raised voices, rowdy behaviour, singing etc.;
- ensure that patrons do not gather in other outdoor areas of any retail tenant where noise would impact on the resident nearby;
- implement a specific policy to deal with all noise complaints, including but not limited to:
    - assign a single member of staff as the "Noise Liaison";
    - log all complaints;
    - acknowledge all complaints;
    - follow up all complaints promptly

9.6.2.3 Inward Noise Impact - Acoustic Design Statement Part 2

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

In this instance the facades highlighted in Figure 9.5 will be provided with glazing and ventilation that achieves the minimum sound insulation performance as set out in Table 9.12 and Table 9.13.

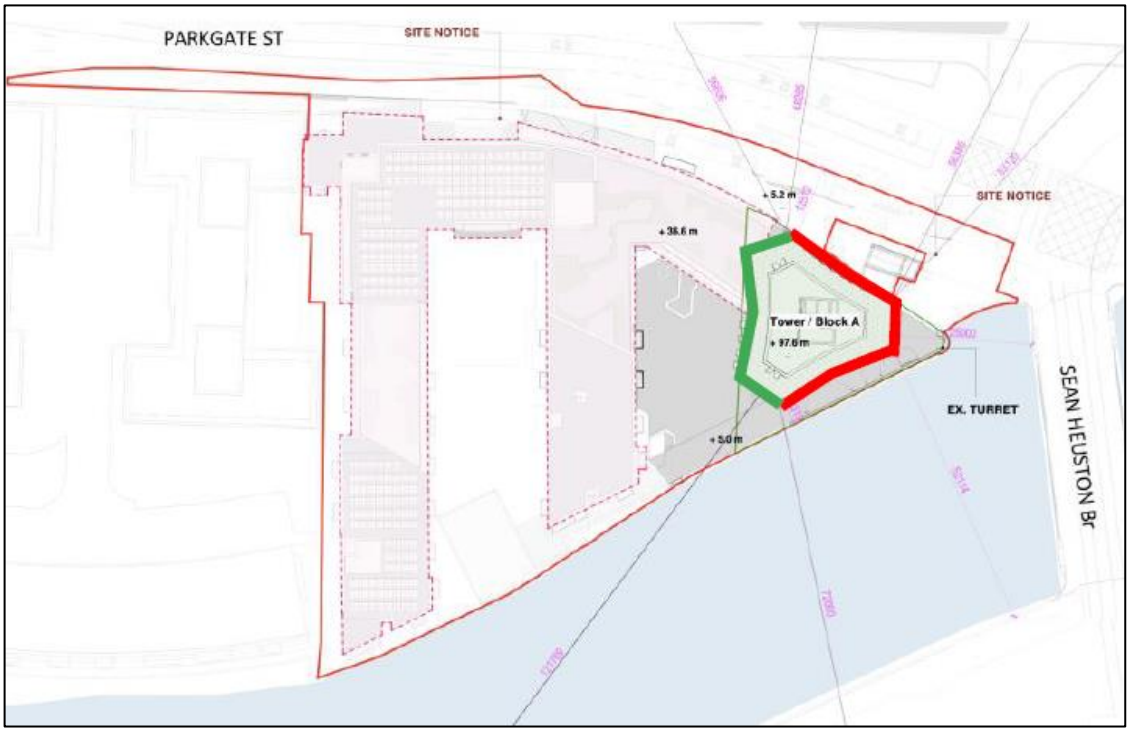

Figure 9.5: Façade Specification

Façade	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1000	2000	4000	
Red	27	24	34	39	42	49	37
Green	17	21	30	38	36	35	33

Table 9.12: Sound Insulation Performance Requirements for Glazing, SRI (dB)

The overall R_w and $D_{ne,w}$ outlined in this section are provided for information purposes only. The over-riding requirement is the Octave Band sound insulation performance values which may also be achieved using alternative glazing and ventilation configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Tables 9.12 and 9.13 or greater.

The following performance requirements apply to all ventilation paths from outside the building. This can be achieved by passive acoustic wall or window vents or via mechanical ventilation systems.

Façade	Octave Band Centre Frequency (Hz)						$D_{n,e,w}$
	125	250	500	1000	2000	4000	
Red	35	34	33	38	49	44	39
Green	34	27	37	35	34	34	36

Table 9.13: Sound Insulation Performance Requirements for Ventilation, $D_{n,e,w}$(dB)

Taking into account the height of Block A1, a check of incident noise levels as the building increases with height has been done. At a height of approx. 32m incident noise levels decrease to a level where standard glazing is sufficient to ensure the required internal noise levels. Therefore, glazing to facades of Block A from 8th Floor upwards are designated under the 'green' category described above.

9.7 Residual Effect of the Proposed Development

9.7.1 Construction Phase

9.7.1.1 Noise

During the construction phase of the development there is the potential for significant impacts on nearby noise sensitive properties due to noise emissions from certain site activities, in the absence of mitigation. The application of binding noise limits, hours of operation, along with the implementation of appropriate noise control measures, will ensure that noise impact at NSLs at distances up to 40m from construction works will have a ***negative***, ***slight to moderate*** and ***short-term*** impact on the surrounding environment.

At distances of 80m and greater from the works, the predicted construction noise levels are below the construction noise criteria and therefore the expected residual impact will be ***negative, slight*** and ***short-term.***

Considering the busy, urban location of the site and the low number of construction vehicles coming to and from the development during the various construction phases, in comparison to the existing traffic, it is expected that construction traffic associated with the development will be ***negative***, ***not significant*** and ***short-term***.

9.7.1.2 Vibration

Due to the distances between sensitive locations and anticipated major works and considering the low vibration levels predicted in the vicinity of piling rigs, etc., it is expected that the vibration impact will be ***negative***, ***not significant*** and ***short-term***. In order to minimise any vibration, good practice measures have been presented in Section 9.6.

9.7.2 Operational Phase

9.7.2.1 Noise

Noise levels associated with mechanical plant will be designed to be within the adopted day and night-time noise limits at the nearest noise sensitive properties taking into account the site layout, the nature and type of units proposed and distances to nearest residences. Assuming the operational noise levels do not exceed the adopted design goals, the resultant residual noise impact from this source will be a ***neutral, imperceptible, long term*** impact.

9.7.2.2 Vibration

There is no source of vibration associated with the operational phase of the proposed development.

9.8 Cumulative Effects

Cumulative effects have been considered for proposed and permitted developments in proximity to the subject development. A list of these developments is presented in Appendix 21.1.

9.8.1.1 Construction Phase

The proposed development connects to the consented development (ABP-306569-20). Certain activities during the construction phase of the proposed development would be taken in under the construction of the consented development. The construction would thereby be split into separate phases for certain aspects of the construction. Noise levels at NSL1 and NSL2, which are located closer to the consented development, will be dominated by noise associated with this development.

Noise associated with the subject development in isolation are within the noise criteria at the various identified NSLs. Depending on the phase of construction, there is a likelihood that construction work associated with the consented phase will occur simultaneous to construction work on the subject site. In the scenario whereby construction noise associated with consented phase is on par with the construction noise criteria and also, the noise associated with subject site is at a level whereby the contribution at nearest NSLs is equal to the consented phase, there is the potential for significant cumulative noise impacts at nearby noise sensitive receivers.

Noise monitoring will be undertaken to determine where noise control measures are required to reduce cumulative impacts.

9.8.1.2 Operational Phase

In the case that additional developments are permitted or proposed in the future, in the vicinity of the proposed development, there is the potential to add further additional vehicles to the local road network. However, as the traffic impact for the proposed development has an imperceptible impact on noise and vibration, it is unlikely that other future developments of similar scale would give rise to a significant impact during the operational phase of those developments. Future developments of a large scale would need to prepare an EIAR to ensure that no significant noise and vibration impacts will occur as a result of those developments.

9.9 Difficulties Encountered

No difficulties were encountered during the formation of this chapter.