TED LIVING RESIDENTIAL DEVELOPMENT DUBLIN

OUTWARD NOISE IMPACT ASSESSMENT

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

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

Technical Report Prepared For

Ted Living Limited

Technical Report Prepared By

Donal Heavey BEng PgDip AMIOA
Jennifer Harmon BSc MIOA

Our Reference

DH/20/11419NR01e

Date of Issue

17 November 2021

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

AWN Consulting Limited
Registered in Ireland No. 319812
Directors: F Callaghan, C Dilworth,
T Donnelly, T Hayes, D Kelly, E Porter

Document History

Document Reference		Original Issue Date	
DH/20/11419NR01		24 March 2020	
Revision Level	Revision Date	Description	Sections Affected
DH/20/11419NR01a	24/03/2020	Project Description	Exec. Summary, 1.0
DH/20/11419NR01b	25/03/2020	Final review and redline-boundary alterations	Cover page, Exec. Summary, 1.0
DH/20/11419NR01c	17/11/2020	Update to Schedule of Accommodation and Final Review	Cover page, Exec. Summary, 1.0
DH/20/11419NR01d	04/08/2021	Project Description & Layout	1, 4
DH/20/11419NR01e	17/11/2021	Development description	1

Record of Approval

Details	Authored by	Approved by
Signature		
Name	Donal Heavey	Jennifer Harmon
Title	Acoustic Technician	Principal Acoustic Consultant
Date	17 November 2021	17 November 2021

EXECUTIVE SUMMARY

Planning Permission is currently being sought from An Bord Pleanála for the development of a mixed-use development at Old Dun Leary Road, Cumberland Street and Dun Leary Hill, Dun Laoghaire, Dublin.

This report, prepared by AWN Consulting Limited (AWN), assesses the potential noise and vibration impacts of the proposed development works in the context of current relevant standards and guidance, and identifies requirements or possibilities for mitigation.

The existing noise climate has been surveyed during both daytime and night-time periods and has been found to be dominated by road traffic and general sub-urban activities.

The assessment has considered the impact of noise and vibration during both the construction and operational phases of the proposed development. A review has been undertaken of the most appropriate guidance and standards relating to both phases and appropriate criteria set for each.

The potential noise impact during the construction phase has been assessed at the nearest residential noise sensitive locations with reference to *BS 5228 (2009 +A1 2014) - Part 1.* The report has set out a range of predicted indicative construction noise levels associated with the varying construction phases in addition to best practice noise and vibration control measures to minimise the impact from this phase.

During the operational phase, potential sources of noise are considered to be limited to building services plant and traffic. In terms of plant noise, a set of criteria have been proposed in order to protect nearby sensitive receptors from potential noise impacts. Plant selection at detailed design stage will ensure that the noise criteria set out in this report are met.

The assessment has concluded that, once consideration is given to a range of noise and vibration mitigation measures (as outlined in the relevant sections of this report), the relevant impacts are below the recommended criteria included in the report.

CONTENTS

1.0 INTRODUCTION

Planning permission is being sought for a new mixed-use development at the former Ted Castles site, and DunLeary House (a proposed Protected Structure), Old Dun Leary Road, Cumberland Street and Dun Leary Hill, Dun Laoghaire. The proposed development will consist of:

- The provision of 146 no. apartment units (Build to Rent) and all associated ancillary facilities (including residential amenities) in a building with an overall height ranging from 6 storeys (with set backs from 4th & 5th storey) addressing Dun Leary Hill, to 5 and 8 storeys (with set back from 7th storey) addressing Old Dun Leary Road and 6-7 storeys (with set backs at 8th storey) addressing Cumberland Street. The proposal provides for private and communal open spaces in the form of balconies and terraces throughout.

- A retail unit (c.290m2) at ground floor level addressing Old Dun Leary Road and Cumberland Street

- The refurbishment, partial removal and adaptation of a 4 storey building on site known as "DunLeary House" (a proposed Protected Structure) to provide co-working office suites (c.247m2) at Levels 01,02 and 03. The works will include partial removal of original walls and floors, removal of non original extensions to DunLeary House, repointing and repair of brickwork and granite fabric, reinstatement of timber sash windows, removal of existing roof, removal; alteration and reinstatement of internal floor layouts, reinstatement of entrance point on DunLeary Hill, removal of non original level 00 and linking the existing building to the new development from level 00 to level 03 with the construction of 3 new floors of development (with set back at roof level) above the existing building. It is proposed to repair, reinstate and improve the existing boundary treatment to DunLeary House.

- Provision of 52 no. car parking spaces in total - 44 no. car parking spaces provided at level 00. At Cumberland Street 11 no. existing on street car parking spaces will be removed and 8 no. on street car parking spaces provided. Provision of 277 bicycle parking spaces (94 no. cycle parking spaces accommodated in bicycle stands and 183 no. long term bicycle parking spaces within a secure storage area) and 4 no. motorbike parking spaces, all at Level 00**.** A new vehicular entrance/cycle path (off the Old Dun Leary Road), ancillary plant areas, ESB substation and storage areas.

- Extensive hard and soft landscaping throughout, green roof, public lighting, signage, boundary treatments and public realm improvements.

- The demolition of the existing open fronted shed on site and all associated ancillary site services and site development works.

AWN Consulting Limited has been commissioned to conduct an assessment into the likely noise and vibration impacts associated with this proposed development on the noise-sensitive locations in the vicinity of the site.

Figure 1 overleaf presents the approximate outline of the proposed development site.

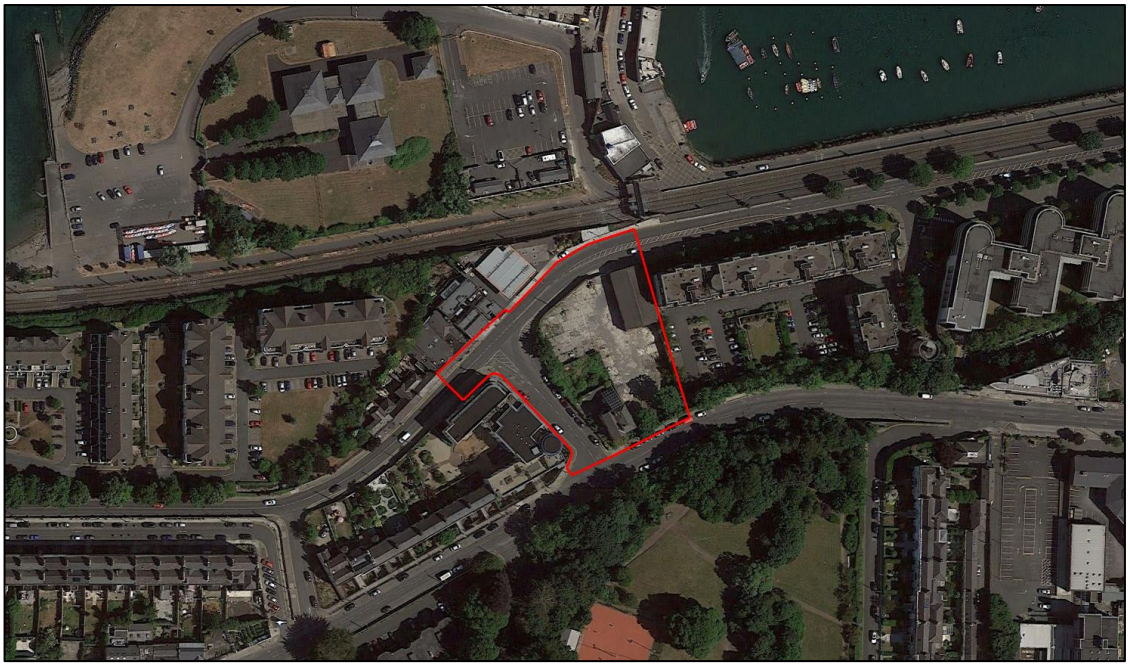

Figure 1 Location of Proposed Development and Approximate Red Line Boundary (Source: Google Earth)

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

2.0 NOISE ASSESSSMENT CRITERIA

2.1 Construction Phase

2.1.1 Construction Noise Criteria

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project.

In the absence of specific local guidance, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*.

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

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 1 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by *BS5228-1:2009+A1:2014*.

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A[1]	Category B[2]	Category C[3]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Evenings and weekends[4]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

Table 1 Example Threshold of Significant Effect at Dwellings

It should be noted that this assessment method is only valid for residential properties.

2.1.2 Construction Vibration Criteria

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

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

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;

1 Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
2 Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
3 Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
4 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

- British Standard BS 5228: 2009: *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings that are structurally unsound.

BS 5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this lower value. Where continuous vibration is such as to give rise to dynamic magnification due to resonance, the guide values may need to be reduced by up to 50%. BS 5288 also comments that important buildings which are difficult to repair might require special consideration on a case by case basis.

Taking the above into consideration the vibration criteria in Table 2 are recommended.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
12 mm/s	20 mm/s	50 mm/s

Table 2 Recommended allowable vibration during construction phase

It is acknowledged that humans are sensitive to vibration stimuli and that perception of vibration at high magnitudes may lead to concern. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short term duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5 mm/s if adequate public relations are in place. These values refer to the day time periods only.

2.2 Operational Phase

2.2.1 Building Services Noise

The most appropriate standard used to assess the impact of a new continuous source of noise (i.e. plant items) to a residential environment is BS 4142 *Methods for rating and assessing industrial and commercial sound (*2014) due to its use by Local Authorities and EPA when assessing for potential noise nuisances. This standard describes a method for assessing the impact of a specific noise source at a specific location with respect to the increase in “background” noise level that the specific noise source generates. The standard provides the following definitions that are pertinent to this application:

“*Specific sound level, $L_{Aeq, Tr}$*” is equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, *T*. This level has been determined with reference to manufacturers information for specific plant items.

"*Rating level*" $L_{Ar,Tr}$ is the specific noise level plus adjustments for the character features of the sound (if any), and;

"Background noise level" is the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, *T.* This level is expressed using the L_{A90} parameter. These levels were measured as part of the baseline survey.

A-weighted refers to the standardised weighting applied to all frequencies to compensate for the varying sensitivity of the human ear to sound at different frequencies.

The assessment procedure in BS4142: 2014 is outlined as follows:

1. determine the specific noise level;
2. determine the rating level as appropriate;
3. determine the background noise level, and;
4. subtract the background noise level from the specific noise level in order to calculate the assessment level.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific source will have an adverse impact or a significant adverse impact. A difference of +10dB or more is a likely to be an indication of a significant adverse impact, a difference of around +5dB is likely to be an indication of an adverse impact, dependent on the context.

The noise criteria for Building Services Plant, as proposed in Section 4.3 of this report has been carried out with consideration of the guidance contained in BS 4142 as summarised above.

2.2.2 Operational Traffic Noise

In the absence of specific Irish guidelines on noise associated with additional vehicular traffic on public roads it is considered common practice to utilise the Design Manual for Roads and Bridges (DMRB) [5] 2020, which offers guidance as to the likely impact in the long-term associated with any change in traffic noise level.

Change in Sound Level (dB L_{A10})	Subjective Reaction	DMRB Magnitude of Impact
Less than 3.0	Barely Perceptible	Negligible
3.0 – 4.9	Perceptible	Minor
5.0 – 9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Major

Table 3 Likely Impact Associated with Change in Traffic Noise Level

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

[5] Design Manual for Roads and Bridges (DMRB), LA111 *Noise and Vibration*, Rev 2, May 2020

2.2.3 Operational Vibration

There are no expected sources of vibration associated with the operational phase, therefore, vibration criteria have not been specified for this phase.

3.0 EXISTING ENVIRONMENT

3.1 Environmental Noise Survey

Environmental noise surveys have been conducted to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Sound Pressure Levels*. The following section reviews the existing noise environment.

Figure 2 indicates the noise monitoring locations surveyed.

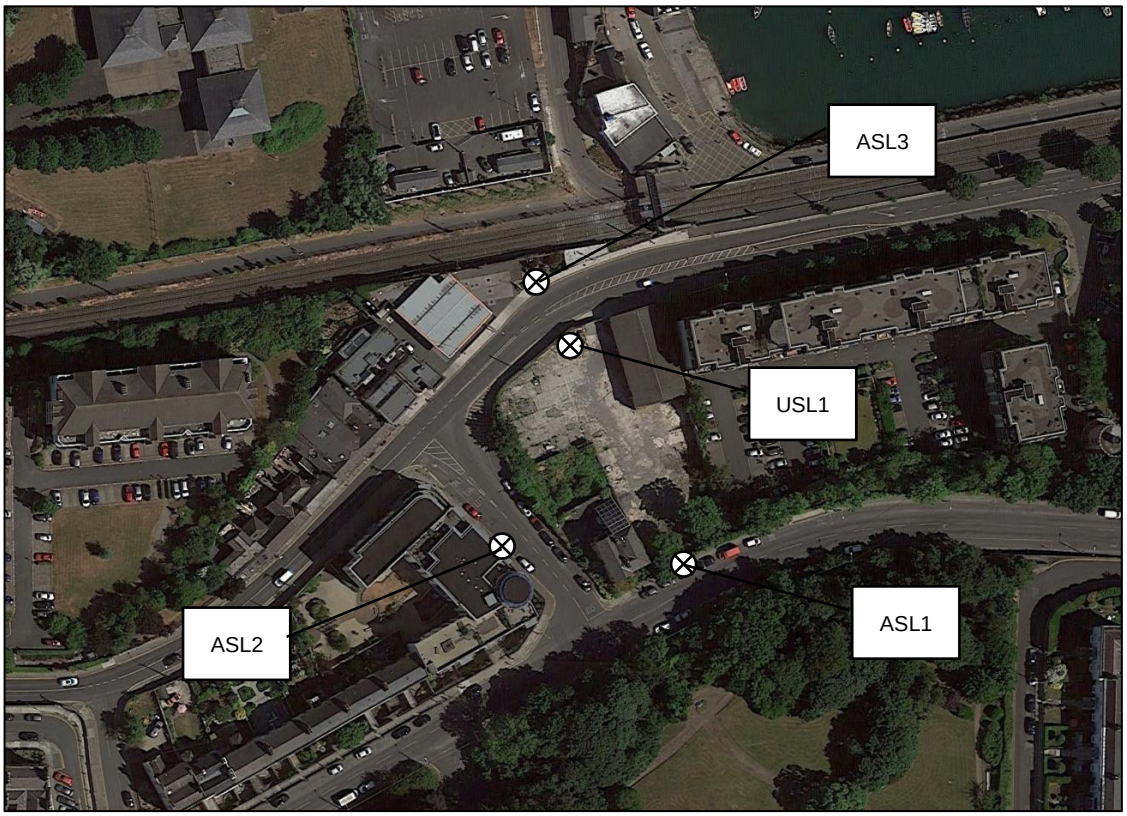

Figure 2 Noise Monitoring Locations

USL1 Located along the northern boundary of the site to capture the influence of the N31 and the DART line upon the noise environment. This position is deemed to be representative of the façade likely to have the greatest exposure to adverse levels of noise.

ASL1 Located at the southern boundary of the site on Cumberland St (R119). This location was chosen to be representative of noise levels incident on the southern façade overlooking Cumberland St.

ASL2 Located at the western boundary of the site on Cumberland St. The noise levels measured at this location are indicative of those expected along façades overlooking Cumberland St.

ASL3 Located at the northern boundary of the site on Old Dun Leary Road (N31). The noise levels measured at this location are considered to be indicative of those expected at the façades overlooking Old Dun Leary Road. Noise contribution from the adjacent DART line was deemed to be a significant contributor.

3.2 Survey Periods

3.2.1 Attended Noise Measurements

Attended noise measurements were conducted at Locations ASL1 to ASL3 over the course of the following survey period:

- 11:00hrs to 12:45hrs 18 March 2020

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

3.2.2 Unattended Noise Measurements

Unattended measurements were conducted at Location USL1 over the course of the following survey period:

- 12:55 on 3 March 2020 to 01:40hrs on 13 March 2020

The unattended monitoring equipment was configured to log data over 15-minute periods and saved to the instrument memory for subsequent analysis. Noise measurements at USL1 were taken at a height of 4m above ground. Survey personnel noted all primary noise sources contributing to noise build-up when the instrumentation was being set up and collected.

3.3 Personnel and Instrumentation

Donal Heavey (AWN) conducted measurements during the survey periods.

All noise measurements were conducted using Rion NL-52 sound level meters (Unattended Meter Serial No.: 1076330 Attended Meter Serial No.: 186668). The measurement apparatus was check calibrated both before and after each survey using a Larson Davis CAL200 Sound Level Meter Calibrator (Serial: 13532).

3.4 Measurement Parameters

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

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

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

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

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

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

3.5 Survey Results

3.5.1 Attended Survey Results

Location ASL1

The survey results for Location ASL1 are given in Table 4.

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
		$L_{Aeq,15min}$	L_{Amax}	L_{Amin}	$L_{A10,15min}$	$L_{A90,15min}$
18/3/2020	11:35 – 11:50	71	86	46	76	52
	12:29 – 12:44	71	89	51	75	55

Table 4 Summary of Attended Results for Location ASL1

Road traffic along Cumberland Street (R119) was the dominant noise source during the daytime. Occasional pedestrian noise, distant construction noise and birdcall were also noted. The general activities associated with an urban soundscape dictated background noise levels. Ambient noise levels (i.e. $L_{Aeq,15min}$) were of the order of 71dB with background noise levels (i.e. $L_{A90,15min}$) in the range of 52dB to 55dB.

Location ASL2

The attended survey results for Location ASL2 are given in Table 5.

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
		$L_{Aeq,15min}$	L_{Amax}	L_{Amin}	$L_{A10,15min}$	$L_{A90,15min}$
18/3/2020	11:18 – 11:33	63	77	48	66	54
	12:11 – 12:26	63	83	49	65	54

Table 5 Summary of Attended Results for Location ASL2

Road traffic along Old Dun Leary Road and Cumberland St were the dominant noise source at this location during the daytime period. Vehicle movements and construction noise from works on the forecourt of the nearby service station, train movements, pedestrians and birdcall were also stated as contributing factors. The general activities associated with an urban soundscape dictated background noise levels. Ambient noise levels (i.e. $L_{Aeq,15min}$) were of the order of 63dB with background noise levels (i.e. $L_{A90,15min}$) the order of 54dB.

Location ASL3

The attended survey results for Location ASL3 are given in Table 6.

Date / Time (hrs)		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
		$L_{Aeq,15min}$	L_{Amax}	L_{Amin}	$L_{A10,15min}$	$L_{A90,15min}$
18/3/2020	11:02 – 11:17	69	85	51	73	58
	11:55 – 12:10	69	88	43	73	53

Table 6 Summary of Attended Results for Location ASL3

The noise environment at this location was made up of road traffic on Old Dun Leary Road, vehicle movements and construction noise from works on the forecourt of an adjacent service station. Train movements, distant construction, pedestrians and birdcall were also stated as contributing factors. The general activities associated with an urban soundscape dictated background noise levels. Ambient noise levels (i.e. $L_{Aeq,15min}$) were of the order of 69dB with background noise levels (i.e. $L_{A90,15min}$) in the range of 53dB to 58dB.

The noise environment measured is considered typical of that associated with a site near a busy roadway.

3.5.2 Unattended Survey Results

Table 7 summarises the ambient $L_{Aeq,16hr}$ value over the daytime period (07:00 and 23:00hrs) and the $L_{Aeq,8hr}$ over the night-time (23:00 to 07:00hrs) period measured at USL1.

Date	Period (T)	Measured Noise Levels, dB	
		$L_{Aeq,T}$	$L_{A90,T}$
03/03/2020	Day (07:00 – 23:00hrs)	70	56
	Night (23:00 – 07:00hrs)	60	41
04/03/2020	Day (07:00 – 23:00hrs)	66	56
	Night (23:00 – 07:00hrs)	61	42
05/03/2020	Day (07:00 – 23:00hrs)	68	56
	Night (23:00 – 07:00hrs)	61	43
06/03/2020	Day (07:00 – 23:00hrs)	70	57
	Night (23:00 – 07:00hrs)	60	44
07/03/2020	Day (07:00 – 23:00hrs)	64	53
	Night (23:00 – 07:00hrs)	60	46
08/03/2020	Day (07:00 – 23:00hrs)	65	54
	Night (23:00 – 07:00hrs)	60	47
09/03/2020	Day (07:00 – 23:00hrs)	69	57
	Night (23:00 – 07:00hrs)	62	50
10/03/2020	Day (07:00 – 23:00hrs)	69	57
	Night (23:00 – 07:00hrs)	60	44
11/03/2020	Day (07:00 – 23:00hrs)	68	57
	Night (23:00 – 07:00hrs)	62	47

Date	Period (T)	Measured Noise Levels, dB	
		$L_{Aeq,T}$	$L_{A90,T}$
12/03/2020	Day (07:00 – 23:00hrs)*	67	58

Table 7 Review of Noise Levels Measured at USL 1

Note: *Measurements were not captured across the entire night-time period for 12/03/2020 hence data has not been used for assessment purposes in this report.

Daytime noise levels were found to range between 64 to 70dB $L_{Aeq,16hour}$, while night-time noise levels ranged between 60 to 63dB $L_{Aeq,8hour}$. The noise environment at the site was dominated by passing traffic along the N31 to the north and the R119 to the south. Traffic noise from Cumberland Street to the west was intermittent but contributory when present.

4.0 ASSESSMENT OF NOISE IMPACT

4.1 Identification of Sensitive Receptors

To assess the impact of the proposed development, the closest sensitive receptors to the development have been identified. The nearest residential properties are located some 5 metres to the east, a large residential apartment building, identified as R3, along Old Dun Leary Road. To the north-west, some 10 metres from the boundary, there is a 2 storey residential dwelling addressing Old Dun Leary Road, identified as R2. To the west, some 15 metres from the site boundary, De Vesci House residential apartments are situated, identified as R1 in Figure 3. The closest residential dwellings to the south are situated some 100 metres to the south-east at De Vesci Terrace, identified as R4.

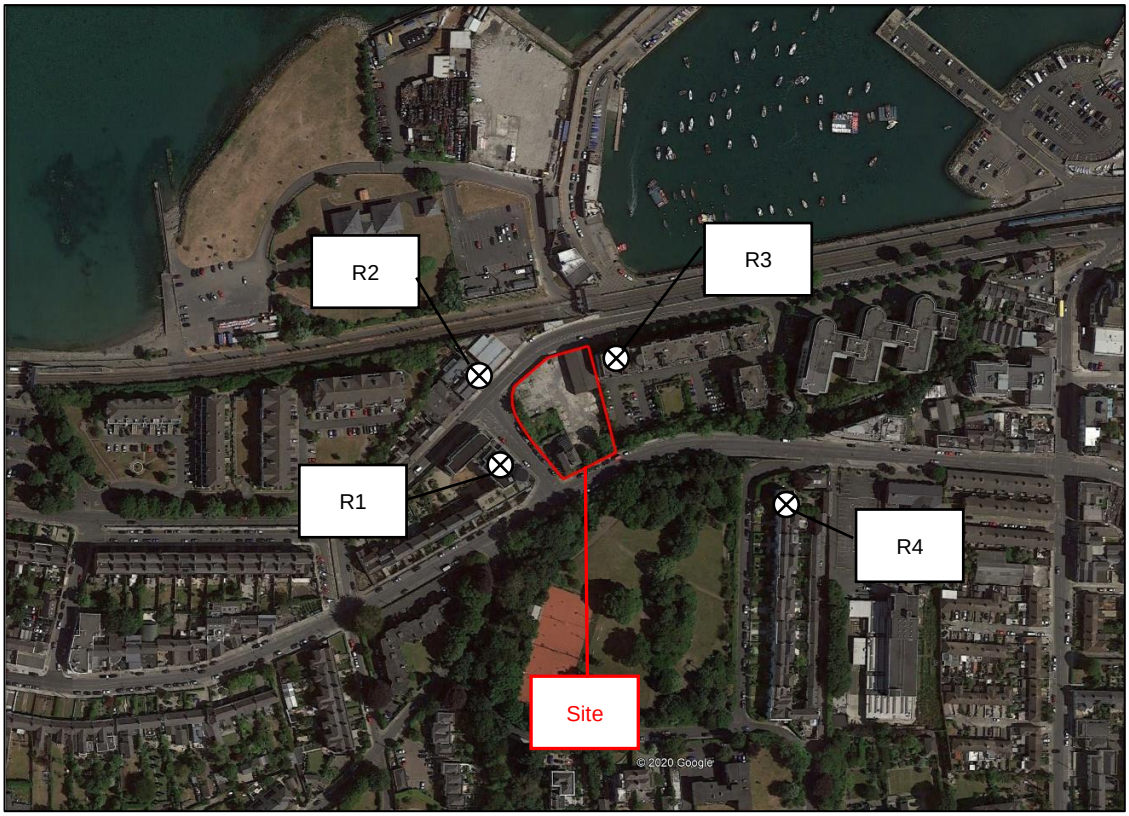

Figure 3 Noise Sensitive Receptor Locations

4.2 Construction Phase Impacts

4.2.1 Noise

Noise levels generated by the site operations and experienced at local receptors will depend upon a number of variables, the most significant of which are:

- the amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
- the periods of operation of the plant at the development site, known as the "on-time";
- the distance between the noise source and the receptor, known as the "stand-off";
- the attenuation due to ground absorption or barrier screening effects; and
- reflections of noise due to the presence of hard vertical faces such as walls.

Given that works during the various construction phases will be transient in nature and will involve the use of several different plant items at any one time, it is difficult at this stage of the assessment to state accurately what items of plant will be in use and what levels of noise will be experienced during construction works. In order to assess the range of potential noise levels associated with the construction phase, therefore, indicative noise prediction calculations have been prepared in relation to construction activities. The calculations have been undertaken in line with guidance set out in British Standard *BS 5228 (2009 +A1 2014): Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.*

A variety of items of plant will be in use for the purposes of site clearance, excavation and basement works, building construction and landscaping. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for generation of high levels of noise to the surrounding environment.

It is AWN's understanding that the proposed hours of construction are:

- 07:00 to 18:00 hrs Monday to Friday and;
- 08:00 to 14:00 hrs on Saturdays.

There is potential for out of hours construction activities to take place to facilitate a proposed sewer diversion. This will involve an element of works during night-time periods between the hours of 22:00 and 06:00.

Construction noise threshold values have been set taking account of the prevailing noise environment, discussed in Section 3.5 and the ABC criteria from BS 5228-1 outlined in Section 2.1. Taking account of the ambient noise level in the area, the following construction noise threshold values are proposed:

- Daytime: Category C: **75dB $L_{Aeq,T}$**
- Night-time** Category C: **55dB $L_{Aeq,T}$**

*Note ** Night-time works are only expected during sewer diversion works.*

If the construction noise level exceeds the appropriate category value, then a significant effect is deemed to occur.

Due to the fact that the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set

out in *BS 5228-1: 2009 +A1 2014*. Table 8 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at 10m Distance (dB $L_{Aeq(1hour)}$)	Noise Level at 10m (dB)	No of Items assumed
Site Preparation/ Clearance	Track Excavator (C2 22)	72	3
	Wheeled Loader Lorry (C2.28)	76	2
	Dozer (C2.13)	78	2
	Dump Truck (C4.2)	78	2
	Generator (C4.78)	66	2
	Water pump (C2.45)	65	2
Substructure	Dump truck (tipping fill) C2.30	79	2
	Tracked Excavator (C3.24)	74	3
	Concrete Pump (C3.25)	78	2
	Compressor (D7 6)	77	2
	Poker Vibrator (C4 33)	78	2
Steel Erection	Mobile Telescopic Crane 100T (C4.41)	71	2
	Telescopic Handler 4T (C.4.54)	70	2
	Articulated lorry (C11.10)	77	2
General Construction	Hand tools	81	4
	Pneumatic Circular Saw (D7.79)	75	3
	Internal fit – out	70	2
Landscaping	Dozer (C2.13)	78	4
	Dump Truck (C4.2)	78	4
	Surfacing (D8.25)	68	2

Table 8 Typical Noise Levels Associated with Construction Plant Items

Predictions have been presented for construction works associated with the key phases of the proposed development at a selection of set distances to reflect the nearest sensitive buildings. Predictions are based on the utilisation of plant 66% of a working day. Although there will be screening from newly constructed buildings during the latter phases of the construction, no such screening has been assumed between the works and the calculated locations in the results presented in the Table 9.

For the purpose of the assessment, a standard site hoarding of 2.4m high has been included in the calculations for noise sensitive boundaries.

Activity	Predicted Construction Noise Level $L_{Aeq(1hour)}$ (dB)			
	<5m	10m	20m	30m
Site clearance/ preparation	90	82	75	70
Substructure	91	84	76	72
Steel Erection	58	78	70	66
General Construction	92	84	77	72
Landscaping	91	83	76	71

Table 9 Calculated Construction Noise Levels at varying distances

Based on the construction noise levels at the set distances calculated in Table 9, the potential impacts are summarised as follows:

- R3 (residential properties) is located directly along the eastern ≤ 10m from the works boundary. The predicted noise levels are above the significance threshold of 75dB $L_{Aeq,1hr}$ based on the assumed level of plant items and numbers associated with each of the construction phases discussed above.

  Noise sensitive facades facing the construction site boundary of this apartment building are limited to upper floor levels. At lower levels there are no windows or balconies facing towards the site. Given the variations of on-site activities, the

number of plant items during any one phase, and the location of works only operating along the closest boundaries for a limited time throughout the duration of the works, the calculated noise levels presented are considered to present a worst-case scenario. Notwithstanding the above, a significant noise impact is calculated during the various work phases at noise sensitive locations along this boundary.

- R1 and R2 (residential properties) are located ≥15m from the works boundary. The predicted construction noise levels between 10 and 20m from the works are at or just above the significance threshold of 75dB $L_{Aeq,1hr}$ based on the assumed level of plant items and numbers associated with each of the construction phases discussed above.

  Given the variations of on-site activities, the number of plant items during any one phase and the location of works only operating along the closest boundaries for a limited period of the duration of the works, the calculated noise levels presented are considered to present a worst-case scenario.

It is important to note that the predicted noise levels referred to in this section are indicative only and are intended for comparison with the construction noise criteria.

During any night-time works associated with sewer diversion works, impact generating, percussive and high noise generating activities will be not be permitted (i.e. ground breaking). It will be incumbent on the contractor to ensure that activities are scheduled during this period to ensure the night-time noise criterion of 55dB $L_{Aeq,1hr}$ are not exceeded. In this instance, ground breaking, excavation works or other high-noise / impact generating activities will be limited to daytime hours only.

For all periods, the construction phase will be controlled through the use of construction noise limits which the contractor will be required to work within. Noise mitigation measures will therefore be required to reduce potential impacts at these residential properties to avoid significant impacts. In this regard, the choice of plant, scheduling of works on site and overlapping phases, provision of localised screening and other best practice control measures will be employed in order to ensure noise limits are not exceeded.

Further discussion on mitigation measures is included in Section 5.

4.2.2 Vibration

In terms of construction vibration, it is anticipated that excavations will be made using standard excavation machinery. At this stage AWN is not aware as to whether these excavations will remain within the boulder clay layer or will extend to bedrock level. Excavations extending to the bedrock layer can typically generate perceptible levels of vibration close to the source, where rock breaking activities are required.

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

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

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

The range of values recorded provides some context in relation to typical ranges of vibration generated by construction breaking activity likely required on the proposed site. The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings (R1 – R3) are likely to be orders of magnitude below the limits set out in Table 2 to avoid any cosmetic damage to buildings. Vibration levels are also expected to be below a level that would cause disturbance to building occupants.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 2 during all activities. Further discussion on mitigation measures during this phase are discussed in Section 5.

4.3 Operational Phase Impacts

4.3.1 Plant Noise Levels

It is understood that various plant items are proposed for the development to serve the apartment buildings, retail/café unit and co-working office suites. The majority of plant items are located within the basement area, including the ESB substation. At this stage of the assessment, details of the plant are as yet not fully progressed.

These items of plant have the potential to emit noise to the environment and consequently an exercise will be undertaken at detailed design stage to ensure that the finalised items of plant do not exceed the proposed noise thresholds.

Table 10 presents the lowest average background noise levels (in terms of L_{A90}) measured at location USL1 during the day and night periods.

Location Ref	Average Background Noise Level (L_{A90} dB)	
	Day	Night
USL1	53	41

Table 10 Lowest Average Background Noise Levels

Taking into account the recommendation from BS 4142 that if the plant noise level does not exceed the background sound level it is an indication of a low impact, it is recommended in this instance that noise emissions from all plant installed on site (considered cumulatively) do not exceed the background noise levels presented in Table 10.

Taking into account the guidance defined in Section 2.1, plant noise criteria for the development is defined below. These limits relate to the façade of the closest off-site noise sensitive building.

- Daytime (07:00 – 23:00hrs): **50 dB $L_{Ar,T}$.**
- Night-time (23:00-07:00hrs) **40 dB $L_{Ar,T}$.**

4.3.2 Operational Traffic Noise

Car parking for the development is provided within an underground car park, hence noise emissions from this area will be suitably screened from the nearest noise sensitive buildings and any noise impact from this area of the site is determined to be not significant.

A traffic impact assessment has been undertaken by DBFL engineers for the proposed development. Traffic from the development will exit the site onto the N31 Old Dun Leary Road. During the year of opening and the future design year (+15 years), baseline Annual Average Daily Traffic (AADT) flows along this road are determined to be of the order of 21,000. The assessment has concluded that once operational, the maximum increase in traffic flows is calculated along the N31 Old Dun Leary Road is 170 additional vehicles over a 24-hour period. This represents an increase in traffic flows of just less than 1% along this road. Along all other surrounding roads assessed, the increase is further reduced as traffic disperses.

In terms of noise impacts, the magnitude of change in traffic flows would result in a negligible increase of less than 1dB. The noise impact of traffic volumes accessing the site onto the surrounding network is determined to be long term, not significant.

5.0 MITIGATION

5.1 Construction Phase Mitigation

5.1.1 Noise

With regard to construction activities, best practice control measures from construction sites within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2 will be used to control noise and vibration impacts. The contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during basement excavation works, foundation construction including piling works, and sewer diversion works which are likely to be the activities to have the highest potential noise impact.

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. If piling or breaking works are in progress on a site at the same time as other works of construction or demolition that themselves may generate significant noise and vibration, the working programme will be phased so as to ensure noise limits are not exceeded due to cumulative activities.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;

- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise*;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations;
- Establishing channels of communication between the contractor/developer, Dun Laoghaire Rathdown County Council and residents so that receptors are aware of the likely duration of activities likely to generate higher noise or vibration, and;
- The Contractor appointing a Site Environmental Manager (SEM) responsible for matters relating to noise and vibration.

Other forms of noise control at source relevant to the development works are set out below:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling.
- For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries. This measure is likely to be required during the early construction phase when demolition and excavation works are taking place in close proximity to the noise sensitive buildings along Old Dun Leary Road and Cumberland Street.
- For all materials handling, ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- Demountable enclosures can also be used to screen operatives using hand tools/ breakers and will be moved around site as necessary.
- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

5.1.2 Vibration

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

In the case of vibration levels giving rise to human discomfort, in order to minimise such impacts, the following measures shall be implemented during the construction period:

- A clear communication programme will be established to inform adjacent building occupants in advance of any potential intrusive works which may give

rise to vibration levels likely to exceed perceptible levels. The nature and duration of the works will be clearly set out in all communication circulars;
- Alternative less intensive working methods and/or plant items shall be employed, where feasible;
- In the case of impact piling or demolition works for instance, a reduction in the input energy per blow shall be considered where required.

5.1.3 Monitoring

During the construction phase consideration may be given to noise and vibration monitoring at the nearest sensitive locations, where high levels of noise and or vibration are expected.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

Vibration monitoring should be conducted in accordance with BS 7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS 6841 (1987) *Guide to Measurement and Evaluation of Human Exposure to Whole-Body Mechanical Vibration and Repeated Shock.*

5.2 Operational Phase Mitigation

5.2.1 Building Services Plant

Noise emissions from building services plant will be designed and installed to not exceed the design criteria of **50dB $L_{Aeq,15min}$** during daytime periods and **40dB $L_{Aeq,15min}$** at night at the facades of the nearest noise sensitive receptors.

During the detailed design of the development, the selection and location of mechanical and electrical plant will be undertaken in order to ensure the noise emission limits set out above are not exceeded. In addition to selecting plant with suitable noise levels, the following best practice measures are recommended for all plant items in order to minimise potential noise disturbance for adjacent buildings:

- where ventilation is required for plant rooms, consideration will be given to acoustic louvers or attenuated acoustic vents, where required to reduce noise breakout;
- ventilation plant serving plant rooms and car parks will be fitted with effective acoustic attenuators to reduce noise emissions to the external environment;
- the use of perimeter plant screens will be used, where required, for roof top plant areas to screen noise sources;
- the use of attenuators or silencers will be installed on external air handling plant, where required;
- all mechanical plant items e.g. fans, pumps etc. shall be regularly maintained to ensure that excessive noise generated by any worn or rattling components is minimised;
- any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document, and;
- Installed plant will have no tonal or impulsive characteristics when in operation.

6.0 CONCLUSION

AWN Consulting has undertaken a review of the potential noise impacts associated with the outward noise impacts due to the construction phase, plant operations and traffic noise impact.

During the construction phase of the project there will be temporary major to short-term moderate noise impacts on nearby noise sensitive properties from site activities due to the close proximity of adjacent buildings. The application of binding noise limits, hours of operation, along with implementation of appropriate noise and vibration control measures, will assist in reducing the overall noise and vibration impact to within acceptable limit values during this short term phase.

Once operational, with the inclusion of the recommended mitigation measures discussed in Section 5.2.1, noise from building services plant will be below a level that would cause any significant impact to adjacent noise sensitive locations and hence the impact will be long-term, minor.

APPENDIX A
GLOSSARY OF ACOUSTIC TERMINOLOGY

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

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

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

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

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

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

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

Octave band — A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.

SEL — Sound Exposure Level is numerically equivalent to the total sound energy. For example a noise level of 90 dBA lasting 1 second would have a SEL of 90 dBA but if the event lasted 2 seconds the SEL would be 93 dBA.