Allegro Acoustics Limited,
C1 South City Business Park,
Tallaght, Dublin 24
Tel: +353 (0) 1 4140485
www.allegroacoustics.ie

Devoy Barracks Residential Development

Naas, Co. Kildare

Planning Stage Noise Assessment

Planning Reference: ABP-311684-21

14 March 2022

Ghníomhaireacht Forbartha Talún
Land Development Agency

Report Author: Stephen Kearney

Report: DC1955-01

Report Control

Document Title:	Planning Stage Noise Assessment

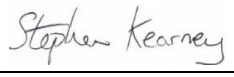
Project:	Devoy Barracks Residential Development

Client:	The Land Development Agency

Job Number:	DC1955-01

File Origin:	Z:\Allegro Acoustics\Allegro Acoustics Live\Projects\DC1700 to DC1999\DC1955\Reports

Report Author:	Stephen Kearney BE MIEI MIOA

Signed:	

Date:	14th March 2022

Issue	Date	Status	Checked By	Signed
1	23/03/2021	Draft	David Cawley BE MSc CEng MIEI MIOA	
2	24/03/2021	Draft	David Cawley BE MSc CEng MIEI MIOA	
3	31/03/2021	Draft	David Cawley BE MSc CEng MIEI MIOA	
4	12/04/2021	Draft	David Cawley BE MSc CEng MIEI MIOA	
5	04/03/2022	Draft	David Cawley BE MSc CEng MIEI MIOA	
6	14/03/2022	Final	David Cawley BE MSc CEng MIEI MIOA	

Table of Contents

Appendices

Glossary of Terminology

L_{Aeq}: Equivalent Continuous A-weighted Sound Level. The continuous steady noise level, which would have the same total A-weighted acoustic energy as the real fluctuating noise measured over the same period of time.

L_{A90}: The A-weighted noise level that is equalled or exceeded for 90% of the measurement period. This is typically used to indicate the background noise level at a location.

L_{A10}: The A-weighted noise level that is equalled or exceeded for 10% of the measurement period.

L_{Amax}: The A-weighted maximum instantaneous noise level that is measured throughout a noise measurement.

1 Introduction

Allegro Acoustics was commissioned by the Land Development Agency to carry out a noise assessment as part of a planning application for a residential development (Planning Application Number: ABP-311684-21). The development site is located on John Devoy Road, Naas, Co Kildare, known as Devoy Barracks. The proposed development is for the construction of 219 no. residential units, comprising of a mix of terraced houses (42 no. in total), and duplex / apartment units (177 no. in total) ranging in height from 2 to 5 storeys, a 59-place childcare facility, public and communal open spaces and all associated site works and infrastructure. Vehicular and pedestrian access is proposed via an existing access point on the John Devoy Road along the southern boundary with additional pedestrian and cycle access provided to the east, and future pedestrian and cycle connection opportunities provided to the north, west and east. The proposed development is shown in Figure 1 below.

Figure 1: Drawing showing the proposed residential development.

The purpose of the noise assessment detailed in this report is to address the noise aspect of Planning Opinion Item 9 from the *Notice of Pre-Application Consultation Opinion* issued by An Bord Pleanála in December 2021 [1]. Planning Opinion Item 9 is shown in Figure 2 below.

> **9.** A report that addresses issues of residential amenity (of both future occupants and existing residents of adjacent development), specifically with regards to overlooking, overshadowing, visual impact and noise. The report shall include

Figure 2: Planning Opinion Item 9 from the *Notice of Pre-Application Consultation Opinion* issued by An Bord Pleanála in December 2021 [1].

This report details the noise assessment carried out and discusses the findings.

2 Suitably Qualified Consultant

This assessment and report has been compiled by Stephen Kearney. Stephen has been working as an acoustician for seven years and has acted as lead acoustic consultant for a range of developments in the Republic of Ireland and in the United Kingdom.

Stephen holds an Honours Engineering Degree from NUI Galway and a Post Graduate Diploma in Acoustics and Noise Control from Trinity College Dublin and the Institute of Acoustics (IOA). Stephen has experience in acoustic design for projects in the commercial, educational, residential and civic fields. It is proposed that Stephen has the experience and qualifications necessary to demonstrate that he is a Suitably Qualified Acoustician.

Consultant Qualifications	
Name	Qualifications
Stephen Kearney BE MIEI MIOA Principal Acoustic Consultant Allegro Acoustics, 2014 to Present	• Postgraduate Diploma in Acoustics and Noise Control from Trinity College Dublin and the Institute of Acoustics (IOA) (Hons 1:1 2016) • Bachelors Degree in Energy Systems Engineering from National University of Ireland, Galway (Hons 2:1 2014)
Examples of Previous Projects: • **Marlin Hotel** – Lead Acoustic Design Consultant for this 300-bed hotel in Dublin City Centre. • **Clonshaugh Hotel** – Lead Acoustic Design Consultant for this 421-bed hotel near Dublin Airport. • **Goldcrest Village Student Accommodation** – Lead Acoustic Design Consultant for this 430-bed student accommodation facility in Galway City. • **Lancaster Circus Student Accommodation** – Lead Acoustic Design Consultant for this 1023-bed student accommodation facility in Birmingham, United Kingdom.	

Table 1: Information regarding the acoustic experience of the report author, Stephen Kearney.

3 Baseline Noise Levels

Allegro Acoustics carried out a manned noise survey at two locations on the 15th of March 2021 to determine the existing baseline noise levels at the site of the proposed development. Noise monitoring was carried out according to the methodologies outlined in the following standards:

- International Standards Organization, *ISO 1996 Acoustics – Description and Measurement of Environmental Noise* [2].
- Environmental Protection Agency, *Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* [3].

The two noise monitoring locations denoted as N1 and N2 are shown on a drawing of the site in Figure 3 below.

Figure 3: Drawing showing noise monitoring locations N1 and N2 with the site boundary outlined in red.

Noise monitoring was carried out at each location during day, evening and night time hours. As per the guidance provided by the Environmental Protection Agency in *Guidance Note for Noise (NG4)* [3], day, evening and night time periods are defined as follows:

- Day: 07:00 - 19:00
- Evening: 19:00 - 23:00
- Night: 23:00 - 07:00

Weather conditions were observed to be conducive to noise monitoring throughout the noise survey (wind <5m/s, rain <1mm per hour [2]). The characteristics of the noise environment are described in Table 2 below. The results of the noise survey are presented in Table 3 and Figure 4 below. A detailed table of results is also included Appendix A.

Characteristics of the Noise Environment		
Location	Period	Observations
N1	Day	The primary noise source during the day time measurement at monitoring location N1 was observed to be traffic noise from the surrounding road network. Additional noise sources included cars from the nearby offices and residential estates passing the monitoring location, intermittent noise from a nearby construction site and birdsong.
N1	Evening	The primary noise source during the evening time measurement at monitoring location N1 was observed to be traffic noise from the surrounding road network. Additional noise sources included cars and people from the nearby residential estates passing the monitoring location.

Characteristics of the Noise Environment		
Location	Period	Observations
N1	Night	The primary noise source during the night time measurement at monitoring location N1 was observed to be traffic noise from the surrounding road network. Additional noise sources included occasional cars from the nearby residential estates passing the monitoring location.
N2	Day	The primary noise source during the day time measurement at monitoring location N2 was observed to be traffic noise from the surrounding road network. Additional noise sources included cars from within the residential estate passing the monitoring location and birdsong.
N2	Evening	The primary noise source during the evening time measurement at monitoring location N2 was observed to be traffic noise from the surrounding road network. Additional noise sources included cars from within the residential estate passing the monitoring location, a van turning near the monitoring location and a dog barking near the end of the measurement.
N2	Night	The primary noise source during the evening time measurement at monitoring location N2 was observed to be traffic noise from the surrounding road network. Additional noise sources included occasional cars from within the residential estate passing the monitoring location.

Table 2: Characteristics of the noise environment as observed during the noise survey.

Measured Noise Levels									
Location	Meas No.	Start Time	Period	Duration	L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{Amin}
					dB	dB	dB	dB	dB
N1	1	15/03/2021 17:03	Day	00:30:00	58.2	45.1	62.4	77.7	42.5
N1	3	15/03/2021 19:08	Evening	00:30:00	54.7	41.9	57.1	76.9	39.2
N1	5	15/03/2021 23:00	Night	00:30:00	63.2	37.3	63.9	91.4	32.1
N2	2	15/03/2021 18:40	Day	00:30:00	52.1	43.7	53.3	72.8	40.8
N2	4	15/03/2021 19:44	Evening	00:30:00	52.8	41.1	52.6	84.1	37.3
N2	6	15/03/2021 23:37	Night	00:30:00	42.0	32.1	42.6	66.6	29.1

Table 3: Measured noise levels at the site of the proposed development.

The 1/3rd Octave frequency breakdown for each measurement has been assessed for tonality using the 1/3rd Octave method outlined by the Environmental Protection Agency in *Guidance Note for Noise (NG4)* [3]. Using this methodology, the following conclusions were made:

- Elevated sound energy was identified in the 16kHz dB L_{eq} 1/3rd octave band during the day time measurement at N1. This elevated sound energy was not audible during the noise survey and is considered to attributable to electrical interference in the microphone.
- Elevated sound energy was identified in the 1kHz dB L_{eq} 1/3rd octave band during the evening time measurement at N2. This elevated sound energy was observed to be attributable to a reversing beeper from a van turning near the measurement location.
- The background noise environment at the site of the proposed development was not observed to have any significant tonal or impulsive characteristics. Background noise is typically depicted using the dB L_{90} statistical indicator [4].

The measured 1/3rd octave dB L_{eq} and dB L_{90} values for each measurement are shown in Figure 4 below. A detailed table of results is also included Appendix A.

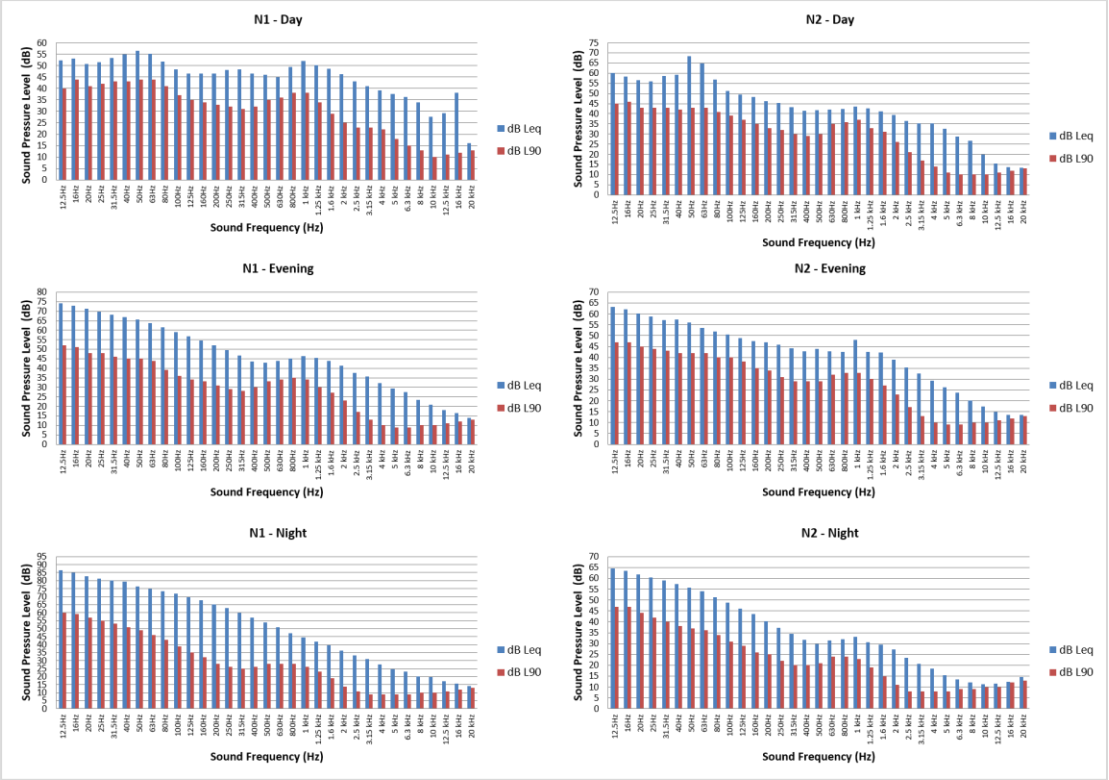


Figure 4: Graphical representation of the measured 1/3rd octave dB L_{eq} and dB L_{90} values for each measurement. This data is included in tabular format in Appendix A.

Note Regarding Covd-19:

Due to the COVID-19 related government guidelines, traffic volumes along the M7 motorway (≈1.8km from the site) and from the surrounding road network are likely to have been lower during the noise survey than during pre-covid levels. This may have had an impact on the measured baseline noise levels. As a guide, the traffic data recorded by Transport Infrastructure Ireland (TII) at the permanent traffic monitoring station located between Junction 7 and Junction 8 on the M7 motorway shows a reduction of approximately 50% in traffic volume when compared to 2020 pre-covid data. However, the percentage of heavy goods vehicles has increased by approximately 40%. This is shown in Table 4 below.

Road Traffic Levels at Junction 7 – Junction 8 (Kill - Johnstown) of the M7 Motorway		
Traffic Indicator	February 2020 (Pre-Covid Restrictions)	February 2021 (During Covid Restrictions)
Average 24hr Traffic Count	84755	40865
Heavy Goods Vehicles (%)	7.8	12.9

Table 4: Measured road traffic levels between Junction 7 and Junction 8 on the M7 motorway.

It is estimated that the reduction in overall road traffic levels may have resulted in a reduction in noise levels of approximately 3dB. However, this reduction will likely have been offset to an extent by the increase in HGV traffic. It is therefore concluded that the Covid-19 restrictions are likely to have a resulted in a small reduction in the overall measured noise levels when compared to pre-covid levels.

4 Construction Noise

Noise sensitive locations have been identified in close proximity to site of the proposed development. These noise sensitive locations include residential dwellings to the north, south and west of the site and commercial offices and the MERITS (Mid-Eastern Region Innovation Think Space) building to the east of the site. Construction noise will be strictly controlled throughout this development to protect these noise sensitive locations.

Allegro Acoustics proposes that the construction noise limits outlined by Kildare County Council in the *Kildare County Council Third Noise Action Plan 2019* – 2023 [2] are appropriate for this development. These noise limits line up with the construction noise limits outlined by The National Roads Authority in *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* [5]. While these limits relate to road schemes, in the absence of any statutory guidelines in the Republic of Ireland relating to noise limits for housing developments, these noise limits are considered to be the most appropriate construction noise limits for this development.

Proposed Construction Noise Limits		
Day & Times	dB $L_{Aeq\ (1hr)}$	dB L_{Amax}
Monday – Friday (07:00 to 19:00)	70	80
Monday – Friday (19:00 to 22:00)	60	65
Saturday (08:00 to 16:30)	65	75
Sundays and Bank Holidays (08:00 to 16:30)	60	65

Table 5: Proposed construction noise limits for this development.

These noise limits will be enforced using continuous noise monitoring during the construction phase of this project. The noise monitoring station used will be equipped with real time text / email alerts to notify the site team as soon as an exceedance takes place. This will allow the contractor to investigate the cause of the exceedance and take action immediately to reduce the noise levels to below the level outlined in Table 5 above.

The good practice measures outlined in *BS 5228-1 + A1 Code of practice for noise and vibration control on construction and open sites* [6] will be implemented at this site as appropriate to control and minimise the impact of construction noise on the surrounding noise environment. These measures are summarised as follows:

- A site representative responsible for matters relating to noise will be appointed at the start of the construction phase of the project.
- Channels of communication between the contractor and the nearby noise sensitive locations will be established. This will allow for the maintenance of good relations and clear channels of communication between the contractor and the occupants of the nearby noise sensitive buildings.
- Plant equipment with low inherent potential for generation of noise will be selected where practical.
- Where earth movers dump material into dumper trucks, the material fall height will be minimised as much as practical so that noise generation is minimised.
- Mufflers and silencers will be fitted to constant noise sources such as vehicular machinery and generators where required.
- Machinery will be switched off when it is not in use instead of leaving it on idle.

- As far as reasonably practical, sources of significant noise will be enclosed. Acoustic screens will be used close to noisy operations where required.
- Temporary hoarding will be erected around items such as generators or high duty compressors where required.
- Noisy plant will be located as far away from noise sensitive facades as practical and as permitted by site constraints.
- Diesel engines will be substituted with electric motors where practical.

5 Operational Noise

The primary noise sources during the operational phase of this development are identified as follows:

- Increased traffic volume from the development.
- Plant noise from M&E plant items associated with the development.

These items are discussed individually in subsections 5.1 and 5.2 below.

Additional everyday domestic noise sources such as waste collection, pedestrians and use of open spaces are generally considered part of everyday living and are generally not considered in the context of noise nuisance.

5.1 Increased Traffic Volume

It is noted that the addition of 219 no. residential units and a childcare facility will result in an increased traffic volume to the area. As shown in Figure 1 above, the site for this development is located in a suburban setting with residential dwellings to the north, south and west of the site and commercial offices and the MERITS (Mid-Eastern Region Innovation Think Space) building to the east of the site. As outlined in Table 2 above, the existing noise environment at this site is characterised by traffic noise from the surrounding road network and from existing local traffic. As such, it is concluded that the additional noise created by traffic servicing this development during the operational phase will not be out of place in the context of the existing noise environment.

A peak traffic assessment carried out by Cronin Sutton Consulting Group [7], concluded that the peak hour 2-way traffic flows along John Devoy Road are predicted to increase by a maximum of 11.9% as a result of this development. Using a logarithmic comparison (N = 10Log(L2/L1)), it is calculated that an 11.9% increase in peak traffic volume will result in a 0.48dB increase in the dB L_{A10} noise level in the vicinity of the John Devoy Road, during peak traffic hours.

As per the guidance outlined in the *UK Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7* [8], an increase in the traffic noise levels of less than 0.9dB dB $L_{A10,18h}$ is considered negligible in the context of both the short term (year the project is opened) and the long term (15 years after the project is opened). This is shown in Figure 5 below.

Noise change, $L_{A10,18h}$	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major

Table 3.1 – Classification of Magnitude of Noise Impacts in the Short Term

Noise change, $L_{A10,18h}$	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

Table 3.2 – Classification of Magnitude of Noise Impacts in the Long Term

Figure 5: Extract from the *UK Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7* [8].

5.2 M&E Plant Noise

Noise emitting items of external M&E Plant may be introduced to this development during the design phase. These items of plant would typically include air / ground source heat pumps, air handling equipment etc. Should these items be introduced during the design phase of this project, the following noise limit is proposed:

- Noise from the item of plant in question (dB $L_{Aeq,30mins}$) should be no more than 3dB above of the measured background noise level at the same location (dB $L_{A90,30mins}$ as outlined in Table 3 above).

According to guidance outlined by the Environmental Protection Agency in *Guidance Note for Noise (NG4)* [3], under normal circumstances, a 3dB change in environmental noise level is the smallest noticeable to the human ear. Allegro Acoustics understands that this a typical level referenced by planning authorities. The background noise level is typically depicted using the dB L_{A90} statistical indicator [4].

This proposed noise limit is detailed further in Table 6 below.

Proposed Noise Limits for M&E Plant				
Monitoring Location	Period	Representative Location	Measured Background Noise Level dB $L_{A90,30mins}$	Proposed Noise Criteria for M&E Plant Noise dB $L_{Aeq,30mins}$
N1	Day	East and North Façade of the Site	45.1	48.1
	Evening		41.9	44.9
	Night		37.3	40.3
N2	Day	West and South of the Site	43.7	46.7
	Evening		41.1	44.1
	Night		32.1	35.1

Table 6: Proposed noise limits for M&E Plant associated with the development.

Operational phase M&E plant noise will be attenuated as required to ensure that these noise limits are achieved at the closest noise sensitive location to the item of plant in question.

6 Regulatory Compliance / Acoustic Comfort

The development will be designed to provide the appropriate level of acoustic comfort to the users of the residential development and the childcare facility.

Residential

- The glazing and façade for each space will be specified and designed so that the internal noise levels meet the recommended indoor ambient noise level for dwellings as outlined in *BS 8233 Guidance on sound insulation and noise reduction for buildings* [9].

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Figure 6: Extract from *BS 8233 Guidance on sound insulation and noise reduction for buildings* [9].

- The separating walls and floors in the residential dwellings and apartments will be designed and specified so that the criteria outlined in Requirement E1 of *Technical Guidance Document E* [10] is achieved.

Table 1 Sound performance levels *(Par. 1.1.1)*

Separating construction	Airborne sound insulation $D_{nT,w}$ dB	Impact sound insulation $L'_{nT,w}$ dB
Walls	53 (min)	-
Floors (including stairs with a separating function)	53 (min)	58 (max)

Figure 7: Extract from *Technical Guidance Document E* [10].

- The sound absorption strategy in common areas throughout this development will be designed and specified so that the criteria outlined in Requirement E2 of *Technical Guidance Document E* [10] is achieved. This will be done using either Method A or Method B as described in *Technical Guidance Document E* [10].

Reverberation.	E2	The common internal part of a building which provides direct access to a dwelling shall be designed and constructed so as to limit reverberation in the common part to a reasonable level

Figure 8: Extract from *Technical Guidance Document E* [10].

Childcare Facility

The internal noise level criteria, the glazing and façade performance, the internal sound insulation performance and the sound absorption strategy for the childcare facility will be specified using appropriate acoustic standards and guideline documents such as:

- *BS 8233 Guidance on sound insulation and noise reduction for buildings* [9]
- *AS / NZS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors* [11].

7 Summary and Conclusion

Allegro Acoustics has carried out a noise assessment at the former Devoy Barracks, John Devoy Road, Naas, Co. Kildare as part of a planning application for the development of 219 no. residential units and a childcare facility (Planning Reference: ABP-311684-21). This assessment is summarised as follows:

- A manned baseline noise survey confirms that the noise environment at this site is characterised by road traffic noise from the surrounding road network.
- The measured baseline noise levels as outlined in Table 3 above are typical of a suburban residential setting.
- Construction noise limits, noise monitoring methodology and good practice measures have been provided in Section 4 above to protect nearby noise sensitive locations during the construction phase of this project.
- It has been deduced in Section 5.1 above that the additional noise created by traffic servicing this development during the operational phase will not be out of place in the context of the existing noise environment. Furthermore, the predicted increase in noise levels due to the increased traffic volume is considered to be negligible in the context of both the short term (year the project is opened) and the long term (15 years after the project is opened).
- Noise limits have been provided in Section 5.2 above to protect nearby noise sensitive locations from the risk of M&E plant noise during the operational phase of this development.
- Acoustic design criteria have been provided in Section 6 above to provide an appropriate level of acoustic comfort to the residents and users of this development.

8 References

[1] An Bord Pleanála, “Planning and Development (Housing) and Residential Tenancies Act 2016 Notice of Pre-Application Consultation Opinion Case Reference: ABP-311684-21,” December 2021.

[2] International Standards Organisation, “ISO 1996-1 Acoustics - Description and measurent of environmental noise - Part 1: Basic quantities and assessment procedures,” 2016.

[3] Environmental Protection Agency, “Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities,” 2016.

[4] British Standards Institution, “BS 4142 Method for rating and assessing industrial and commercial sound,” 2014.

[5] National Roads Authority, “Guidelines for the Treatment of Noise and Vibration in National Road Schemes,” 2004.

[6] British Standards Institution, “BS 5228-1 + A1 Code of practice for noise and vibration control on construction and open sites. Noise,” 2014.

[7] Cronin Sutton Consulting Group, “Traffic and Transport Assessment Proposed Residential Development Devoy Barracks, Naas, Co. Kildare,” March 2022.

[8] The Highways Agency UK, “HD 213/11 Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, Revision 1,” November 2011.

[9] British Standards Institution, “BS 8233 Guidance on sound insulation and noise reduction for buildings,” 2014.

[10] Department of Housing, Local Government and Heritage , “Building Regulations Technical Guidance Document E - Sound,” 2014.

[11] Australian / New Zealand Standard, “AS/NZS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors,” 2016.

Appendix A

Measured Noise Levels

ALLEGRO
acoustics

Testing Agency:	Allegro Acoustics
Testing Operator:	Stephen Kearney BE MIEI MIOA
SLM:	NTi XL2-TA
SLM Serial Number:	A2A-09612-E0
SLM Factory Calibration Date:	29/07/2019
Sound Field Correction:	Free Field
Bandwidth:	1/3rd Octave - Fully Integrating
Time Weighting:	Fast

dB Leq Measurement Data

Location	Period	Measurement	Start Time	Elapsed	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq	LZeq
				Time	12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
N1	Day	1	15/03/2021 17:03	00:30:00	52.4	53.2	50.6	51.5	53.4	54.9	56.6	55.1	51.7	48.4	46.5	46.6	46.6	48.2	48.3	46.5	45.9	45	49.4	52.1	50.2	48.6	46.2	43.2	41	39.1	37.7	36.4	33.8	27.5	29.2	38.2	16.1
	Evening	3	15/03/2021 19:08	00:30:00	74.3	72.8	71.3	69.8	68.1	66.9	65.5	63.6	61.5	59.1	56.7	54.5	52.1	49.4	46.7	43.6	42.9	43.8	45.2	46.5	45.4	43.9	41.2	37.6	35.8	32.3	29.4	27.4	23.5	20.7	17.9	16.3	13.8
	Night	5	15/03/2021 23:00	00:30:00	86.4	84.9	82.9	81.4	80	79.2	76.3	74.9	73.3	71.8	69.8	67.7	65.2	62.8	59.9	56.9	53.9	50.8	47.3	44.5	42	39.7	36.4	33.2	31.2	27.6	24.7	23	20	19.7	17.1	15.6	14.2
N2	Day	2	15/03/2021 18:40	00:30:00	60	58.4	56.7	55.9	58.7	59.1	68.5	64.8	57	51.1	49.6	48.2	46.3	45.4	43.3	41.6	41.7	42	42.5	43.6	42.8	41.3	39.5	36.3	35.2	35.2	32.6	28.9	26.6	19.9	15.5	13.8	13.5
	Evening	4	15/03/2021 19:44	00:30:00	63.3	62	60.3	58.7	57.2	57.3	56	53.6	52	50.6	48.9	47.5	47	45.9	44.3	42.9	43.9	42.8	42.6	48	42.4	42.2	38.8	35.3	32.5	29.3	26.2	23.8	20.3	17.5	14.8	13.5	13.5
	Night	6	15/03/2021 23:37	00:30:00	64.5	63.4	61.8	60.3	59	57.5	55.7	54	51.4	48.7	46.2	43.5	40.4	37.2	34.4	31.7	29.9	31.4	31.9	33.1	30.7	29.6	27.3	23.5	20.7	18.4	15.5	13.4	12	11.4	11.6	12.4	14.5

dB L90 Measurement Data

Location	Period	Measurement	Start Time	Elapsed	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90	LZ90
				Time	12.5Hz	16Hz	20Hz	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	20 kHz
N1	Day	1	15/03/2021 17:03	00:30:00	40	44	41	42	43	43	44	44	41	37	35	34	33	32	31	32	35	36	38	38	34	29	25	23	23	22	18	15	13	10	11	12	13
	Evening	3	15/03/2021 19:08	00:30:00	52	51	48	48	46	45	45	44	39	36	34	33	31	29	28	30	33	34	35	34	30	27	23	17	13	10	9	9	10	10	11	12	13
	Night	5	15/03/2021 23:00	00:30:00	60	59	57	55	53	51	49	46	43	39	35	32	28	26	25	26	28	28	28	26	23	19	14	11	9	9	9	9	10	10	11	12	13
N2	Day	2	15/03/2021 18:40	00:30:00	45	46	43	43	43	42	43	43	41	39	37	35	33	32	30	29	30	35	36	37	33	31	26	21	17	14	11	10	10	10	11	12	13
	Evening	4	15/03/2021 19:44	00:30:00	47	47	45	44	43	42	42	42	40	40	38	35	34	31	29	29	29	32	33	33	30	27	23	17	13	10	9	9	10	10	11	12	13
	Night	6	15/03/2021 23:37	00:30:00	47	47	44	42	40	38	37	36	34	31	29	26	25	22	20	20	21	24	24	23	19	15	11	8	8	8	8	9	9	10	10	12	13

Appendix B

Calibration Certification

SONITUS SYSTEMS

Statement of Calibration

Issued to:	Calibration Reference
Allegro Acoustics South City Business Park C1 Tallaght	SLM190066

Test Date: 29/07/2019
Prcocedure: TP-SLM-1

Equipment

Item Calibrated:	Sound Level Meter	**Model**	XL2-TA
Make:	Nti Audio	**Serial Number:**	A2A-09612-E0

Calibration Procedure

The sound level meter was allowed to stablize for a suitable period, as described in the manufacturer's instruction manual, in laboratory conditions. The sound level meter was calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), Periodic tests, specification of sound level meters. Tolerances for verification procedures are specified in IEC 61672-1 (2003).

Calibration Standards

Description	Serial Number
National Instruments PXI-4461	19C91D2
GRAS 42AA Pistonphone	227947
GRAS 46A0 Pressure Field Microphone	228216

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

Signed on behalf of Sonitus Systems: