

Chapter 11:

Noise and Vibration

11.0 NOISE & VIBRATION

11.1 INTRODUCTION

This section of the EIAR has been prepared by Byrne Environmental Consulting Ltd to identify and assess the potential noise and vibrational impacts associated with the proposed development of lands for residential use at Glencairn House, Murphystown Way, Dublin 18, during both the Construction and Operational Phases of the development.

The application site is located within the curtilage of Glencairn House. Glencairn House and associated buildings / structures are identified as a protected structure on the Record of Protected Structures (RPS Ref. No. 1643). The RPS identifies the following elements which comprise the protected structure: 'House, Gate Lodge, Outbuildings and Conservatory, Entrance Railings, Piers, Archway and Gates.'

The proposed development seeks to demolish an existing house on site and provide for the construction of 341 no. residential units, a childcare facility with a GFA of 300 sq.m., open space and all associated site and infrastructural works on a site of c. 9.59 hectares.

The residential development consists of 243 no. apartments and 98 no. houses. The 243 no. apartments are proposed to be provided within 6 no. apartment buildings (4 and 5 no. storeys in height), including undercroft basements, 1 no. 4 storey apartment building (with childcare facility at ground floor level) with adjacent surface car parking, and a 2 no. storey apartment building with adjacent surface parking. The childcare facility has an area of 300 sq.m and is located at the ground floor level of the apartment block within the south western section of the site. The houses consist of 2 and 3 storey terraced, semi-detached and detached dwellings.

The associated site and infrastructural works include foul and surface water drainage, internal roads and footpaths, parking spaces and bicycle spaces, public open space, landscaping, street lighting, walls and fences. The proposal includes for access to and improvements to the greenway to the south of the application site and to Murphystown Road to the west of the application site.

The proposal seeks to relocate the entrance portal (including the entrance railings, piers, archways and gates), from the existing location at the entrance to the site, to a new location within the site in closer proximity to the permitted new entrance to Glencairn House (new entrance and boundary wall to Glencairn House permitted under Reg. Reg.: D17A/0913). A new entrance arrangement is to be provided at the existing entrance portal location. The proposal includes landscaping, car parking, and boundary treatments within the curtilage of the existing gate lodge (no works proposed to gate lodge building). The application site includes the ruins of Murphystown Castle (Recorded Monument Ref. No. DU023-025), which are located towards the western boundary of the site, and which are to be incorporated into an open space amenity area.

This document includes a comprehensive description of the receiving ambient noise climate in the vicinity of the subject site; a description of how the construction and operational phases may impact the existing ambient noise climate, the mitigation measures that shall be implemented to control and minimise the impact that the development may have on ambient noise levels and the proposed acoustic design features required to minimise the impact of external noise sources, namely M50 and LUAS tram noise on the residential units.

The mitigation measures designed for the development shall demonstrate how the development shall be constructed and operated in an environmentally sustainable manner in order to ensure its minimal impact on the receiving noise climate and to provide adequate sound insulation in residential units from external sound sources and adjoining residential properties.

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11.2 STUDY METHODOLOGY

The general assessment methodology of the potential impact of the proposed development on air quality and climate has been devised in accordance with:

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, August 2018).
- 2017 EPA Guidelines on information to be contained in Environmental Impact Assessment Reports.
- Guidelines on Information to be Contained in an Environmental Impact Statement (EPA 2002).
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA 2003).
- Environmental Protection Agency, 2015. Revised Guidelines on the Information to be Contained in Environmental Impact Statements
- Environmental Protection Agency, 2015. Draft Advice Notes for Preparation of Environmental Impact Statements
- Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development (DoEHLG 2003).
- Development Management Guidelines (DoEHLG, 2007).
- European Union (Planning & Development)(Environmental Impact Assessment) Regulations 2018.

11.2.1 Noise Assessment Methodology

Baseline Environment

The baseline noise environment in the vicinity of the Glencairn development has been determined by conducting site noise surveys and a desktop review of the Dublin Agglomeration Environmental Noise Action Plan 2013-2018.

The existing ambient noise climate in the vicinity of the site has been characterised with information obtained from site specific baseline noise surveys conducted both on-site and in the vicinity of the closest noise sensitive receptors to the subject site. Baseline noise surveys were conducted in accordance with *ISO 1996: 2017: Acoustics – Description and measurement of environmental noise*.

Existing noise levels within the vicinity of the proposed development have also been informed from reviewing the Dublin Agglomeration Environmental Noise Action Plan 2013-2018 and associated Strategic Noise Maps, which indicate modelled noise levels as a result of modelled traffic flow on major roads.

Impact Assessment Methodology

The impact of the proposed development has been determined through prediction of future noise levels associated with the scheme using established calculation techniques.

Construction impacts have been assessed in accordance with Transport Infrastructure Ireland's (TII) guidance document *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014)*. Indicative construction noise calculations have been undertaken using the methodology set out in *BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise 2009+A1 2014*.

Impacts associated with road traffic movements on the development when operational have been assessed with regard to the TII's *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014)*. UK Department of Transport (Welsh Office) - *Calculation of Road Traffic Noise [CRTN]* and the *Highways Agency Design Manual for Roads and Bridges Part 7 HD 213/11 – Revision 1 Noise and Vibration*.

The operational phase of the development has been assessed with regard the *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound*. Acoustic design of apartments is referred to in the DLRCC Development Plan 2016-2022 – Advisory Note dated 16th March 2016 which refers to the Ministerial Guidelines “Sustainable Urban Housing – Design Standards for New Apartments. Paragraph 1.8 of the document refers specifically to the Building Regulations TGD E-Sound and states that the construction of the apartment building shall comply with all relevant requirements.

Construction Impact Assessment Criteria

The construction noise limits, which are presented in Table 11.1 represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable noise level for the nearby residents and other sensitive receptors including amenity space. Table 1 specifies the recommended Project Noise Limit Criteria in accordance with *BS 5228 – 1:2009+A1 2014 Code of practice for noise and vibration control on open sites: Part 1 Noise*. Noise limit criteria are based on the noise measured at the façade of each receptor location.

Table 11.1: BS5228-2014 Construction Phase Noise Limit Criteria

Construction Phase			Noise Limit Criteria
Location / Day	Assessment Period	External Noise Limit Criteria	
All Receptors Monday to Friday Morning	07:00hrs – 08:00hrs	70 dB(A), LAeq, 1hr	
All Receptors Monday to Friday Daytime	08:00hrs – 18:00hrs	75dB(A), LAeq, 10hr	
All Receptors Monday to Friday Early Evening	18:00 – 19:00hrs	70 dB(A), LAeq, 1hr	
All Receptors Monday to Friday Late Evening	19:00hrs – 22:00hrs	65 dB(A), LAeq, 3hr	
All Receptors Monday to Friday Nighttime	22:00hrs – 07:00hrs	55 dB(A), LAeq, 1hr	
All Receptors Saturday Morning	07:00hrs – 08:00hrs	70 dB(A), LAeq, 1hr	
All Receptors Saturday Daytime	08:00hrs – 13:00hrs	75dB(A), LAeq, 5hr	
All Receptors Saturday Midday	13:00 – 14:00hrs	70 dB(A), LAeq, 1hr	
All Receptors			

Saturday	Afternoon-Evening	14:00 – 22:00hrs	65 dB(A), L _{Aeq} , 3hr
All Receptors Monday to Friday Nighttime		22:00 – 07:00hrs	55 dB(A), L _{Aeq} , 1hr
All Receptors Sundays and Public Holidays Daytime		07:00hrs – 21:00hrs	65 dB(A), L _{Aeq} , 1hr
All Receptors Sundays and Public Holidays Nighttime		21:00 – 07:00hrs	55 dB(A), L _{Aeq} , 1hr

It should be noted that the noise criteria quoted in the table above are specific to construction activities only i.e. these levels are not cumulative with the existing noise environment from road traffic and other surrounding sources. Actual construction noise levels are determined by subtracting existing baseline noise levels from the measured total noise including construction activity noise to allow assessment against the limit criteria.

Operational Impact Assessment Criteria

Relative impact assessment criteria associated with road traffic noise is set out in Table 11.2 below.

Table 11.2: Likely impact associated with change in traffic noise level

Change in sound level (L ₁₀)	Subjective reaction	Impact
<3	Inaudible	Imperceptible
3-5	Perceptible	Slight
6-10	Up to a doubling of loudness	Moderate
11-15	Over a doubling of loudness	Significant
>15		Profound

A change in traffic noise of less than 2dBA is generally not noticeable to the human ear whilst a change of 3dBA is generally considered to be just perceptible. Changes in noise levels of 3 to 5 dBA would however be noticeable and, depending on the final noise level, there may be a slight or moderate noise impact. Changes in noise level in excess of 6dBA would be clearly noticeable, and depending on the final noise level, the impact may be moderate or significant. However, a significant change in traffic volumes or traffic category i.e. increase in the use of a road by HGVs, would be required to result in such increases.

The UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that a change in noise level of 1dB L_{A10,18h} is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3dB L_{A10,18h} is equivalent to a 100% increase or a 50% decrease in traffic flow.

Traffic noise levels in excess of 60dBA (L_{DEN}) are considered to be potentially intrusive. L_{DEN} is the day-evening-night composite noise indicator for assessing overall noise annoyance. For new roads projects the National Roads Authority design goal is to mitigate when predicted levels exceed 60dB L_{den}. However, for existing roads the Dublin Agglomeration, within the Noise Action Plan, have set a level of 70dB (L_{Day}) and 55dB (L_{Night}) above which mitigation measures should be considered.

The World Health Organisation (WHO) has proposed guidelines for community noise. In this guidance, a L_{Aeq} threshold daytime noise limit of 55dB is suggested for outdoor living areas in order to protect the majority of people from being seriously annoyed. Levels of 45dB or less are proposed at night-time, when measured 1m from the external facade of a noise sensitive location such as a residential unit. In the absence of other national standards, these levels are often used as guideline limits in assessing noise impacts.

The operational phase of the development shall be assessed with regard to the WHO guidelines and appropriate acoustic design of residential units to ensure that they comply with the *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound*.

11.2.2 Vibration Assessment Methodology

Impact Assessment Methodology

Vibration standards come in two varieties: 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).

Construction impacts have been assessed in accordance with *BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration* and *BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014*.

Operational impacts have been assessed in accordance with the Transport Infrastructure Ireland, TII (formerly NRA) Guidelines for the Treatment of Noise & Vibration in National Road Schemes.

Construction Impact Assessment Methodology

Table 11.3 shows the limits above which cosmetic damage could occur for transient vibration. Minor damage is possible at vibration magnitudes which are greater than twice those shown in Table 11.3, and major damage to a building structure would only generally occur at values greater than four times the tabulated values. These values only relate to transient vibration. If there is a continuous vibration, the guide values shown in Table 11.3 might need to be reduced by up to 50%.

This guidance is reproduced from *BS 5228-2:2009+A1 2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 2 – Vibration* and *BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration*.

Table 11.3: Transient vibration guide values for cosmetic damage

Type of building	PPV (mm/s) in frequency range of predominant pulse	
	4-15Hz	15Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above.	50mm/s at 4Hz and above.
Unreinforced or light framed structures. Residential or light commercial buildings.	15mm/s at 4Hz increasing to 20mm/s at 15Hz.	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above.

Paragraph 7.4.3 of *BS 7385* states that where continuous vibration occurs (which would be the case where piling, pneumatic breaking or percussive activities occur), the guide values detailed in Table 11.3 should be reduced by up to 50%.

Note 1

Sensitive, vulnerable or historic structures or buildings shall have a maximum PPV limit of 3mm/sec. This limit criteria shall be assigned to the Murphystown Castle structure.

Note 2

The impact of construction works on the adjacent LUAS Cherrywood line and associated LUAS infrastructure shall consider the requirements of TII's Engineering specifications for safe working and monitoring.

Table 11.4, reproduced from *BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014* outlines the vibration levels (in terms of PPV) from construction activities and their likely effect on humans.

Table 11.4: Guidance on the effect of construction vibration levels on humans

Vibration Level (PPV)	Effect
0.14mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30mm/s	Vibration might be just perceptible in residential environments.
1.0mm/s	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.
10mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Operational Impact Assessment Methodology

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of road traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes.

Ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Vibration impacts associated with road traffic can therefore be largely avoided by good maintenance of the road surface.

11.3 EXISTING RECEIVING ENVIRONMENT

11.3.1 Description of the baseline environment/ Environmental Noise Context

The Glencairn House site is located off Murphystown Road and is located southwest to the M50 Motorway. The LUAS Cherrywood tram line runs adjacent to the northwestern site boundary. Existing residential development is located bordering the eastern and southern and western site boundaries

The development area is located within a zone which includes dominant sources of transportation related noise principally from the Murphystown Road, the M50 Motorway and local road infrastructure. It is noted that there are no major sources of industrial noise within 1km of the site.

The Murphystown Road is heavily trafficked and exhibits a diurnal pattern with AM and PM peaks resulting in greater road traffic movements and thus increased ambient noise levels. Traffic volumes decrease between approximately 19:00hrs – 05:00hrs Monday to Sunday resulting in lower night time ambient noise levels.

The M50 dominates the noise climate at the boundaries of and within the site with road traffic noise clearly audible throughout the daytime, evening and nighttime periods from Monday – Sunday.

The operation of the LUAS Cherrywood line between Sandyford and Brides Glen includes approximately 200 No. passing tram movements per day between 05:30hrs and 00:30hrs. Although each tram-pass is of relatively short duration, the nature of the tram movement results in high intermittent noise levels with a duration of approximately 30-45 seconds during which the LUAS is audible. Inbound tram movements have an approximate level of 73dB(A) $L_{Aeq,T}$ and an associated L_{AFmax} of 80dB(A) and Outbound tram movements have an approximate level of 68dB(A) $L_{Aeq,T}$ and an associated L_{AFmax} of 76dB(A).

11.3.2 Baseline environmental noise survey

Baseline noise data in the vicinity of the closest residential receptors to the site and within the site at the footprints of the proposed buildings of the proposed development site has been obtained from noise monitoring surveys conducted by Byrne Environmental Consulting Ltd during November 2017. The baseline monitoring locations were selected in accordance with *ISO 1996,2, 2017: Acoustics – Description, Measurement and Assessment of environmental noise* and the 2016 EPA publication, “*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*” and included locations in proximity to existing residential dwellings adjacent to the development areas and within the site itself to assess the impact of the LUAS noise on the closest proposed residential units.

Measurement locations

Baseline noise measurements were conducted at four locations in the vicinity of the proposed site. Figure 11.1 below details the approximate locations of the measurement positions. Noise monitoring surveys were conducted under free-field conditions at a height of approximately 3.5m above ground (to reflect 1st floor bedroom height) and approximately 3.5m away from reflecting surfaces.

Location NM1	Measurement location is along the eastern site boundary at the location of the closest façade of the proposed apartment building to the LUAS line
Location NM2	Measurement location is along the northern site boundary at the location of the closest façade of the proposed houses to the M50 Motorway.
Location NM3	Measurement location is along the north eastern site boundary adjacent to the Orby residential estate
Location NM4	Measurement location is at the existing Glencairn House
Location NM5	Measurement location is along the north eastern site boundary adjacent to the Mount Eagle residential estate off Murphystown Rd

Figure 11.1: Baseline Noise Monitoring Locations NM1 – NM5



The noise parameters used to describe the existing ambient noise climate are described as follows:

L_{Aeq} :	The equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.
L_{A10} :	The sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.
L_{A90} :	The sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
L_{Amax} :	The instantaneous maximum sound level measured during the sample period.
$\frac{1}{3}$ Octave band analysis	The frequency analysis of a sound such that the frequency spectrum is subdivided into bands of one-third of an octave each. Used to determine tonal components of a sound source

Noise levels are measured using a logarithmic noise scale (decibel) and are denoted dBA. The "A" indicates that a frequency weighting has been applied to allow for the variation in the sensitivity of the human ear.

Baseline noise measurement results

Table 11.5: Location NM1: LUAS Baseline Noise Survey Results 4th July 2017

Period	Time	Mean Measured sound pressure levels dBA (re 20µPa)			
		L _{Aeq, 1hr}	L _{A101hr}	L _{A901hr}	L _{AMax}
Day	08:00 – 19:00hrs	66	67	59	85
Night	23:00 – 08:00hrs	64	66	56	85

Noise levels measured at NM1 are dominated by transport related noise from the M50 and passing LUAS trams and to a lesser extent by traffic on Murphystown Road. Noise levels during the daytime and nighttime periods are relatively similar with only a minor decrease in nighttime levels. A specific high noise event was recorded during the nighttime monitoring period as a result of a LUAS track maintenance vehicle operating on the track as confirmed by TII. This nighttime activity occurs on a regular and routine basis.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM1.

Table 11.6: Location NM2 Orby adjacent M50: Baseline Noise Survey Results

Period	Time	Mean Measured sound pressure levels dBA (re 20µPa)			
		L _{Aeq1hr}	L _{A101hr}	L _{A901hr}	L _{AMax}
Day	08:00 – 19:00hrs	72	74	68	86
Night	23:00 – 08:00hrs	70	72	63	85

Noise levels measured at Location NM2 are dominated by M50 road traffic noise. Noise levels decrease during the daytime as a result of lower vehicle movements within the estate and on Murphystown Road.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM5.

Table 11.7: Location NM3 Orby: Baseline Noise Survey Results

Period	Time	Mean Measured sound pressure levels dBA (re 20µPa)			
		L _{Aeq1hr}	L _{A101hr}	L _{A901hr}	L _{AMax}
Day	08:00 – 19:00hrs	62	63	58	85
Night	23:00 – 08:00hrs	57	62	55	76

Noise levels measured at NM3 are influenced by transport related noise, principally from the M50 and passing LUAS trams and to a lesser extent by traffic on Murphystown Road. Noise levels decrease during the nighttime as a result of lower vehicle movements on Murphystown Road and the cessation of operational LUAS trams.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM3.

Table 11.8: Location NM4 Glencairn House: Baseline Noise Survey Results

Period	Time	Mean Measured sound pressure levels dBA (re 20µPa)			
		L _{Aeq1hr}	L _{A101hr}	L _{A901hr}	L _{AMax}
Day	08:00 – 19:00hrs	56	58	53	74
Night	23:00 – 08:00hrs	46	49	42	67.8

Noise levels measured at Location NM4 are influenced by various activities within the curtilage of Glencairn House and noise from other transport sources including the M50 which is audible throughout the daytime and nighttime periods. Noise levels decrease during the nighttime as a result of less activity within the estate.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM4.

Table 11.9: Location NM5: Mount Eagle Baseline Noise Survey Results

Period	Time	Mean Measured sound pressure levels dBA (re 20µPa)			
		L _{Aeq1hr}	L _{A101hr}	L _{A901hr}	L _{AMax}
Day	08:00 – 19:00hrs	60	64	57	85
Night	23:00 – 08:00hrs	55	58	48	72

Noise levels measured at Location NM5 are consistent with a quiet residential area which is influenced by local traffic noise and noise from other transport sources including the M50 and Murphystown Road. Noise levels decrease during the nighttime as a result of lower vehicle movements within the estate and on Murphystown Road.

No source of vibration was observed and vibration was not perceptible during surveys at Location NM5.

11.3.3 Review of the Dublin Agglomeration Environmental Noise Action Plan 2013-2018 and Strategic Noise Maps

The Dublin Agglomeration Noise Action Plan 2013-2018 was prepared jointly by the four Local Authorities in the Dublin Agglomeration to meet the requirements of the Environmental Noise Directive (2002/49/EC) which is transposed into Irish legislation through the Environmental Noise Regulations (S.I No. 140 of 2006). The key objective of the Directive is to avoid, prevent and reduce, where necessary, on a prioritised basis the harmful effects, including annoyance, due to long term exposure to environmental noise from road traffic, rail and aircraft.

The Environmental Noise Directive requires all European Union Member States to produce strategic noise maps for the main sources of environmental noise, i.e. major roads, major railways, major airports and all sources within agglomerations with a population of more than 100,000 persons in 2012. These strategic noise maps inform the Noise Action Plan. Levels of <55dBA (L_{Day}) and <50dBA (L_{Night}) are considered to be desirably low noise levels within the Noise Action Plan.

The relevant Strategic Noise Maps for the study area have been reviewed and it has been determined that the northern aspect of the subject site at which the proposed residential units will be located will be subject to noise levels which range from 65-70 dB (L_{DEN}) Higher noise levels are experienced at properties fronting onto the M50.

The Strategic Noise Map results are in general agreement with levels recorded during the site specific baseline environmental noise survey.

11.3.4 Significance

Based on the recorded baseline noise surveys conducted in the vicinity of the proposed development site, and a review of the Strategic Noise Maps, it may be concluded that the existing ambient noise levels are moderate at the closest existing residential receptors.

Traffic movements along the Murphystown Road and on the M50 and within existing residential estates south of the site dominate the ambient noise levels in the vicinity of the development site. Passing LUAS trams and nighttime track maintenance vehicles also have a significant noise impact along the western site area.

11.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The proposed development seeks to demolish an existing house on site and provide for the construction of 341 no. residential units, a childcare facility with a GFA of 300 sq.m., open space and all associated site and infrastructural works on a site of c. 9.59 hectares.

The residential development consists of 243 no. apartments and 98 no. houses. The 243 no. apartments are proposed to be provided within 6 no. apartment buildings (4 and 5 no. storeys in height), including undercroft basements, 1 no. 4 storey apartment building (with childcare facility at ground floor level) with adjacent surface car parking, and a 2 no. storey apartment building with adjacent surface parking. The childcare facility has an area of 300 sq.m and is located at the ground floor level of the apartment block within the south western section of the site. The houses consist of 2 and 3 storey terraced, semi-detached and detached dwellings.

When considering a development of this nature, the potential impact on noise and vibration must be considered for each distinct stage: the short term (2-3 years) impact of the construction phase and the longer term impact of the operational phase. It is important that there is no unacceptable increase in ambient noise levels during the construction phases and during the operational phase.

Short term noise exposure during the construction phase must be managed and controlled to acceptable levels. There are a number of existing residential noise sensitive receptors located in proximity to the development site boundaries. It is fundamental that the proposed development or any aspect of the proposed development must not adversely impact the existing noise levels experienced at these receptors over the long term.

It is also critical that adequate sound insulation is provided within residential units to be constructed from both external sound sources and adjoining residential properties.

11.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

11.5.1 Potential Impacts

Various elements of both the construction and operational phases of the proposed development have the potential to impact the local receiving noise environment, adjacent residential properties and on human health. The likely potential impacts for both construction and operation of the proposed scheme prior to mitigation are described in this section of the EIAR. The mitigation measures are described in Section 11.7 and the predicted impacts with the development in place and the mitigation measures incorporated in Section 11.9. Section 11.10 describes the monitoring programmes that shall be implemented to measure and evaluate the impact of the development and to ensure that unacceptable impacts do not occur.

Construction Impacts

The development of the site will be conducted in the following phased stages:

- Enabling works - Site set up and Site clearance
- Construction works including infrastructure and building construction and landscaping

Enabling works - Site Set Up and Clearance

Works activities associated with the 'Site set up' will be undertaken prior to construction works commencing. The setting up of the site shall involve the construction of site security hoarding and site compounds, site offices, materials and waste storage areas and staff welfare facilities. These short term activities will have a minimal potential to generate excessive noise levels.

The proposed development involves the ground clearance of the existing site to facilitate the proposed development including buildings, internal roads and hard standing areas, services and landscaped areas.

Site clearance, levelling and an element of ground excavation shall also occur at this stage. A variety of items of plant will be in use during site clearance and ground excavation. These will include excavators, dump trucks, compressors and generators. The operation of these items of plant does have the potential to generate short term elevated noise levels.

During the 'Site Clearance' works Construction and Demolition (C&D) waste shall be segregated as per the requirements of the Construction, Demolition and Operational Waste Management Plan for the site and shall be exported off-site by an appropriately permitted waste contractor. The movement of these trucks to and from the site shall result in an increase in the volume HGV's within the immediate area and along the proposed haul routes which will generate additional noise levels.

Construction Works

The proposed development will include the construction of 341 no. residential units, a childcare facility with a GFA of 300 sq.m., open space and all associated site and infrastructural works on a site of c. 9.59 hectares.

During the construction phase there will be extensive site works, involving construction machinery, construction activities on site, and construction traffic, which will all generate noise. The highest noise levels will be generated during the general construction activities and during pneumatic breaking and piling works. The construction noise levels will occur over an approximate 3 year period and will only occur during daytime hours which will serve to minimise the noise impacts at local existing receptors over the course of the construction phase.

It is predicted that the construction phases shall result in a short term increase in noise levels in the area as well as introducing tonal and impulsive noise as a result of construction activities such as pneumatic breaking, cutting, excavating, vehicle movements and general manual construction activities.

Due to the phased nature of the development which will occur over an approximate 3 year period, there will be slight to moderate impacts on existing residents in adjacent and adjoining residential estates and on Glencairn House. However, the proposed construction phase noise mitigation measures as detailed in Section 11.7 shall ensure that all construction activities are controlled and managed and audited by an independent acoustic consultant to confirm that the mitigation measures are implemented throughout the construction phase.

Construction noise predictions

As set out in Section 11.2.1 the predicted noise levels that will be experienced at the nearest residences as a result of construction activities have been calculated using the activity L_{Aeq} method outlined in *BS 5228 1:2009+A1 2014 – Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise*.

Tables 11.9 to 11.10 set out assumed plant items during the key phases of construction with the associated source reference from *BS 5228: 2009+A1 2014*. The closest residential properties to the proposed development site are located at distances ranging from approximately 25-150m. Construction noise calculations have therefore been conducted at distances of 25 to 150m from the works for the Site Clearance and Main Construction phases, representing the nearest properties to the works.

Table 11.9: Indicative construction noise predictions associated with Enabling works

Plant Item	BS 5228 Reference	Calculated sound pressure levels L_{Aeq} dB at distance from the proposed development				
		10m	25m	50m	100m	150m
Generator (enclosed)	C.4 Ref 84	68.2	60.3	54.2	48.2	44.7
Compressor(enclosed)	D.6 Ref 19	71.2	63.3	57.2	51.2	47.7
Tracked Excavator	C.2 Ref 3	76.2	68.3	62.2	56.2	52.7
Wheeled Excavator	C.2 Ref 26	77.2	69.3	63.2	57.2	53.7
HGV	C.4 Ref 19	75.2	67.3	61.2	55.2	51.7
Pneumatic breaking 15t	C.1 Ref 9	90.0	82.1	76.2	70.2	67.7
Combined $L_{Aeq,period}$	Note 1 No mitigation	90	82	76	70	68
Combined $L_{Aeq,period}$	Note 2 With mitigation	80	72	66	60	58

Note 1 - Calculations are based on 100% on-time for all plant without mitigation measures in place

Note 2 – Calculations are based on 50% on time for plant at any location with mitigation measures in place. Mitigation measures are as specified in Section 11.8

Table 11.10: Indicative construction noise predictions associated with Construction works

Plant Item	BS 5228 Reference	Calculated sound pressure levels L_{Aeq} dB at distance from the proposed development				
		10m	25m	50m	100m	150m
Generator (enclosed)	C.4 Ref 84	68.2	60.3	54.2	48.2	44.7
Compressor(enclosed)	D.6 Ref 19	71.2	63.3	57.2	51.2	47.7
Tracked Excavator	C.2 Ref 3	76.2	68.3	62.2	56.2	52.7
Wheeled Excavator	C.2 Ref 26	77.2	69.3	63.2	57.2	53.7
HGV	C.4 Ref 19	75.2	67.3	61.2	55.2	51.7
Concrete / Steel Cutting Equipment	Various	82.2	74.3	68.2	62.2	58.7
Dump truck	C.2 Ref 30	77.2	69.3	63.2	57.2	53.7
Combined $L_{Aeq,period}$	Note 1 No mitigation	86	75	72	66	62
Combined $L_{Aeq,period}$	Note 2 With mitigation	76	65	62	56	52

Note 1 - Calculations are based on 100% on-time for all plant without mitigation measures in place

Note 2 – Calculations are based on 50% on time for plant at any location with mitigation measures in place. Mitigation measures are as specified in Section 11.8.

The results of the assessment has indicated that, in general, at distances of greater than 25m from the works sites, the construction day time noise limit of 75dB $L_{Aeq, 10hr}$ can typically be complied with during both enabling and construction works. It is also important to note that the impact due to construction activities will be transient in nature and not all activities will occur in the one location at the same time

The proposed construction phase noise mitigation measures as detailed in Section 11.7 shall ensure that all construction activities are controlled and managed and audited by an independent acoustic consultant to confirm that the mitigation measures are implemented throughout the construction phase.

Construction Traffic Noise

Based on the assumption of up to 16 HGV movements per day on the haul routes to and from the site along public roads, the resulting average predicted traffic noise level at the closest receptors is calculated as follows:

The predicted noise levels at any receptor located within 5m of the haul route road has been calculated using a standard international acoustical formula as described below.

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

where $L_{Aeq, T}$ is the equivalent continuous sound level over time period (T) (3600 sec);

SEL is the A weighted Sound Exposure Level of the noise event (77dB);

N is the number of events over the time period T (16);

r1 is the distance at which SEL is assessed (5m)

r2 is the closest distance to the receptor from the road (5m)

The calculations assumed a typical scenario of 2 truck movements per hour based on an 8 hour working day a maximum Sound Exposure Level of 77dBA for the trucks and the minimum distance between the local road passing by each of the nearest noise sensitive receptors to the public road (5m). No attenuation, above geometric spreading, has been considered within these calculations may be considered the worst case scenario.

The maximum predicted $L_{Aeq, period}$ values as a result of the HGV traffic movements at the nearest noise sensitive receptors located along the haul route roads is predicted to be 53 dBA, $L_{Aeq, period}$.

It is not expected that the predicted short-term increase in HGV movements associated with the construction phase of the development will have an adverse impact on the existing noise climate of the wider area or on local receptors and would not significantly increase the L_{den} at any receptor location in the area.

Vibration

The most significant potential sources of ground borne vibrations that may be generated during the construction phase of the development will be generated by the following practices:

- Ground preparation excavation activities that require the use of pneumatic rock breakers
- Concrete pile breakdown activities

Vibration impacts have been considered from any particular plant items that have the potential to generate perceptible levels of vibration.

The nearest off-site residential receptors are located at the Orby residential estate which are adjacent to the eastern – southeastern site boundary at a closest distance of 25m. Depending on the methods of construction, there is the possibility of construction related vibration impacts on human beings as a result of ground preparation and concrete foundation activities. However, such sources of vibration shall be temporary and intermittent.

Table 11.11 details the predicted vibration levels that could occur at the closest receptor at 25m (0.81 mm/sec PPV) during the pneumatic rock breaking which is the highest vibration causing activity that shall occur during the construction phase. A vibration limit of 7.5 mm/sec PPV based on *BS5228, 2014* shall be applied at third party residential receptors during pneumatic rock breaking activities.

A lower vibration limit of 3 mm/sec PPV shall be applied at Glencairn house and Murphystown Castle.

It is predicted that it is highly unlikely that any construction vibration impacts on buildings will occur. Experience of similar construction projects has shown that beyond this distance there is no risk of cosmetic damage occurring within buildings.

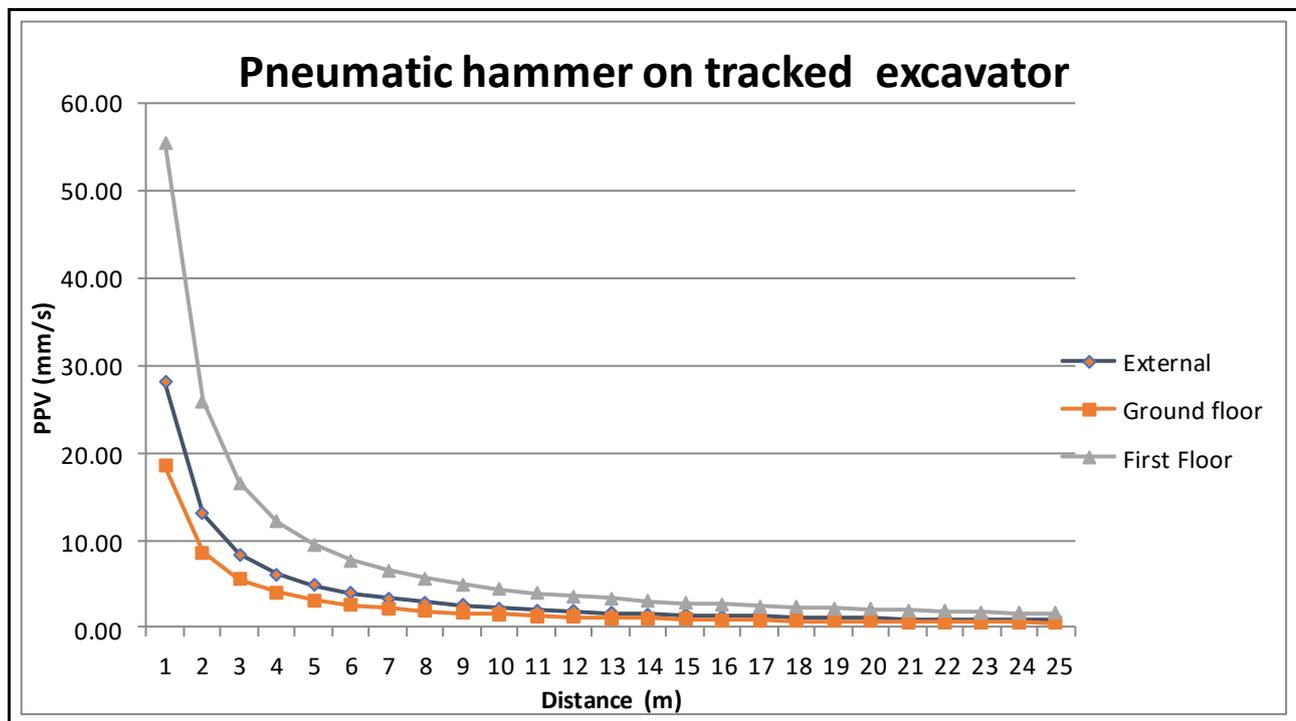
A construction phase vibration monitoring programme shall be implemented to ensure this assumption for the duration of the construction phase.

The vibration monitoring programme shall also provide for the continuous vibration monitoring of Glencairn House and the Murphystown Castle structure.

The vibration monitoring programme shall also include the monitoring of the LUAS Cherrywood line located along the western and northwestern development site boundary.

Table 11.11: Predicted vibration levels associated with pneumatic breaking 15 tonne tracked excavator

Distance	Vibration Level PPV (mm/s)		
	External	Ground floor	First Floor
1	28.01	18.48	55.45
5	4.77	3.15	9.44
10	2.22	1.47	4.40
15	1.42	0.94	2.82
20	1.04	0.68	2.05
25	0.81	0.54	1.61



Operational Phase

The noise aspects to be considered for the completed development can be divided into two categories:

- Noise impacts on neighbouring residential receptors
- Inward noise impacts on the development from traffic and construction works

Noise impacts on neighbouring residential receptors

The main potential for altering the noise environment once the development is operational, and thus impacting neighbouring residential receptors, is road traffic noise associated with the development.

The Traffic and Transportation Report submitted with this application includes a detailed assessment of the traffic impact associated with the proposed development. As part of this assessment, detailed traffic flow information has been derived for the existing road network for the 2020 opening year, 2025 and 2035 scenarios. The 2035 Traffic Network Impact scenario predicts that the traffic associated with the development will increase traffic at the developments Murphystown Road junction by 8% during the AM peak and by 11.4% during the PM peak for the 2020 opening year, by 10.6% during the AM peak and by 18.5% during the PM peak for 2025, and by 9.2% during the AM peak and by 14.4% during the PM peak for 2035. These maximum predicted values will result in a less than 3dB increase in existing ambient noise levels.

The UK Design Manual for Roads and Bridges (DMRB, Volume 11, Section 3, Part 7) states that it takes a 25% increase or a 20% decrease in traffic flows in order to get a 1dBA change in traffic noise levels. On this basis, the traffic flow increases associated with the development for all year scenarios will result in a traffic noise increase of approximately 1dBA. There will be an imperceptible impact on existing ambient noise levels at existing residential development in proximity to the existing roads and junctions within the surrounding area as a result of road traffic alterations associated with the proposed development.

The subject development includes the provision of surface and undercroft car parking spaces for the residential units. Vehicles using car parking areas generally travel at speeds <20kmph which result in relatively low noise levels. On site car parking within the proposed development will have no impact on adjacent residential developments.

Within the proposed development, sounds generated by everyday domestic activities including waste facilities, pedestrians, children, and use of open spaces, are part of everyday living, and are not considered “noise” in the sense of a potential nuisance. This activity noise would not have any potential for impact beyond the boundaries of the site. In particular, the design of the proposed development has ensured that waste management facilities will not result in impacts on adjacent sensitive receptors

Inward Noise impacts on the proposed development

Regarding noise aspects within the proposed development itself, the aspects to be considered are:

- Suitability for residential development, in terms of the existing noise climate
- Avoidance of potential conflict in terms of activity noise within the development itself

Properties to the north of the site, and closest to M50 Motorway, will be subjected to higher noise levels than properties located to the south of the site.

The main potential noise impact on existing receptors associated with the proposed development relates to additional traffic flows on the surrounding road network. Given that traffic from the development will make use of existing and new road infrastructure on Murphystown Road, it is appropriate to consider the increase in traffic

noise level that arises as a result of vehicular movements associated with the development using the L_{A10} parameter which is typically used to describe traffic noise.

It is noted that the proposed access route off the Murphystown Road which shall serve the development is opposite the Mount Eagle residential area. The area is screened from Murphystown Road by a c. 3m stone wall which will provide attenuation of noise associated with traffic entering and exiting the subject site.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 11.11 offers guidance as to the likely impact associated with any particular change in traffic noise level.

Table 11.11: Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level (dB LA10)	Subjective Reaction	Impact
< 3	Inaudible	Imperceptible
3 – 5	Perceptible	Slight
6 – 10	Up to a doubling of loudness	Moderate
11 – 15	Over a doubling of loudness	Significant
> 15		Profound

A traffic impact assessment relating to the proposed development has been prepared by DBFL Consulting Engineers as part of this application. Information from this report has been used to determine the predicted change in noise levels in the vicinity of the area surrounding the proposed development, for the 2020, 2025 and 2035 scenarios.

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing internal roads and internal site junctions with and without the development. Traffic data has been assessed and the calculated change in noise levels associated with both the developments is predicted to be <3dB – 3dB which is considered an imperceptible to slight impact.

For existing roads the Dublin Agglomeration Noise Action Plan 2013-2018, prepared jointly by the four Local Authorities in the Dublin Agglomeration, has set a level of 70dB (L_{Day}) and 55dB (L_{Night}) above which mitigation measures should be considered. Similar to noise impacts on neighbouring residential receptors, there will be no significant impacts associated with road traffic and domestic activities on future residents of the proposed development.

LUAS Cherrywood Line

The apartment blocks that shall front onto the LUAS line have been designed to ensure a high degree of acoustic insulation from LUAS noise sources to reduce the significance of external noise intrusion into the residential units. The mitigation measures which will be incorporated into the construction of the units and the scheme are summarised below and are detailed in Section 11.7.

To attenuate the propagation of passing LUAS tram noise into the apartment buildings located along the western and northwestern development site boundaries, noise mitigation by design measures shall include the installation of acoustically rated double or triple glazed window sets and balcony doors. Passive wall ventilation vents are not included in the design. Mechanical Ventilation & Heat Recovery (MVHR) systems or an equivalent system shall be installed in the apartment buildings no negate the requirement for passive ventilation vents.

External walls and the roof structures of the apartments shall be designed and constructed to include acoustic insulation to ensure that the World Health Organisation (WHO) internal bedroom nighttime design criteria of 30dB(A) is achieved.

Glencairn House

It is predicted that the noise impact of the additional vehicle movements associated with the operational phase will be slight as Glencairn House estate shall be screened by a 3m high solid block wall and existing trees and planting which shall serve as an effective acoustic barrier.

Vibration

The only source of vibration predicted, once the development has been constructed and is operational, is vibration associated with road traffic movements.

As a vehicle travels along a road, vibration can be generated in the road and subsequently propagate towards nearby buildings. Such vibration is generated by the interaction of a vehicle's wheels and the road surface and by direct transmission through the air of energy waves. Some of these waves arise as a function of the size, shape and speed of the vehicle, and others from pressure fluctuations due to engine, exhaust and other noises generated by the vehicle.

Ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Vibration impacts associated with road traffic can therefore be largely avoided by good maintenance of the road surface.

It has been assessed that vibration levels related to road traffic movements, including those additional movements due to the proposed development would be significantly lower than those levels required to lead to disturbance of occupiers or to cause cosmetic or structural damage to buildings including the Murphystown Castle structure.

11.5.3 Cumulative Noise Impacts

In accordance with *Schedule 6, Part 2(c) of the Planning and Development Regulations 2001-2018*, this section has considered the cumulative impact of the proposed development in conjunction with future development in the vicinity of the subject site. This section relates to the cumulative impact on the subject site itself and on surrounding sites.

The European Commission's report of May 1999 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' defines cumulative impact as follows:

"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project".

The noise and vibrational impacts of the development will be managed during the construction phase in a manner that will not have an adverse or unacceptable noise or vibrational impact on Glencairn House, Murphystown Castle, the LUAS Cherrywood line or any other residential areas in the vicinity of the site through the implementation of mitigation and control measures throughout the construction and operational phases of the development. There are no other residential developments proposed for any adjacent or adjoining lands as all lands are currently developed.

It is considered that there will be short to medium term moderate negative cumulative impacts associated with the construction phase of the project over all phases of the development.

11.6 Inward Noise Impact Assessment

To mitigate the traffic noise impacts on the proposed residential units within the scheme, mitigation measures will be incorporated into the design of the proposed residential units (mitigation by design).

External noise can enter rooms within dwellings through windows, ventilators, walls, roof and doors. In most cases, however, windows provide the main path and therefore, mitigation by design has focussed on this building element to ensure that their insulation is adequate.

All residential units with facades facing towards the M50 to the north and northeast and northwest and all residential units with facades facing towards the LUAS Cherrywood line shall have acoustically rated triple pane glazing to prevent the breakthrough of external noise. There shall be no passive air vents on external walls to reduce the breakthrough of external noise. The apartments shall include ducted Heat Recovery and Ventilation Systems.

At the earliest stage during the construction phase, residential test units shall be constructed to their finished level and shall be tested by a suitably qualified independent Acoustic Engineer to ensure that they comply with *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound*. Table 11.12 provides detail on the recommended sound insulation values that shall be achieved to ensure acoustic privacy between adjoin residential units.

Table 11.12: Recommended sound insulation values for internal party walls / floors

Dwellings	Airborne Sound Insulation D_{nTw} (dB)	Impact Sound Insulation L_{nTw} (dB)
Floors and Stairs	53	58
Walls	53	N/A

The main potential noise impact on existing receptors associated with the proposed development relates to additional traffic flows on the surrounding road network. Given that traffic from the development will make use of existing and new road infrastructure, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development using the L_{A10} parameter which is typically used to describe traffic noise.

For other non-traffic related sources appropriate guidance on internal noise levels for dwellings is contained within *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings*. This British Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as detailed in Table 11.13

Table 11.13: Recommended Indoor Ambient Noise Levels from BS 8233: 2014

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

As outlined in Section 11.9, noise mitigation measures for the development are specified to ensure that the following internal ambient noise criteria shall be achieved:

35 – 40dB $L_{Aeq,T}$ daytime within living/dining rooms;
30dB $L_{Aeq,T}$ night-time within bedrooms.

With regard to the existing ambient noise climate of the area, the site layout and the internal noise criteria, the sound insulation requirements of the residential units have been assessed to ensure that external noise from traffic movements along Murphystown Road, M50 traffic, traffic movements within the development, and Luas tram movements do not have an adverse impact on internal noise levels.

11.7 DO NOTHING IMPACT

If the site remains undeveloped it shall continue to have no impact on the receiving noise environment. Based on the projected increase in traffic up to the reference year of 2035 the increase in traffic noise levels based on projected Traffic Impact Assessment figures without the subject development would be <3dB. This increase above the existing situation would be minor and would not result in a perceptible change in the existing noise climate at any local receptor.

11.8 REMEDIAL AND MITIGATION MEASURES

11.8.1 General Construction Site Management

The following noise management measures shall be implemented at the site from the outset of site activities to control and manage noise levels during the construction phase of the proposed development:

N&V CONST 1

- An independent acoustic consultant shall be engaged by the contractor prior to the commencement of site activities to ensure that all noise mitigation measures as specified in this Section of the EIS Report are implemented and to prepare a site specific *Construction Phase Noise Management Plan*. The Plan shall include all relevant noise and vibration control measures as specified in this document. The Plan shall be submitted to Dun Laoghaire Rathdown Council for approval.
- The nominated contractor shall appoint a designated person to manage all environmental complaints including noise and vibration.
- A noise complaint procedure shall be implemented in which the details of any noise related complaint are logged, investigated and where required, measures are taken to ameliorate the source of the noise complaint.
- Appropriate signage shall be erected on all access roads in the vicinity of the site to inform HGV drivers that engines shall not be left idling for prolonged periods and that the use of horns shall be banned at all times.
- HGV's queuing on any local or public road shall not be permitted and it shall be the responsibility of site management to ensure this policy is enforced.
- The hours of operation for the site shall be limited to the following hours:
 - 08:00hrs – 19:00hrs Monday to Friday
 - 08:00hrs – 16:00hrs Saturday
 - Closed on Sundays and Bank/Public Holidays
- All onsite generator units (if required) used to supply electricity to the site shall be super silenced or enclosed and located away from any receptor.

11.8.2 Construction Phase Noise & Vibration Mitigation

The following shall be implemented to mitigate construction noise impacts in order to ensure that the construction phase of the development does not have an unacceptable impact on sensitive receptors:

N&V CONST 2

- A strictly enforced noise management programme shall be implemented at the site from the outset of construction activities.
- The Developer shall appoint an acoustic consultant independent of the Contractor to conduct routine noise audit surveys which shall be conducted at the baseline noise monitoring locations throughout the construction phase of the development to assess compliance with the construction noise limit criteria detailed in this document and to assess the effectiveness and implementation of the specific Construction Phase noise mitigation measures detailed in this document.
- The principal of controlling noise at source shall be implemented at the site. Best practice mitigation techniques as specified in *BS 5228:2009+A1 2014 – Noise and Vibration Control on Construction and Open Sites* shall be implemented during the construction phase and are detailed in this Section.
 - All plant where possible shall be low noise rated.
 - High noise activities such as pneumatic hammering / rock breaking shall not occur before 08:00hrs and not after 17:00hrs Mondays to Fridays.
 - Where necessary the use of enclosures and noise screens shall be used to control noise from plant.
 - Plant shall be located away from the closest noise sensitive receptors where practicable.
 - All site vehicles shall either be turned off when not in use or throttled down when idle.
 - Site plant and vehicles shall be maintained to ensure they are not excessively noisy.
 - Vibration sources such as compressors, pumps or generators shall be isolated and placed on anti-vibration pads to minimise ground vibrations and vibrational noise.
 - Site offices / cabins shall be grouped together in a manner that forms an additional noise barrier relative to the closest receptors to the site boundaries.
 - Appropriately sized pneumatic breaking equipment shall be used to reduce the vibrational and noise impact of rock breaking and pile cap breaking activities.

11.8.3 Construction Phase Vibration Mitigation

In order to ensure that site construction activities are conducted to minimise the vibration impacts on the receiving environment, structural vibration monitoring shall be conducted during the course of the project works as and if required. It is proposed that vibration monitoring will be conducted at adjacent properties as required using calibrated vibration monitors and geophones and that audible and visual alarm units may be installed to ensure that if vibration levels approach or exceed specified warning and limit values, site personnel will be alerted to cease at the earliest instance and appropriate mitigation measures may then be implemented to minimise the vibrational impacts of protected structures.

As detailed in Section 11.2.2 the transient vibration guide values for cosmetic damage as specified in *British Standard BS 7385: Evaluation and measurement for vibration in buildings, Part 2 1993 Guide to damage levels arising from ground borne vibration*.

Having regard to the above it is recommended that the inclusion of the following mitigation measure for ease of reference:

N&V CONST 3: In order to protect the amenities enjoyed by nearby residents, premises and employees a full Construction Management Plan (including traffic management) should be put in place prior to the commencement of development. This will need to have regard to the mitigation measures set out in Section 11.8.3 of the EIA Report.

11.8.4 Operational Phase Noise Mitigation

To mitigate the impacts associated with transport related noise emissions from the M50, Murphystown Road and the LUAS Cherrywood line, the following mitigation measures have been incorporated into the design of the proposed residential units (mitigation by design).

N&V OPER 1 External Noise Mitigation

External noise can enter rooms within dwellings through windows, ventilators, walls, roof and doors. In most cases, however, windows provide the main path and therefore, mitigation by design has focussed on this building element to ensure that their insulation is adequate. All external windows shall be triple glazed acoustically rated window and frames or equivalent double glazing reaching the same level to prevent breakthrough of external noise. In addition, Mechanical Ventilation & Heat Recovery (MVHR) systems or an equivalent system may be incorporated into the design of the apartment units thus there will be no requirement for passive air vents.

Acoustic Design requirements for residential buildings

Windows

In order to ensure a sufficient level of sound insulation is provided for all dwellings within the development, the following lists the minimum sound insulation performance of windows and window frame sets in terms of the weighted sound reduction index (R_w):

40dB R_w for Living rooms & Bedrooms
37dB R_w for Kitchen – Dining Rooms.

The acoustic performance specifications detailed are the minimum requirements which shall apply to the overall glazing system when installed on site. In the context of the acoustic performance specification the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc. All exterior wall and door frames should be sealed tight to the exterior wall construction.

Ventilation Systems

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations. The apartment units shall include mechanical ventilation and heat recovery systems (MVHR) or an equivalent system which will negate the requirement for passive wall vents in bedrooms and living spaces which would otherwise allow the transfer of external noise into the building through the air gaps in the passive vents. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. This design feature of the residential units will ensure that the building structure is acoustically insulated from the external environment. A range of heating systems shall be considered for the residential houses including air source heat pumps and gas heating. All residential houses shall be fitted with acoustic wall vents with a minimum 50dB(A) $D_{n,e,w}(C;Ctr)$ sound reduction performance to mitigate the ingress of external noise.

Wall Constructions

The wall construction typically provides the highest level of sound insulation performance to a residential building. The minimum sound insulation performance of the chosen wall construction will be 55dB R_w . It is noted that rated walls systems can decrease by 5-7dB when installed in-situ. It is recommended that wall systems with a R_w value of at least 60dB are utilised.

Roof Construction

The insulated roof constructions proposed across the site will provide an adequate level of sound insulation to the properties within the development site. A minimum sound insulation value of 40dB R_w should be used for roof spaces. This can nominally be achieved using tiled pitched roof with 100mm acoustic insulation and plasterboard ceiling.

At the earliest stage during the construction phase, residential test units shall be constructed to their finished level and shall be tested by a suitably qualified independent Acoustic Engineer to ensure that they comply with *Department of the Environment, Building Regulations 2014, Technical Guidance Document E – Sound*. Table 11.12 above provides detail on the recommended sound insulation values that shall be achieved to ensure acoustic privacy between adjoining residential units and to assess compliance with external noise intrusion criteria as defined in *BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings*.

As set out in Section 11.5.1 the operational phase of the development is unlikely to have an adverse noise impact on the receiving environment or on existing residential developments adjacent to the site during the operational phase of the scheme. Therefore, no mitigation measures additional to those set out above are proposed.

11.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

Outward Noise Impact

Construction phase

During the construction phase there is the potential for some minor impact on nearby noise sensitive properties due to noise generated by construction site activities. The implementation of the construction phase noise and vibration mitigation and monitoring programme as detailed in Section 11.8 above and Section 11.10 below, will minimise the potential noise and vibration impact on the receiving environment including existing residential receptors.

Operational Phase

The predicted noise impact generated by additional traffic movements associated with the development is predicted to be of an imperceptible to slight impact on existing ambient noise levels at the Orby, Glencairn View or the Mount Eagle housing estates, or on the Glencairn House property.

Inward Noise Impact

It may be concluded that during daytime and night-time periods, acceptable internal noise levels can be achieved across the site as defined in *BS 8233* with windows closed using the recommended triple glazing, wall and roof constructions as proposed in Section 11.8 above.

The installation of Mechanical Heat Recovery and Ventilation systems or equivalent in the apartment units will negate the requirement for external wall vents in apartments, thus maintaining the sound insulation integrity of external wall structures.

With regard to the recommended mitigation by design measures as specified above, it may be concluded that residential properties located within the proposed development can be appropriately designed and constructed to achieve acceptable internal noise levels.

11.10 MONITORING

This section describes the noise and vibration monitoring methodologies that shall be implemented at the site to ensure that construction site activities do not cause excessive nuisance or cause cosmetic or structural damage to properties in the vicinity of the site.

11.10.1 Proposed Noise Monitoring Programme During Site Construction

On commencement of the site construction activities, routine (quarterly) noise monitoring shall be conducted in the vicinity of the site to assess the impact that site activities may have on local external noise levels and on ambient noise levels on local receptors.

It is proposed to conduct routine noise monitoring surveys to establish the noise impacts of site activities at the closest receptors to the site (baseline monitoring locations) and to ensure that mitigation and control measures are implemented if elevated noise levels are recorded.

All noise monitoring data will be compiled into a technical monitoring report which will include a full assessment of the potential noise impacts arising from site construction activities. Noise Monitoring reports shall be maintained by the Construction Site manager and shall be available to the Local Authority as required.

The environmental noise measurements will be completed in accordance with the requirements of *ISO 1996: Acoustics – description and measurement of environmental noise*. The measurement parameters to be recorded include wind speed, temperature, L_{Aeq} , L_{A90} , L_{A10} and L_{Amax} . and 1/3 octave band frequency analysis.

Noise Monitoring Locations

The monitoring locations selected for the noise monitoring survey will be at residential noise sensitive receptors adjacent to the site boundaries and as identified in the baseline noise assessment.

11.10.2 Proposed Vibration Monitoring Programme During Site Construction

In order to ensure that site construction activities are conducted to minimise the vibration impacts on the receiving environment, it is proposed that structural vibration monitoring may be implemented during the course of the construction phase if and as required. It is proposed that vibration monitoring will be conducted at adjacent properties opposite the site boundaries as required using calibrated vibration monitors and geophones and that audible and visual alarm units may be installed to ensure that if vibration levels approach or exceed specified warning and limit values, site personnel will be alerted to cease at the earliest instance and appropriate mitigation measures may then be implemented to minimise the vibrational impacts of protected structures.

It is proposed that continuous live vibration monitoring systems with text and email alert capability shall be installed at the following locations for the duration of the construction phase and for a period of 1 month following the full operation of the development.

- LUAS Cherrywood Line
- Glencairn House
- Murphystown Castle structure
- Orby Avenue estate

Vibration Monitoring reports shall be maintained by the Construction Site manager and shall be available to the Local Authority as required.

If construction works are considered to have the potential to impact the infrastructure of the LUAS Cherrywood line, a programme of vibration monitoring and track surveys shall be conducted in accordance with TII Zone of Influence protocols.

Vibration Monitoring Locations

The monitoring points chosen for locating the geophone of the vibration measuring instrument will be chosen according to the guidelines in British Standard *BS 7385: Evaluation and measurement for vibration in buildings, Part 1 1990 Guide for measurement of vibrations and evaluation of their effects on buildings* and *Part 2 1993 Guide to damage levels arising from groundborne vibration*.

11.11 REINSTATEMENT

Reinstatement issues are not relevant to this Section of the EIAR.

11.12 INTERACTIONS

The principal interactions between Noise & Vibration impacts and Population and Human Health have been addressed in Section 11.7 of this report which describes in detail the mitigation measures that shall be implemented to ensure that human health and residential amenity are not adversely impacted by any aspect of the construction or operational phases of the development.

11.13 DIFFICULTIES ENCOUNTERED IN COMPILING

There were no difficulties encountered in compiling this section of the EIAR.

11.14 REFERENCES

- Department of Environment, Heritage and Local Government 2003 Environmental Impact Assessment (EIA), Guidance for Consent Authorities Regarding Sub-Threshold Development*
- Department of Environment, Heritage and Local Government 2007 Development Management Guidelines*
- Department of Environment, Community and Local Government March 2013 Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*
- Environmental Protection Agency, 2002. Guidelines on the Information to be Contained in Environmental Impact Statements*
- Environmental Protection Agency, 2003. Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*
- ISO 1996: 2007: Acoustics – Description and measurement and assessment of environmental noise.*
- NRA (TII) Guidance for the Treatment of Noise and Vibration in National Road Schemes (2014).*
- BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise 2009+A1 2014.*
- UK Department of Transport (Welsh Office) - Calculation of Road Traffic Noise [CRTN] and*
- UK Highways Agency Design Manual for Roads and Bridges Part 7 HD 213/11 – Revision 1 Noise and Vibration.*
- BS 5228 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration 2009+A1 2014*
- BS 7385-2:1993 – Evaluation and Measurement for Vibration in Buildings: Part 2 – Guide to Damage Levels from Groundborne Vibration.*
- Department of the Environment, Building Regulations 2014, Draft Technical Guidance Document E – Sound.*