

Daytime ambient noise levels at this location were dominated by city centre activity along Henry Street, namely buskers and pedestrians, along with distant road / Luas traffic noise from O'Connell Street. Noise levels were in the range of 65 to 67 dB $L_{Aeq,15min}$ and in the order of 61 dB $L_{A90,15min}$ during the measurement periods.

Night-time ambient noise levels at this location were dominated by road traffic noise from O'Connell Street. Noise levels were in the range of 52 to 54 dB $L_{Aeq,15min}$ and in the range of 46 to 48 dB $L_{A90,15min}$ during the measurement periods.

No significant level of vibration was noted at this location during site attendance.

Survey Position AN4

The survey results for Location AN4 are presented in Table 11.16. During the day time period pedestrians passing by with plant noise and intermittent road traffic were the dominant noise sources at this location. Distant construction noise, intermittent street sweeper pass-by and alarms ringing also contributed to the noise build up. During the first two night-time noise measurements a delivery along Moore Street with truck pass-by and idling with pallet truck movements were the dominant noise sources. Continuous plant noise, distant road traffic noise, intermittent Luas pass-by and shouting from pedestrians along Parnell Street were also noted as contributors to the noise build up. During the final measurement, the truck delivery had finished and the dominant noise source was continuous plant noise with distant road traffic noise also audible.

Date	Period	Measurement Period	L_{Aeq}	L_{AFMax}	L_{A90}	L_{Aeq} Octave Band Centre Frequency (Hz)					
						125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Tues, 11 August 2020	Day	12:12 – 12:27	65	82	62	61	59	57	55	52	45
		13:27 – 13:42	64	83	61	60	57	58	56	51	45
		14:41 – 14:56	69	93	63	62	60	64	62	58	52
Wed, 12 August 2020	Night	23:49 – 00:04	72	98	54	61	65	69	64	58	51
		00:04 – 00:19	68	91	54	60	55	58	67	54	48
		00:20 – 00:35	51	68	49	49	41	40	37	33	26

Table 11.16: Measured Noise Levels at Location AN4.

Daytime ambient noise levels at this location were dominated by plant noise and intermittent local road traffic and pedestrians passing by. Noise levels were in the range of 64 to 69 dB $L_{Aeq,15min}$ and in the range of 61 to 63 dB $L_{A90,15min}$ during the measurement periods.

Night-time ambient noise levels at this location were dominated by truck deliveries and plant noise from Moore Street commercial developments. Noise levels were in the range of 51 to 72 dB $L_{Aeq,15min}$ and in the range of 49 to 54 dB $L_{A90,15min}$ during the measurement periods.

No significant level of vibration was noted at this location during site attendance.

Noise Baseline Overview

The measured noise levels reflect typical city centre locations. At roadside positions, traffic on the busy main road and pedestrian activity dominate while at positions further from main roads, individual vehicle movements and pedestrian activity dominate with constant distant traffic contributing to measured levels.

Comment on Covid-19 Pandemic on 2020 Survey Noise Environment

The unattended noise monitor at UN4 installed in 2020 was positioned on eastern boundary of the Dublin Central Masterplan site, in a comparable location to the 2019 UN1 noise monitor. Comparison between the average L_{Aeq} values at the two locations indicate that there was a reduction no greater than 3 dB at the UN4 location due to the Covid-19 travel restrictions.

As a worst-case assessment, the highest noise environments identified during 2019 or 2020 will be used to inform the inward impact assessment, with the lowest noise environments used to inform the outward impact assessment.

11.3.2 Proposed Development – Site 2

The receiving environment in terms of baseline noise and vibration is expected to be the same for the Dublin Central Masterplan development and each individual site within the development. Therefore, the baseline environment outlined in Section 11.3.1 does not differentiate between the Dublin Central masterplan development or the individual site of the development being assessed within this EIAR chapter.

In Site 2 (Sites 2AB and 2C) the nearest existing residential NSLs to the Proposed Development are those located at Greeg Court Apartments, to the west of the site boundary along Moore Street. The Rotunda Hospital is located to the north of the site boundary on Parnell Street.

Apart from the receptors identified above, there are protected buildings identified at 14 to 17 Moore Street to the west of the site boundary.

Commercial NSLs include Jurys Inn Hotel Parnell Street and Lynams Hotel, which are located beyond the western boundary on O'Rahilly Parade and southern boundary on Henry Place respectively. Other hotels in close proximity to the eastern site boundary are Holiday Inn Express and The Gresham Hotel on O'Connell Street.

With reference to the Dublin Central Masterplan construction phasing, it is likely during the construction of Site 2, that Sites 1, 3 & 4 will be built and the residential units will be occupied. Therefore, these sites should be considered as residential noise sensitive locations.

11.4 CHARACTERISTICS OF PROPOSED DEVELOPMENT

When considering a development of this nature, the potential noise and vibration impacts on the surroundings are considered for each of two distinct stages, the short to medium-term construction stage and the long term operational stage.

11.4.1 Dublin Central Masterplan

11.4.1.1 Construction Stage

The construction stage of the development of the Dublin Central Masterplan will be undertaken over all five sites, each of which involve key stages which will involve site preparation, demolition, basement excavation and building construction. Site 2AB and Site 2C also includes the MetroLink Enabling Works (MEW) construction of a basement under Nos. 43 to 58 O'Connell Street which will facilitate the future provision of the MetroLink Station by Transport Infrastructure Ireland (TII), the EIAR for which has been prepared by the TII under a separate application and contains airborne and ground borne noise and vibration assessments.

The MEW stage will involve demolition and site preparation works, excavation, piling works, D-wall operations, dewatering, concrete works and general site works. The remaining stages will involve a number of potential noise and vibration sources including excavators, crushing plant, piling rigs, demolition equipment and other general building construction works including landscaping. In addition, there will be construction traffic to and from the development site over the course of the works. The construction stage of the Dublin Central Masterplan development is expected to have the

highest potential for noise and vibration impacts on the surrounding environment. This stage will be of medium-term impact and is assessed in the following sections.

The phasing of construction works over the Dublin Central Masterplan will need to consider potential impacts on NSLs external to the development site and those within the earlier stages of the Dublin Central Masterplan for the following scenarios: -

- No sites will be occupied during the MEW stage.
- Site 3 and Site 4 may be in construction phase when Site 1 is completed and may be occupied.
- Site 2AB and Site 2C may be in construction phase when Sites 1, 3 and 4 are completed and may be occupied.
- Site 5 may be in construction phase when Sites 1, 2AB, 2C, 3 and 4 are completed and may be occupied.

11.4.1.2 Operational Stage

During the operational stage the Dublin Central Masterplan will comprise several functions including residential, commercial offices, retail, café / restaurant and cultural units, hotel accommodation and transport link.

Noise sources associated with the operational phase will include noise from mechanical plant items serving the various buildings, traffic noise associated with private vehicles of residents, workers and visitors journeying to and from the development, delivery and servicing vehicles and entertainment noise.

The inward impact of the noise environment on the development itself is also considered during the operational stage.

11.4.2 Proposed Development – Site 2

11.4.2.1 Construction Stage

Due to the nature of the Proposed Development under consideration, typically the same characteristics apply to both the Proposed Development (Sites 2) and the Dublin Central Masterplan. Outlined in the sections below, the specific works associated with the Proposed Development are listed.

Site 2 comprises two buildings – a six-storey building above basement level and a eight-storey building above basement level and a nine-storey building above basement level. Enabling works from the Metro Box located beneath Site 2 will also be carried out. As discussed in Section 11.4.1.1 the main site activities will include: -

- MEW for the underground Metro Box.
- Site preparation.
- Demolition.
- Basement excavation, including piling works and secant retaining wall construction.
- General construction.
- Landscaping.

These activities will have the greatest potential noise and vibration impacts on the surrounding environment, however the construction stage will be of short-term impact.

During the stages of construction works on Site 2, the assessment will need to consider potential impacts on noise sensitive locations both internal and external to the development site as several of the buildings constructed in the earlier stages of the Dublin Central Masterplan site will likely be occupied.

11.4.2.2 Operational Stage

Site 2 comprises two buildings – a six-storey building above basement level and a eight-storey building above basement level providing for offices, retail and café / restaurant spaces. The proposed Metro Box is located at basement level. The anticipated operational noise sources associated with this site include: -

- Mechanical plant noise.
- Entertainment noise.
- Servicing and delivery noise.
- Metro ventilation services.
- Additional traffic associated with Proposed Development

The above noise sources are linked to the operation of the development and are therefore the resultant impacts are designated permanent in duration.

11.4.3 Proposed Development – No. 61 O'Connell Street Upper

11.4.3.1 Construction Stage

The Proposed Development also consists of the refurbishment of the existing 4 storey building at No. 61 O'Connell Street Upper comprising of 3no. apartments, 2 no. café / restaurant units and gym / leisure studio.

As discussed in Section 11.4.1.1 the main site activities will include: -

- Minor demolition.
- General construction.

These activities will have the greatest potential noise and vibration impacts on the surrounding environment, however the construction stage will be of short-term impact.

During the stages of construction works on No. 61 O'Connell Street Upper, the assessment will need to consider potential impacts on noise sensitive locations both internal and external to the development site as several of the buildings constructed in the earlier stages of the Dublin Central Masterplan site will likely be occupied.

11.4.3.2 Operational Stage

The Proposed Development also consists of the refurbishment of the existing 4 storey building at No. 61 O'Connell Street Upper comprising of 3no. apartments, 2 no. café / restaurant units and gym / leisure studio.

The anticipated operational noise sources associated with this site include: -

- Mechanical plant noise.
- Entertainment noise.

The above noise sources are linked to the operation of the development and are therefore the resultant impacts are designated permanent in duration.

11.5 POTENTIAL IMPACTS

11.5.1 Dublin Central Masterplan

11.5.1.1 Construction Stage

11.5.1.1.1 Relevant Criteria – Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction stage of a project. Dublin City Council (DCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

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

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

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

- Duration of the works.
- Distance to NSLs.
- Ambient noise levels.
- Site operating hours.
- Location of works.
- Duration of demolition.
- Intrusive noise activities, including vibration generating activities.

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

"The ABC Method detailed in Paragraph E.3.2 of BS 5228-1:2009 shall be used to determine acceptable noise levels for day, evening and night time work."

Please note that construction works in relation to this development are proposed during normal working hours only as set out below: -

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

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

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

Potential noise impacts during the construction stage of a project are often assessed in accordance with BS 5228-1:2009+A1:2014. Various mechanisms are presented as examples of determining if an impact is occurring, these are discussed in the following paragraphs.

ABC Method

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

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 11.17 sets out the values which, when exceeded, signify a potential significant effect at the facades of residential receptors as recommended by BS 5228-1:2009+A1:2014.

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

Table 11.17: Maximum Permissible Noise Levels at the Façade of Dwellings during the Construction Stage

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

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

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

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

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

Fixed Limits

BS 5228-1:2009+A1:2014 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states: -

“Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut.”

Paragraph E.2 goes on to state: -

“Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed: -

70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;

75 decibels (dBA) in urban areas near main roads in heavy industrial areas”.

Other Largescale Developments Granted Permission in Dublin City

It is also appropriate to reference other large developments that have been granted planning permission in Dublin City. In this instance the following two project examples are presented: -

- DART Underground.
- New Children’s Hospital, St. James’ Hospital.

The following tables present the noise limits for each of these developments at the façade of residential NSLs.

Day	Period & Limit	Notes
Monday to Friday	75dB L _{Aeq,1hr} 07:00 – 19:00hrs 65dB L _{Aeq,1hr} 19:00 – 22:00hrs 45dB L _{Aeq,15mins} 22:00 – 07:00hrs *	*Non tonal, non impulsive
Saturdays	70dB L _{Aeq,1hr} 08:00 – 16:30hrs 55dB L _{Aeq,1hr} 16:30 – 22:00hrs 45dB L _{Aeq,15mins} 22:00 – 08:00hrs *	
Sundays, Bank & Public Holidays	60dB L _{Aeq,1hr} 08:00 – 16:30hrs 50dB L _{Aeq,1hr} 16:30 – 22:00hrs 45dB L _{Aeq,15mins} 22:00 – 08:00hrs *	

Table 11.18: Dart Underground Construction Noise Level Criteria at any Façade of a Normal Residence

Day	Period & Limit	Notes
Monday to Friday	70dB L _{Aeq,1hr} 07:00 – 19:00hrs 60dB L _{Aeq,1hr} 19:00 – 22:00hrs * The higher of 45dB L _{Aeq,1hr} or the ambient level 22:00 – 07:00hrs *	* Construction activity at these times, other than that required for emergency works, will require the explicit permission of the relevant local authority
Saturdays	65dB L _{Aeq,1hr} 08:00 – 16:00hrs 45dB L _{Aeq,1hr} outside of these hours*	
Sundays, Bank & Public Holidays	60dB L _{Aeq} 08:00 – 16:00hrs *	

Table 11.19: New Children's Hospital Construction Noise Level Criteria at any Façade of a Normal Residence

Proposed Threshold Levels for Noise

Taking into account the proposed documents outlined above and making reference to the baseline noise environment monitored around the development site (see Section 11.3.1.2), BS 5228-1:2009+A1:2014 has been used to inform the assessment approach for construction noise in line with the DCC GPG.

The following construction noise threshold levels are proposed for the construction stage of this development: -

- For residential NSLs along Moore Lane it is considered appropriate to adopt the 70 dB(A) threshold level, given the baseline monitoring carried out, it would indicate that Category B values are appropriate using the ABC method.
- For residential NSLs along Parnell Street it is considered appropriate to adopt the 75 dB(A) threshold level, given the baseline monitoring carried out, it would indicate that Category C values are appropriate using the ABC method.
- For commercial NSLs it is considered appropriate to adopt the 75 dB(A) threshold level, given the urban environment in which the closest commercial properties reside, in line with BS 5228-1:2009+A1:2014 and DCC GPG.
- For clinical NSLs it is considered appropriate to adopt the 75 dB(A) threshold level, given the urban environment in which the Rotunda Hospital resides. In addition, if the ABC method were applied to the Rotunda Hospital, given the baseline monitoring carried out, it would indicate that Category C values are appropriate i.e. 75 dB(A) threshold level.

Interpretation of the Construction Noise Levels (CNL)

In order to assist with interpretation of CNL, Table 11.20 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the threshold value. This guidance is taken from Table 3.16 of DMRB: Noise and Vibration (UKHA 2020) and adapted to include the EPA EIAR Guidelines.

Impact Guidelines for Noise Impact Assessment Significance (Adapted from DMRB)	CNL per Period	EPA EIAR Guidelines	Determination
Negligible	Below or equal to baseline noise level	Not Significant	Depending on range of CNL and baseline noise level
Minor	Above baseline and below or equal to CNL	Slight to Moderate	
Moderate	Above CNL and below or equal to CNL +5 dB	Moderate to Significant	
Major	Above CNL +5 dB	Significant to Very Significant	

Table 11.20: Example Threshold of Significant Effect at Dwellings

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely impacts during the construction stages.

Additional Traffic on Public Roads – Construction Stage

In order to assist with interpretation of construction traffic noise, Table 11.21 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This guidance is taken from Table 3.17 of DMRB: Noise and Vibration (UKHA 2020).

Change in Sound Level, dB(A)	Magnitude of Impact
<1.0	Negligible
1.0 – 2.9	Minor
3 – 4.9	Moderate
<5.0	Major

Table 11.21: Likely Effect Associated with Change in Traffic Noise Level – Construction Noise. Source: (DMRB 2020).

In accordance with the DMRB guidance (UKHA 2020), construction traffic shall constitute a significant effect where it is determined that a major or moderate magnitude will occur for a duration exceeding: -

- Ten or more days or nights in any 15 consecutive day or night period.
- A total number of days exceeding 40 in any 6 consecutive months.

The DMRB guidance outlined will be used to assess the predicted increases in traffic levels on public roads associated with the Proposed Development and comment on the likely impacts during the construction stage.

11.5.1.1.2 Potential Impacts During Construction

Given that the construction stage is highly transient in nature and involves a number of various stages which will encompass a range of different activities on a day to day and week to week basis, it is not possible to calculate with a high degree of accuracy the specific levels of noise associated with each stage. The construction stage will be undertaken over a number of stages from site preparation through to building construction and internal fit out. Reference has been made to the Construction and Environmental Management Plan in order to identify the potential noise and vibration impacts and the key stages. Construction activities are expected to involve: -

- MEW Enabling works – which will be detailed in a separate section of this Chapter.
- Site Preparation & Demolition.
- Façade Demolition.
- Secant Piled Wall.
- Basement Excavation.
- Retaining Wall.
- Piling & Basement Foundation Slab Construction.
- Super-Structure Construction.
- General Construction.

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

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

The construction phase will be controlled through the use of construction noise threshold values which the contractor will be required to work within as much as is practicable. In this regard, the choice of plant, scheduling of works on site, provision of localised screening and other best practice control measures will be employed.

Sensitive Receptors

Noise and vibration impacts will be assessed to the nearest sensitive locations to the Dublin Central Masterplan site boundaries i.e. a worst-case assessment of the closest sensitive locations during any of the construction stages of the five sites. These closest locations are identified in Figure 11.11 overleaf.

- NSL1 Residential apartments on Moore Lane located approximately 15m to the west of Site 5 boundary.
- NSL 2 The Rotunda Hospital on Parnell Street located approximately 20m to the north of Site 1 boundary.
- NSL 3 AIB Bank offices on O'Connell Street / Parnell Street located directly adjacent to the north of Site 1 boundary.
- NSL 4 Hotel rooms located in Jurys Inn Hotel Parnell Street, located approximately 10m to the north of the Site 5 boundary and 10m to the west of Site 1 and Site 2C boundaries.
- NSL 5 Hotel rooms located in Holiday Inn Express on O'Connell Street Upper, located approximately 45m to east of the Site 1 boundary.

- NSL 6 Hotel rooms located in Gresham Hotel on O'Connell Street Upper, located approximately 45m to east of the Site 1 and Site 2C boundaries.
- NSL 7 Hotel rooms located in Lynams Hotel on Henry Place, located approximately 10m to the east of the Site 3 boundary.
- NSL 8 Commercial properties located on Henry Street, located directly adjacent to the southeast of Site 3 boundary.
- VSL 1 The Rotunda Hospital on Parnell Street located approximately 20m to the north of Site 1 boundary.
- VSL 2 Protected buildings at 14 to 17 Moore Street, located directly adjacent to the Site 4 boundary.
- VSL 3 The operational Luas Line rail tracks located on O'Connell Street, located approximately 20m to the east of the Site 2AB boundary.

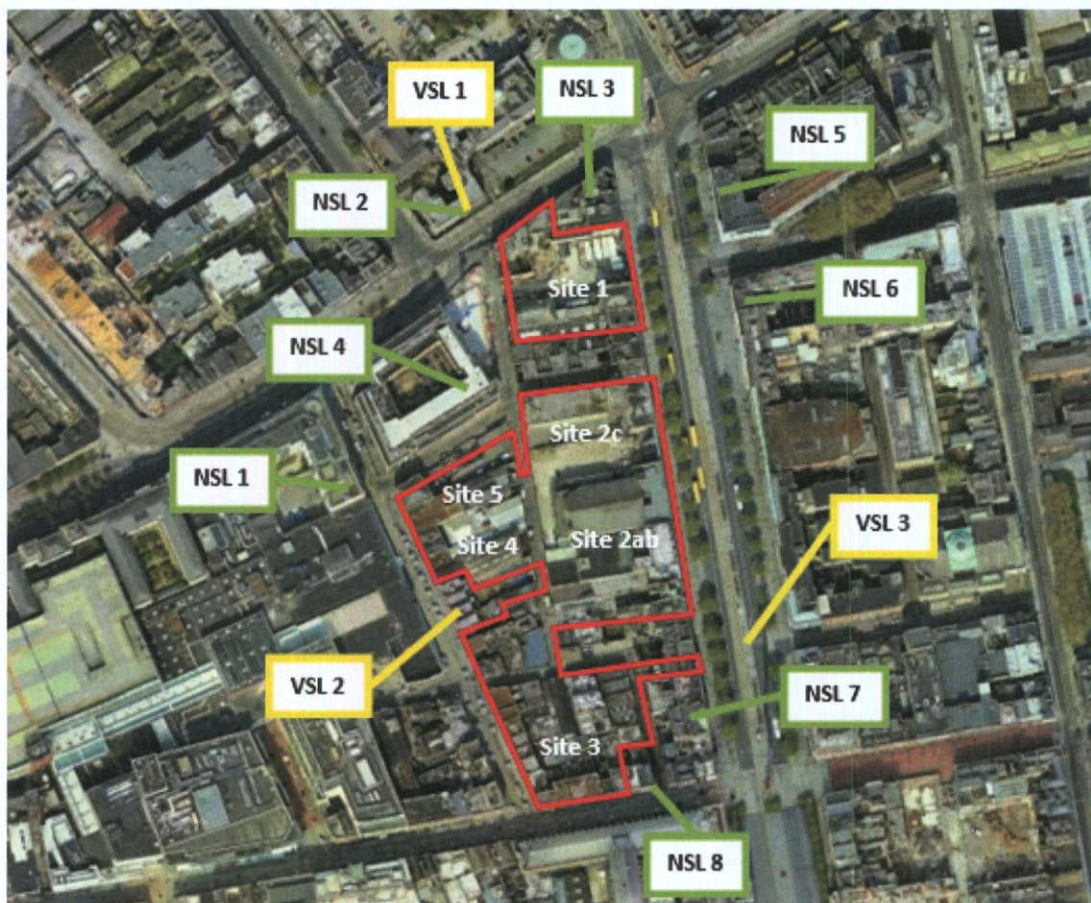


Figure 11:11: Dublin Central Masterplan Boundary with Noise (Green) and Vibration (Yellow) Sensitive Locations (Image Source: Google Earth).

During the construction of the Dublin Central Masterplan, as a worst-case assessment the closest NSLs within the development site at any stage of construction are: -

- Hotel rooms in Site 1 building, located adjacent to Site 2C northern boundary.
- Hotel rooms in Site 3 Block A, located approximately 10m from Site 2AB southern boundary.
- Residential apartments in Site 3 Block B, located approximately 15m from Site 2AB southern boundary.
- Residential dwellings in Site 4, located adjacent to Site 2AB western boundary.

General Construction Noise Impacts

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

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

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. Indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise. This standard sets out sound power / sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels. However, it is not possible to conduct detailed accurate prediction calculations for the construction phase of a project in support of the EIAR due to the level of variability during different construction stages over short periods of time.

The following section discusses typical noise levels associated with the Proposed Development and comments on potential noise impacts at distances to the nearest NSLs.

Intrusive Works and High Noise Activities Including Façade Demolition and Basement Excavation

Reference to BS 5288:2009+A1: Part 1 indicates that highest noise levels likely to be required on the site are associated with activities associated with site enabling and ground breaking associated with the initial demolition and ground clearance phase. Noise levels from these activity types are typically in the range of 80 to 90 dB L_{Aeq} at 10m.

For construction activities associated with hard ground breaking, crushing etc, a total construction noise level of 92 dB L_{Aeq} , at 10m has been used for the purposes of indicative calculations. This would involve for example, one item of plant at 90 dB L_{Aeq} and two items of plant at 85 dB L_{Aeq} and one item of plant at 80 dB L_{Aeq} operating simultaneously within one work area which is considered a highly worst-case scenario.

Utilities and Structural Works Including Secant Piled Walls, Retaining Walls, Piling and Basement Foundation Slab Construction

For construction works associated with activities such as site clearance, excavation and structural works including excavators, loaders, dozers, cranes, generators, concreting works and piling etc. noise levels are typically in the range of 70 to 80 dB L_{Aeq} at 10m.

For ongoing construction activity associated with the above activities, a total construction noise level of 82 and 85 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations for these activities representing variety over this stage. This would include, for example two items of plant at 80 dB L_{Aeq} and three items of plant at 75 dB L_{Aeq} operating simultaneously within one work area resulting in a total noise level of 85 dB L_{Aeq} and up to six items of plant with a noise level of between 70 and 75 dB L_{Aeq} resulting in a total noise level of 82 dB L_{Aeq} at 10m.

Superstructure and Lower Noise Activities

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

Given the variations of on-site activities and noise levels over any one day and considering that all activities will not operate simultaneously, the values noted above are considered robust for the purposes of assessing potential construction impacts.

Indicative Construction Noise Calculations at Varying Distances

The closest external NSLs to the Dublin Central Masterplan are directly adjacent to the site boundaries to the north and southeast, with the remaining closest NSLs at distances of approximately 10m to 45m. Remaining properties are located at distances greater than 45 m from different work stages.

The closest internal NSLs within the Dublin Central Masterplan are directly adjacent to the site boundaries to the north and south, with the remaining closest NSLs at distances of approximately 10m to 15m.

Table 11.22 presents the calculated noise levels at distances between 10m and 100m representing the closest NSLs to the construction works. The calculations assume that plant items are operating for 66%¹⁰ of the time. For the purpose of the assessment, a standard site hoarding of 2.4m high has been included in the calculations for noise sensitive boundaries. Screening from existing buildings have not been included in the calculations. It must be stated that for most of the time, plant and equipment will be a greater distance from the nearest NSLs than those used within the calculations in and consequently will have lower impact. Our assessment is therefore representative of a “worst-case” scenario representing construction activities at a minimum distance from the NSLs.

Construction Programme Activity	Combined L _{Aeq} at 10 m	Cumulative Predicted Construction Noise Level at a Specific Distance with plant operating at 66% On-Time (dB L _{Aeq,1hour})					
		10 m	15 m	20 m	30 m	50 m	100 m
Initial Works Stage including Intrusive Works e.g. Rock Breaking / Drilling / Rock Crushing	92	86 (89)	82 (85)	75 (78)	71 (74)	67 (70)	61 (64)
Utilities and Structural Works including Secant Piled Walls, Retaining Walls, Piling and Basement Foundation Slab Construction	85	78 (81)	74 (77)	67 (70)	63 (66)	59 (62)	53 (56)
	82	75 (78)	72 (75)	64 (67)	61 (64)	56 (59)	50 (53)
General Site Work including Site Compounds and Landscaping	78	71 (74)	68 (71)	60 (63)	57 (60)	52 (55)	46 (49)

Table 11.22: Indicative Construction Noise Calculations at Varying Distances (with worst case cumulative Dublin Central Masterplan predicted values presented in parenthesis).

The activities described in Table 11.22 will also include some Metro Enabling Works (MEW) at certain times. This is a complex arrangement and will be carried out as part of Site 2 works. Therefore, a detailed assessment of the MEW works along with Site 2 works is contained in Section 11.5.2.

In order to assess the cumulative impacts from the Dublin Central Masterplan it has been assumed that there would be an increase in noise level by no more than 3 dB, as shown in parenthesis in Table 11.22 above. While a 3 dB increase is a doubling of sound energy, subjectively any change in noise level below 3 dB would be barely perceptible. This 3 dB increase (maximum doubling of plant items) is based on the practical number of plant and equipment items that could be reasonably assumed at the closest boundaries to the NSLs i.e. there will be a greater separation between plant / equipment and the NSL, which will result in a reduction in the predicted noise level at the closest NSL. In addition,

¹⁰ This estimate assumes that the plant will operate for approximately 6.5 hours over the proposed 10 hour working period which equates to a 66% on time over a daytime period or 40 minutes over a 1 hour period. The dynamic nature of construction sites is such that this is deemed to be a conservative estimate, particularly for breaking and drilling work.

the construction activities in the closest site to the NSL will be the dominant noise source, with very little contribution from sites at greater distances to the NSL i.e. where the contribution from the specific phase is more than 10 dB below noise contribution from the closest phase to the NSL. Our assessment is therefore representative of a "worst-case" scenario representing Dublin Central Masterplan construction activities at a minimum distance from the NSLs. This worst-case scenario would be expected to take place over a very short period of time, if at all.

Comment on Dublin Central Masterplan Cumulative Intrusive Works and High Noise Activities

The reference values outlined in Table 11.22 indicate that for construction activities with highest combined noise levels (L_{Aeq} up to 92 dB at 10 m), commercial NSLs at a distance of 20m or less from the north, southeast and west works boundaries are above the recommended construction noise threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs). All other commercial receivers at a distance of 30m or greater from the works boundary would be at or below the construction noise threshold value in the absence of any noise mitigation.

At distances beyond the immediate site boundary (greater than 50m), with the presence of existing buildings and distance attenuation, the construction threshold value for residential receivers is likely to be achieved during the various stages of works. For the closest residential properties 15m west of the Dublin Central Masterplan, calculated noise levels during this stage are above the recommended construction noise threshold value of 70 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs). However, works at this minimum distance to the NSLs are during boundary site works at Site 5 only. The second closest boundary is Site 4, is 30m from the NSL and more than 10 dB below the noise contribution from Site 5. Therefore, once works in Site 5 are at a distance of 30m or greater from the western works boundary, the residential NSL would be at or below the construction noise threshold value in the absence of any noise mitigation.

For the closest clinical receptors, the works at Site 1 are at 20m to the north of the Dublin Central Masterplan boundary. The second closest boundary is Site 2C, is 80m from the NSL and more than 10 dB below the noise contribution from Site 1. Therefore, assuming that there is no cumulative increase in noise levels, the clinical receptor is at or below the construction noise threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs).

Whilst this construction stage will be intermittent and transient specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during these intrusive works and high noise activities at the north, southeast and west works boundaries.

Comment on Dublin Central Masterplan Cumulative Utilities and Structural Works

During utilities and structural works etc. with combined site works up to 85 dB L_{Aeq} at 10m, the recommended construction threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs) at commercial receivers will be exceeded at distances of up to 15m from the works boundary in the absence of any noise mitigation. At distances beyond 15m of the immediate site boundary, with the presence of existing buildings and distance attenuation, the construction noise threshold value are likely to be achieved at commercial receptors during the various stages of works.

For the closest residential properties 15m west of the Dublin Central Masterplan development, calculated noise levels during this stage are above the recommended construction noise threshold value of 70 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs). Once works in Site 5 are at any distance greater than 20m from the western works boundary, the residential NSL would be at or below the construction noise threshold value in the absence of any noise mitigation.

For the closest clinical receptors, calculated noise levels during this stage are below the construction noise threshold value and below the measured ambient baseline environment in the area (71 dB L_{Aeq}).

Whilst this construction stage will be intermittent and transient specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during these intrusive works and high noise activities at the north, southeast and west works boundaries.

Comment on Dublin Central Masterplan Cumulative General Site Works

During general site work with combined site works up to 78 dB L_{Aeq} at 10m, the recommended construction noise threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs) at commercial receivers is likely to be complied with at the closest Dublin Central Masterplan site boundaries and beyond.

For the closest residential properties, calculated noise levels during this stage are 1 dB above the construction noise threshold value.

For the closest clinical receptors, calculated noise levels during this stage are significantly below the construction noise threshold value and below the measured ambient baseline environment in the area (71 dB L_{Aeq}).

Comment on Commercial NSLs within the Dublin Central Masterplan

During all activities with the exception of the general construction works, the commercial receivers (in Sites 1, 2AB, 2C and 3) within the Dublin Central Masterplan at the minimum distance to works boundaries would exceed the recommended construction threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs).

During initial site works, at distances within 25m of the immediate site boundaries to the south of Site 2AB, north of Site 2C and east of Site 5 would exceed the recommended construction threshold value. At distances beyond 25m of the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Dublin Central Masterplan commercial receptors during the cumulative initial site works.

During utilities and structural works, at distances within 15m of the immediate site boundaries to the south of Site 2AB, north of Site 2C and east of Site 4 and Site 5 would exceed the recommended construction threshold value. At distances beyond 15m of the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Dublin Central Masterplan commercial receptors during the cumulative utilities and structural works.

Whilst this construction stage will be intermittent and transient specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during these initial site works, high noise activities, utilities and structural works to the south of Site 2AB, north of Site 2C and east of Site 4 and Site 5.

Comment on Residential NSLs within the Dublin Central Masterplan

During all activities the residential receivers (in Sites 3 and 4) within the Dublin Central Masterplan at the minimum distance to works boundaries would exceed the recommended construction threshold value of 70 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs).

During initial site works, at distances within 40m of the immediate site boundaries to the south of Sites 2AB and 5 would exceed the recommended construction threshold value. At distances at or beyond 50m of the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Dublin Central Masterplan residential receptors during the cumulative initial site works.

During utilities and structural works, at distances within 20m of the immediate site boundaries to the south of Sites 2AB and 5 would exceed the recommended construction threshold value. At distances at 20m and beyond the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Dublin Central Masterplan residential receptors during the cumulative utilities and structural works.

During general site works, at distances within 15m of the immediate site boundaries to the south of Sites 2AB and 5 would exceed the recommended construction threshold value. At distances beyond 15 m of the immediate site boundaries noted above, with distance attenuation, the construction noise

threshold value is likely to be achieved at the Dublin Central Masterplan residential receptors during the cumulative general site works.

Whilst this construction stage will be intermittent and transient specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during all construction activities to the south of Sites 2C and 5.

MEW Construction Noise Impacts

Due to the complexity of the proposed MEW works, this has been assessed in detail within the assessment of the Proposed Development, i.e. Site 2. Conclusions relating to noise and vibration impacts as part of the Masterplan Development are set out in Section 11.5.2.

Cumulative Construction Traffic

There will be no car parking on the site for construction employees and as a result no assessment for construction parking facilities has been conducted. Given that traffic along the potential routes at Henry Place and Henry Place are not yet available, it is possible to calculate the noise levels associated with the passing vehicle using the following formula.

$$L_{Aeq,T} = L_{AX} + 10\text{Log}_{10}(N) - 10\text{Log}_{10}(T) + 20\text{Log}_{10}\left(\frac{r_1}{r_2}\right) \text{dB}$$

where: -

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T in seconds).

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered (dB).

N is the number of events over the course of time period T.

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

r_2 is the distance to the assessment location.

A calculation distance of 3m from the road has been used to assess noise levels at the closest buildings along the construction routes on Henry Place and Henry Street. The mean value of Sound Exposure Level for truck moving at low to moderate speeds (i.e. 15 to 45 km/hr) is in the order of 82 dB L_{AX} at a distance of 8m from the vehicle. This figure is based on a series of measurements conducted under controlled conditions. Construction vehicle numbers have been provided by Waterman Moylan Consulting Engineers Limited for the worst-case scenario (based on when the station box will be excavated in Phase 2 during 2025 / 2026) i.e. 65 haul trucks in and 65 no. haul trucks out per day. Assuming that no more than 20 trucks will pass per hour (a haul truck arriving or leaving site every 5 minutes), below summarises the calculated noise level associated with passing haul vehicles.

Cumulative Construction Phase	No. of trucks/peak hour	Calculated Noise level at edge of road (3m), dB $L_{Aeq,1hr}$
Worst case scenario on Henry Place and Henry Street	20	68

Table 11.23: Calculated Construction Traffic Noise Levels at Edge of Road.

The calculated noise levels associated with the worst case cumulative traffic assessment are in the order of 68 dB $L_{Aeq,1hr}$, which is below the construction noise criterion of 70 dB(A) for residential receptors and 75 dB(A) for commercial and clinical receptors. The calculated noise levels are not expected to generate any significant impact along the routes on which construction traffic will travel.

Reference to the baseline noise levels made along the road edge in the vicinity of the site indicates that the calculated noise levels are within 3 dB of the existing baseline, a change in noise level which would be barely perceptible. It should be noted that, in order to assess a worst-case scenario, a large proportion of the daily vehicle numbers have been assumed to arrive/depart over an hour long period. Therefore, it is expected in the absence of specific mitigation measures that there will be a **negative, not significant** and **short-term** impact at the closest receptors.

11.5.1.1.3 Relevant Criteria – Vibration

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

The most significant sources of transient vibration during the construction phase of the Proposed Development are likely to be from the following activities: -

- Piling of secant walls and foundations.
- Rock breaking during excavation works.

Peak Particle Velocity (PPV)

Peak particle velocity (PPV) is commonly used to assess the structural response of buildings to vibration. Reference to the following documents has been made for the purposes of this assessment in order to discuss appropriate PPV limit values: -

- British Standard *BS7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration* (hereinafter referred to as BS7385).
- British Standard *BS5228-2: 2009 + A1: 2014: Code of practice for noise and vibration control on construction and open sites – Vibration* (hereinafter referred to as BS5228-2:2009+A1:2014).

BS7385 and BS5228-2:2009+A1:2014 advise 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 for transient vibration. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table B.2 might need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges.

The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 11.24 (below). Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in Table 11.24. It should be noted that these values refer to the vibration at base of the building.

Historically important buildings, including the National Monument, that are difficult to repair might require special consideration on a case by case basis, but buildings of historical importance should not be assumed to be more sensitive unless they are structurally unsound. If a building, or a structure is in an unstable state, then it will tend to be more vulnerable to the possibility of damage arising from vibration or any other ground borne disturbance.

The vibration limit range for protected and historical buildings are equal to or up to 50% of those for light framed structures, depending on their structural integrity. Where no structural defects are noted, the same limit to those for light framed buildings apply. For other structures and buildings that are determined to be potentially vulnerable to vibration due to significant structural defects, a further stringent criteria has been applied for transient vibration. It is assumed that known buildings and structures of this kind, will be subject to condition surveys well in advance of the works, and any

defects identified repaired. The results of conditions surveys will determine whether a building or structure is classed as “vulnerable”.

Table 11.24 sets out the limits as they apply to vibration frequencies below 4Hz where the most conservative limits are required. At higher frequencies, the limit values for transient vibration within Table B.2 of BS5228-2:2009+A1:2014 will apply, with similar reductions applied for continuous vibration and those for protected structures.

Structure Type	Allowable Vibration (in terms of PPV) at the Closest Part of Sensitive Property to the Source of Vibration, at a Frequency of 4Hz and less:	
	Transient Vibration	Continuous Vibration
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s	25mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15mm/s	7.5mm/s
Protected and Historic Buildings *Note 1	6mm/s – 15mm/s	3 mm/s – 7.5mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3mm/s	

Note 1: The relevant threshold value to be determined on a case by case basis. Where sufficient structural information is unavailable at the time of assessment, the lower value within the range will be used.

Table 11.24: Recommended Construction Vibration Thresholds for Buildings.

As per BS5228-2:2009+A1:2014, below a frequency of 4Hz where a high displacement is associated with a relatively low component PPV, a maximum displacement of 0.6mm (zero to peak) should be used.

Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. There are no current standards which provide guidance on typical ranges of human response to vibration in terms of PPV for continuous or intermittent vibration sources.

BS5228-2:2009+A1:2014, provides a useful guide relating to the assessment of human response to vibration in terms of the PPV. Whilst the guide values are used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources. Table 11.25 below summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.140mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3mm/s	Vibration might be just perceptible in residential environments.
1mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Table 11.25: Guidance on effects of human response to PPV magnitudes.

Vibration typically becomes perceptible at around 0.15 to 0.3mm/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 and or the duration 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 or up to 12 mm/s during blasting when advance warning is given and timeframes are known. These values refer to the day-time periods only.

During surface construction works (piling and ground breaking etc.) the vibration limits set within Table 11.24 would be perceptible to building occupants and have the potential to cause subjective effects. The level of effect is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication and information circulars relating to planned works, their duration and vibration monitoring can significantly reduce vibration effects to the neighbouring properties.

Interpretation of the Human Response to Vibration

In order to assist with interpretation of vibration thresholds, Table 11.26 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS5228-2:2009+A1:2014.

Criteria	Impact Magnitude	Significance Rating
≥10 mm/s PPV	Very High	Very Significant
≥1 mm/s PPV	High	Moderate to Significant
≥0.3 mm/s PPV	Medium	Slight to Moderate
≥0.14 mm/s PPV	Low	Not significant to Slight
Less than 0.14 mm/s PPV	Very Low	Imperceptible to Not significant

Table 11.26: Human Response Vibration Significance Ratings.

Luas Line Vibration

For the operational Luas line, TII provides the Code of engineering practice for works on, near, or adjacent to the Luas light rail system, which details maximum allowable vibration values on the line in order to prevent damage: -

Frequency	Allowable vibration (in terms of peak particle velocity) at the Luas Line:-		
	Level 1	Level 2	Level 3
> 50 Hz	10mm/s	12mm/s	15mm/s
≤ 50 Hz	10mm/s	10mm/s	10mm/s

Table 11.27: Vibration guidance values for avoidance of damage to the Luas line.

The document describes the following actions to be taken at each level: -

“(i) Vibration readings below trigger level 1

As long as measured vibrations are below level 1, works can continue as applied.

“(ii) Vibration readings between trigger levels 1 and 2

In the case when measured vibration results exceed level 1, the relevant party shall initiate a review of his techniques and propose alterations to his methods including measures for reduction of vibration. These

measures shall consider the works techniques, the geological conditions and other relevant factors. Any such measures shall be tested, applied and carefully monitored by the relevant party.

(iii) Vibration readings between trigger levels 2 and 3

In the event of vibration readings exceeding trigger level 2 or when damage to the light railway has been suspected, the associated works shall cease and the relevant party shall initiate a review of his techniques. The relevant party shall submit details of his proposed modifications to the works to ensure that vibrations do not exceed trigger level 1. The modifications shall be identified in a document submitted to TII. Works shall not recommence without the consent of TII.

(iv) Vibration readings above trigger level 3

In the event of vibration readings exceeding level 3 in a discrete event, the procedure as described in (iii) shall apply."

Construction Vibration Impacts

The main potential source of vibration during the construction programme is associated with piling and ground breaking activities. In terms of piling, low vibration methods involving bored or augured piles are proposed. This piling method minimises the vibration levels generated as it is a non-percussive piling technique.

For the purposes of this assessment the expected vibration levels during piling have been determined through reference to published empirical data. BS 5228-2 publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106): -

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

Considering the use of low vibration levels at very close distances to the piling rigs, vibration levels at the surrounding buildings are not expected to pose any significance in terms of cosmetic or structural damage to any of the protected structures in proximity to the development works or any of the other nearby buildings. Vibration levels at Clinical Buildings in the Rotunda Hospital and along the Luas Line tracks are expected to be below the relevant criteria considering the large distances between areas of works and sensitive buildings / rail line identified. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of adjacent buildings.

If any rock breaking is proposed on the site, there is also potential for vibration to be generated through the ground. Empirical data for this activity is not provided in BS 5228-2, however the likely levels of vibration from this activity is expected to be significantly below the lower adopted criteria for building damage based on experience from other sites. Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 11.24 and Table 11.27.

With respect to the potential vibration impact, the only significant source of vibration is expected to be due to excavations, piling and foundation activities. However, the distance between the areas where these activities are to occur and the nearest noise sensitive locations are such that all vibration transmission would be below recommended guideline criteria. It is not anticipated in a worst-case cumulative vibration assessment that the limit values presented in Section 11.5.1.1.3 would be exceeded i.e. the impact from vibration would be relative to the closest phase of construction, and the distance to the next phase would be negligible. Therefore, it is expected in the absence of specific mitigation measures that there will be a neutral, not significant and temporary impact at the closest receptors.

Notwithstanding the above, any cumulative construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 11.6, Table 11.8 and Table 11.9. Mitigation measures and recommended good practices have been outlined in Section 11.6.1.1.

11.5.1.2 Operational Stage

11.5.1.2.1 Relevant Criteria – Noise

Mechanical Plant Noise

Once the Dublin central Masterplan becomes fully operational, a variety of electrical and mechanical plant will be required to service the development. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (i.e. overnight). Noisy plant with a direct line-of-sight to NSLs would potentially have the greatest effect. Plant contained within plantrooms has the least potential for effect once consideration is given to appropriate design of the space.

The following wording would be considered typically suitable for a planning condition related to operational noise (plant) associated with a development of this nature: -

“Noise levels from the Proposed Development should not be so loud, so continuous, so repeated, of such duration or pitch or occurring at such times as to give reasonable cause for annoyance to a person in any premises in the neighbourhood or to a person lawfully using any public space. In particular the rated noise levels from the Proposed Development shall not constitute reasonable grounds for complaint as provided for in B.S. 4142. Method for rating industrial noise affecting mixed residential and industrial area.

Reason: In order to ensure a satisfactory standard of development, in the interests of residential amenity.”

The typical planning condition outlined above related to noise emissions from mechanical plant items makes reference to the British Standard *BS 4142: 2014+A1:2019: Methods for Rating and Assessing Industrial and Commercial Sound*. This document is the industry standard method for analysing building services plant noise emissions to residential NSLs and is the document used by Dublin City Council in their standard planning conditions and also in complaint investigations.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 assessment it is necessary to compare the measured external background noise level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 recommends the application of a 2dB penalty for a tone which is just perceptible at the NSL, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible.

The following definitions as discussed in BS 4142 as summarised below: -

“ambient noise level, $L_{Aeq,T}$ ”	is the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
“residual noise level, $L_{Aeq,T}$ ”	is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
“specific noise level, $L_{Aeq,T}$ ”	is the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the

equivalent continuous A-weighted sound pressure level over the reference time interval [T].

“rating level, $L_{Ar,T}$ ” is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);

“background noise level, $L_{A90,T}$ ” is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level, then this indicates that complaints are likely to occur and that there will be a significant adverse effect. A difference of around +5 dB is likely to be an indication of an adverse effect, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse effect or a significant adverse effect. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low effect.

It is important to note that cumulative plant noise levels from the Dublin Central Masterplan site must be designed so as to meet the relevant noise criteria set at a given sensitive receptor location.

Receivers within the Development

To ensure there is no adverse impact on the future inhabitants of the Proposed Development itself, it is appropriate to refer to internal noise targets derived from BS 8233: 2014: *Guidance on Sound Insulation and Noise Reduction for Buildings*. The recommended indoor ambient noise levels are set out in Table 11.28 Table 11.26 and are based on annual average data, that is to say, they omit occasional events where higher intermittent noisy events may occur.

Activity	Location	Day (07:00 to 23:00hrs) dB	Night (23:00 to 07:00hrs)
		$L_{Aeq,16hr}$	dB $L_{Aeq,8hr}$
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/ area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,18r}$ 45 dB $L_{Amax,T}^*$

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

Table 11.28: ProPG Internal Noise Levels (BS 8233:2014).

Entertainment Noise Breakout

There is no Irish Standard or legislative guidance regarding the assessment of noise nuisance from entertainment source, e.g. music. However, it is typical for the local authority to apply a planning condition which would specify a noise criterion relative to the existing noise levels and ensure that the Proposed Development had no significant impact on the nearest sensitive locations.

In the case of the Proposed Development potential sources of entertainment noise include restaurant/bar areas, communal amenity spaces (residential), presentation/convention spaces, retail units and food & beverage units.

The UK Institute of Acoustics (IOA) document Good Practice Guide on the Control of Noise from Pubs and Clubs (March 2003) contains recommendations for acoustic design criteria. This document however does not contain any objective assessment methods for music noise but defines what is considered to be inaudible music breakout as follows: -

“Noise is considered to be inaudible when it is at low enough level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question.”

Whilst a subjective assessment of audibility will identify the likelihood of a noise nuisance, it is considered prudent to assess any noise complaint on an objective basis with respect to noise.

In order to apply an objective criterion to allow for a structured analysis, we propose that the following criterion is adopted for the assessment of the entertainment noise from the Proposed Development: -

“The $L_{Aeq,5min}$ level measured at the nearest noise sensitive location, with entertainment taking place, shall show no increase when compared with the representative $L_{Aeq,5min}$ level measured from the same position, under the same conditions and during a comparable period with no entertainment taking place; and

The $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands at the nearest noise sensitive location, with entertainment taking place, should show no increase when compared with the representative $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands measured from the same position, under the same conditions and during a comparable period with no entertainment taking place.”

This criterion is based on the guidance contained within the Draft IOA Code of Practice Guide on the Control of Noise from Pubs and Clubs (November 1999). This is considered to be an appropriate guidance document for the control of music noise breakout.

Change in Traffic Noise Levels During Operational Phase

A potential source of outward noise impact associated with a Proposed Development relates to additional traffic associated with journeys to and from the development on the surrounding road network. The Dublin Central Masterplan site includes for some 33no. parking spaces in Site 2.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 11.29 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source DMRB, 2019). It shows that small changes in noise levels are not normally noticeable, whereas an increase of 10dB would be described as a doubling of loudness. In summary the assessment looks at the impact with and without development at the nearest noise sensitive locations.

Change in Sound Level (dB)	Subjective Reaction	DMRB magnitude of Impact	EPA Classification Magnitude of Impact
0	Inaudible	No Change	Neutral
0.1 – 2.9	Barely Perceptible	Negligible	Imperceptible
3 – 4.9	Perceptible	Minor	Slight
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate

Table 11.29: Significance in Change in Noise Level.

Inward Impact Assessment - Dublin City Council Noise Action Plan (NAP)

The Dublin Agglomeration Environmental Noise Action Plan (NAP) December 2018 – July 2023 was published in December 2018. The NAP indicates that guidance within the ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise document should be referred to: -

“In the scenario where new residential development or other noise sensitive development is proposed in an area with an existing climate of environmental noise, there is currently no clear national guidance on appropriate noise exposure levels. The EPA has suggested that in the interim that Action Planning Authorities should examine the planning policy guidance notes issued in England titled, ‘ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise’. This has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England.”

In accordance with this NAP policy, this EIAR chapter will include an Acoustic Design Statement (ADS) to comply with the requirements of this policy.

Inward Impact Assessment – Office Inward Noise Impact

Guidance has been drawn from the *British Council for Offices Guidance to specification*. The guidance suggests three noise curve values for internal noise due to external sources. The values are dependent on the circumstances of the project and are reproduced in Table 11.30.

Location	Maximum Permissible Ambient Noise Level
Open Plan Offices	NR40 $L_{eq,T}$
Speculative Offices	NR38 $L_{eq,T}$
Cellular offices / meeting rooms	NR35 $L_{eq,T}$

Table 11.30: Internal Noise Specification (Office).

In addition to the above the guidance suggests that L_{AFmax} , noise intrusion levels should not normally exceed 55 dB in open office space / speculative offices or 50 dB in cellular offices.

In order to ensure a high-quality internal noise environment commensurate with other similar developments in Dublin, it is proposed to adopt the NR35 and 50dB L_{AFmax} criteria in this instance.

For the purposes of the assessment the office space has not been considered as noise sensitive during evening and the night-time (19:00 to 07:00hrs).

11.5.1.2.2 Relevant Criteria – Vibration

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

11.5.1.3 Do-Nothing Impact

In the absence of the Proposed Dublin Central Masterplan site being developed, noise and vibration levels across the study area would be expected to remain in line with the prevailing baseline environment. Therefore the impact of the Do-Nothing scenario would be regarded as **neutral**.

11.5.2 Proposed Development – Site 2

11.5.2.1 Construction Stage

The construction stages of the Proposed Development will occur on a staged basis. This section of the EIAR chapter will assess the construction noise and vibration impacts of Site 2 i.e. Sites 2AB and 2C cumulatively.

The noise and vibration criteria detailed in Sections 11.5.1.1.1 and 11.5.1.1.3 also apply to the Proposed Development. As per the Dublin Central Masterplan, the construction phase will be controlled through the use of construction noise and vibration threshold values which the contractor will be required to work within. In this regard, the choice of plant, scheduling of works on site, provision of localised screening and other best practice control measures will be employed in order to ensure noise and vibration threshold values are not exceeded.

As part of the construction works for Site 2, MetroLink Enabling Works (MEW) will take place at the same time as excavation and below-ground works for Site 2. These works for the two developments are assessed as one activity and therefore the potential cumulative impact is predicted.

11.5.2.2 Noise Impact at Proposed Development – Site 2

The potential construction activities detailed in Section 11.5.1.1.2 are also applicable to the proposed Site 2 (Sites AB and 2C). The indicative noise calculations presented in Table 11.22 are valid for above ground and superstructure works occurring on Site 2 (Site 2AB and 2C) at the nearest sensitive locations external to the site, which are common to the Dublin Central Masterplan development sensitive locations, the only variable are the distances to specific site boundaries, discussed in the following section.

Due to the complexity of the works associated with the MetroLink, additional noise modelling has been undertaken in order to predict the potential effects of these works when they are completed as part of this development.

Noise calculations for the MEW construction activity included within the excavation and below ground works for Site 2 have been conducted in accordance with ISO 9613 (1996): *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* using noise source data from BS 5228-1: 2009+A1(2014): *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*.

The vibration impact due to the construction works will be assessed by making reference to published empirical data rather than detailed predictions. This assessment will comment on the expected vibration levels from the various MEW construction activities at a range of distances from the source.

11.5.2.2.1 Sensitive Receptors

As part of the Site 2 and MEW noise modelling, additional noise sensitive receptors have been considered. These are listed below.

Noise levels have been predicted at each of 34 locations in the vicinity of the MEW site. The receptor is located at the height of the top-floor window in each case, as this is the least protected from any noise source by screening effects of the excavation. Lower floors will experience lower construction noise levels due to additional screening effects.

The locations include residential buildings, clinical and commercial buildings. The noise level receptors are listed in Table 11.31 below and shown in Figure 11:12.

Receptor	Description
R1	Rotunda
R2	Ambassador Theatre
R3	Cassidys Hotel
R4	2 - 6 Rae Cavendish (Commercial)
R5	153 - 162 Parnell St (Residential Upper Floors)
R6	Murray's Pub
R7	Holiday Inn
R8	Hotel Rui
R9	19 O'Connell St (Commercial)
R10	Savoy Cinema
R11	14 O'Connell St (Commercial)
R12	9 - 12 O'Connell St (Commercial)
R13	1 - 8 O'Connell St (Commercial)
R14	18 - 34 O'Connell St Lower (Commercial)
R15	GPO Henry St
R16	24 - 30 Henry St (Commercial)

Receptor	Description
R17	34 - 41 Henry St (rear) (Commercial)
R18	1-9 Moore Street (rear) – N/A due to proposed Masterplan
R19	55 - 61 Moore St (Commercial)
R20	Henry Place (rear)– N/A due to proposed Masterplan
R21	13 - 16 Moore St (Rear) (Commercial)
R22	20 Moore Street (rear)– N/A due to proposed Masterplan
R23	24 Moore Street, Hope Rehabilitation Centre (rear)– N/A due to proposed Masterplan
R24	Ilac Centre (Commercial)
R25	Gregg Court (Residential)
R26	Jurys Inn (S)
R27	Jurys Inn (E)
R28	Jurys Inn (N)
R29	72 Parnell St (Commercial)
R30	AIB (West)
R31	AIB (east)
R32	49 - 58 R132 (Commercial)
R33	166 - 168 Parnell St (Residential Upper Floors)
R34	Ivy Exchange (Residential Upper Floors)

Table 11.31: Receptor locations included in the MEW Assessment



Figure 11.12: Noise model receptor locations – MEW Site within DCP Masterplan (Clinical, Residential and Commercial Receptors – Source: Google Earth)

11.5.2.2.2 Predicted Construction Noise Levels

During the MEW stages of construction works on Site 2, there will be no internal noise sensitive receptors to the Masterplan development site. As a result, the facades within Sites 1, 3, 4 or 5 have not been included in the calculations.

Regarding Site 2 and MEW construction activities, the associated plant noise levels and the assumed operational 'On Time' are presented in Table 11.32.

Construction Programme Phase	Plant Item	BS 5228-1:2014 Data Source	Activity dB L _{Aeq,T} at 10m	% On time
Asbestos removal, soft strip, demolition and façade retention	Skid steers	Manufacturer Reference	68	75
	Dumper 6t	Table C.4:6	79	50
	Articulated Dump Truck	Table C.4:1	81	5
	Scaffolding	Table D.7:1	80	100
	Hand-Tools	Table C.4:72	79	50
	Circular Saw	Table C.4:73	84	25
	360 Excavator with Breaker	Table C.1:2	92	100
	Breaker mounted on Excavator	Table C.1:9	90	100
	20t Excavator with Pulveriser	Table C.1:3	80	50
	22t Excavator with Hammer	Table C.9:13	95	25
	Dust Suppression	Table C.4:91	78	100
	Skip Wagon	Table C.8:21	78	10
	General Site Loader	Table C.4:13	71	10
	Lorry with lifting boom	Table C.4:53	77	10
	Mobile Crane 250t	Table C.4:38	78	25
	Concrete Delivery	Table C.4:20	80	5
Reduced level excavation	Dozer 20t	Table C.2:12	81	50
	Medium Roller	Table C.5:24	84	100
	360 Excavator (45t)	Table C.2:14	79	75
	Dumper 6t	Table C.4:6	79	50
Piling operations	Pile Boring Rig (Contig/Secant)	Table C.3:14	83	100
	Dumper 6t	Table C.4:6	79	100
	Concrete Delivery	Table C.4:20	80	5
	Mobile Crane 250t	Table C.4:38	78	50
	General Site Loader	Table C.4:13	71	10
	360 Excavator (20T)	Table C.2:21	71	100
D Wall operations	D-wall Rig	Manufacturer Reference	84	100
	D-wall Hydrofraise	Manufacturer Reference	84	100
	Tracked Mobile 110T	Table C.3:28	67	100
	Tracked Mobile 150T	Table C.3:29	70	100
	Bentonite Plant	Table C.4:22	76	100
	Jet Wash	Table C.3:13	63	25
	Bentonite Pumping Equipment	Manufacturer Reference	62	100
	Diesel Generator	Table C.4:84	74	100
	Compressor	Table C.3:19	75	100

Construction Programme Phase	Plant Item	BS 5228-1:2014 Data Source	Activity dB L _{Aeq,T} at 10m	% On time
	Dump Truck	Table C.2:30	79	100
	Excavator (Loading)	Table C.2:29	79	100
	Concrete Delivery	Table C.4:20	80	5
	General Site Loader	Table C.4:13	71	10
	Concrete Pump	Table C.4:25	82	100
	Site Lighting	Table C.4:86	65	100
Dewatering	Diesel Generator	Table C.4:84	74	100
	De-watering Pump	Table C.4:88	68	100
Excavation	360 Excavator with Breaker	Table C.1:2	92	100
	HGV	Average of Table C.11:4-20	82	5
Concrete works	Concrete Delivery	Table C.4:20	80	5
	HGV	Average of Table C.11:4-20	82	5
	Tracked Mobile 110T	Table C.3:28	67	100
	Tower Crane	Table D.4:49	77	100
General	Telehandler	Table C.4:54	79	50
	Road Sweeper	Table C.4:90	76	100

Table 11.32: Plant noise levels at various phases of the construction programme

Predicted Construction Noise Levels with 2.4m Site Hoarding as Standard

Noise levels predicted for each of the main construction phases are presented in Table 11.33. Please note that the sources listed in Table 11.32 for each phase of construction have been modelled in clusters close to the nearest receptor locations. Therefore, the results listed in Table 11.33 are the highest levels predicted for any one receptor and represent the noise level when construction activity is on-going at the closest point within the site to each receptor. This is considered to be a worst-case assessment. The results in Table 11.33 include the mitigation offered by the solid site hoarding/barrier which is proposed to be erected around the site boundaries closest to residential, commercial and clinical buildings. The standard height of the barrier/hoarding has been assumed as 2.4m height. Where facades are retained a screening height of 5m has been assumed in the model.

Receptor	MEW Construction Phase Maximum Predicted Noise Levels at Receptors (dB L _{Aeq,T})							
	Demolition	Reduced Level Excavation	Piling	D-wall	Dewatering	Excavation	Concrete Works	General
R1	82	68	72	74	57	63	69	68
R2	63	50	54	56	39	48	47	41
R3	73	59	62	65	48	55	59	53
R4	75	63	66	68	50	56	60	56
R5	70	59	63	64	46	49	55	53
R6	78	65	69	71	54	57	63	61
R7	81	68	72	74	57	62	67	63
R8	84	69	75	77	60	65	69	65
R9	84	70	75	77	60	65	70	65

Receptor	MEW Construction Phase Maximum Predicted Noise Levels at Receptors (dB L _{Aeq,T})							
	Demolition	Reduced Level Excavation	Piling	D-wall	Dewatering	Excavation	Concrete Works	General
R10	84	70	75	77	60	65	70	65
R11	83	70	74	76	59	65	69	65
R12	82	69	74	75	58	64	69	64
R13	79	67	70	71	54	60	64	60
R14	72	56	62	66	49	55	58	53
R15	79	66	70	70	52	64	65	61
R16	80	68	70	71	54	67	67	63
R17	82	69	72	72	55	65	68	63
R18	To be demolished as part of the development and are therefore no longer considered sensitive to noise							
R19	82	68	71	73	56	61	67	62
R20	To be demolished as part of the development and are therefore no longer considered sensitive to noise							
R21	85	71	75	76	59	64	71	67
R22	To be demolished as part of the development and are therefore no longer considered sensitive to noise							
R23								
R24	69	54	62	63	42	52	56	53
R25	79	66	70	71	53	60	66	63
R26	86	75	79	80	62	69	75	74
R27	89	77	81	81	63	73	76	76
R28	58	47	52	51	35	51	46	43
R29	83	69	74	76	59	69	69	66
R30	84	70	74	77	60	70	69	66
R31	82	69	71	75	58	67	67	60
R32	78	63	68	72	55	57	66	64
R33	78	63	68	72	55	58	66	65
R34	52	41	45	45	27	48	40	37

Table 11.33: Predicted Highest Noise Levels at Receptor Locations with 2.4m hoarding around site

The predicted cumulative construction noise levels (CNL) for highly intrusive activities (demolition, piling and D-wall operations) at the closest receptor façades are between < 50 to 89 dB L_{Aeq,T} in the absence of any noise mitigation. The predicted cumulative CNLs for excavations, concrete works and general site works at the closest receptor façades are between <50 to 77 dB L_{Aeq,T} in the absence of any noise mitigation. The predicted cumulative CNLs for lower noise activities (dewatering) at the closest receptor façades are between <50 to 63 dB L_{Aeq,T} in the absence of any noise mitigation.

During the majority of the MEW construction activities the predicted highest cumulative construction noise levels (CNLs) do not exceed the CNT at the vast majority of closest receptors to the site boundary. The highly intrusive noise activities, namely demolition and D-wall operations, exceed the CNT at 22 no. receptors in the absence of noise mitigation beyond a standard 2.4m site hoarding screen around the site boundary, including closest residential receptors to the west, clinical receptors to the north and commercial receptors to the north, east, south and west. The CNT exceedances during demolition activities at the closest site boundaries are between 3 to 14 dB above the CNT and during D-wall operation activities at the closest site boundaries are between 1 to 6 dB above the CNT. It is reiterated however that the results presented above are based on the highest noise levels at the

worst effected façade for each of the receptors and at lower receptor heights may be in compliance with the CNTs.

Making reference to the CNLs in Table 11.33 the predicted noise impacts for all construction activities with the exception of demolition and D-wall activities, is Not Significant at all receptors in the absence of noise mitigation.

Table 11.34 presents the noise impact assessment pre-mitigation for the demolition and D-wall activities for each receptor that exceeded the CNT. The impact assessment considers the baseline noise level for the individual receptors using the criteria outlined previously in Table 11.20.

Receptor Ref	Address	Weekday Day (07:00 - 19:00)	
		Demolition Impact Assessment	D-wall Impact Assessment
R1	Rotunda	Significant to Very Significant	--
R6	Murray's Pub	Not Significant	--
R7	Holiday Inn	Significant to Very Significant	--
R8	Hotel Rui	Significant to Very Significant	Moderate to Significant
R9	19 O'Connell St (Commercial)	Significant to Very Significant	Moderate to Significant
R10	Savoy Cinema	Significant to Very Significant	Moderate to Significant
R11	14 O'Connell St (Commercial)	Significant to Very Significant	Moderate to Significant
R12	9 - 12 O'Connell St (Commercial)	Significant to Very Significant	--
R13	1 - 8 O'Connell St (Commercial)	Moderate to Significant	--
R15	GPO Henry St	Moderate to Significant	--
R16	24 - 30 Henry St (Commercial)	Moderate to Significant	--
R17	34 - 41 Henry St (rear) (Commercial)	Significant to Very Significant	--
R19	55 - 61 Moore St	Significant to Very Significant	--
R21	13 - 16 Moore St (Rear) (Commercial)	Significant to Very Significant	Moderate to Significant
R25	Greeg Court (residential)	Significant to Very Significant	Moderate to Significant
R26	Jurys Inn (S)	Significant to Very Significant	Moderate to Significant
R27	Jurys Inn (E)	Significant to Very Significant	Significant to Very Significant
R29	72 Parnell St (Commercial)	Significant to Very Significant	Not Significant
R30	AIB (West)	Significant to Very Significant	Not Significant
R31	AIB (east)	Significant to Very Significant	--
R32	49 - 58 R132 (Commercial)	Not Significant	--
R33	166 - 168 Parnell St (Residential Upper Floors)	Not Significant	--

Table 11.34: Predicted Noise Levels and Noise Impact Assessments at Receptor Locations with 2.4m Hoarding Around Site

As presented in Table 11.34 above, during demolition activities there is one residential receptor to the northwest and two commercial receptors, with a Not Significant predicted noise impact. Three commercial receptors to the east have a Moderate to Significant predicted noise impact. There is one clinical receptor to the north, one residential receptor to the west, fourteen commercial receptors to north, east, south and west of the site, all with a Significant to Very Significant predicted noise impact. All of the above impacts are in the absence of noise mitigation.

During D-wall activities there are two commercial receptors to the north with a Not Significant predicted noise impact. There is one residential receptor to the west and six commercial receptors to north and west of the site, with a Moderate to Significant predicted noise impact. One commercial receptor to the northwest has a Significant to Very Significant predicted noise impact. All of the above impacts are in the absence of noise mitigation.

Comment on Jurys Inn Receptors

During piling and D-wall activities the Jurys Inn south receptor (R26) has Moderate to Significant predicted noise impacts in the absence of noise mitigation. During demolition activities the Jurys Inn south receptor has Significant to Very Significant predicted noise impacts in the absence of noise mitigation.

During excavation, concrete works and general site activities the Jurys Inn east receptor (R27) has Moderate to Significant predicted noise impacts in the absence of noise mitigation. During demolition, piling works, D-wall, concrete works and general site activities the Jurys Inn east receptor has Significant to Very Significant predicted noise impacts in the absence of noise mitigation.

Predicted Construction Noise Levels with Localised Screening and 4m Site Hoarding

With the exception of the Jurys Inn receptors, the demolition and D-wall activities were the only construction works to exceed the CNT at multiple receptors closest to the site. Further modelling has been carried out for these two activities to identify the impact of noise mitigation in the form of localised screening and 4m site hoarding would have on the predicted noise levels.

Noise levels predicted for each of the highly intrusive noise activities of demolition and D-wall are presented in Table 11.35. As highlighted before, the results listed in Table 11.35 are the highest levels predicted for any one receptor and represent the noise level when construction activity is on-going at the closest point within the site to each receptor. The results in Table 11.35 include the mitigation offered by the solid site hoarding/barrier which is proposed to be erected around the MEW site boundaries. The height of the barrier/hoarding has been assumed as 4m height. Where facades are retained a screening height of 5m has been assumed in the model. Localised screening has also been considered around excavators and generators.

Receptor	MEW Construction Phase Maximum Predicted Noise Levels at Receptors (dB L _{Aeq,T})	
	Demolition	D-Wall
R1	75	71
R2	57	53
R3	66	61
R4	69	64
R5	64	59
R6	71	67
R7	75	71
R8	78	74
R9	78	74
R10	77	74
R11	77	73
R12	77	72
R13	75	68
R14	64	62
R15	73	68

Receptor	MEW Construction Phase Maximum Predicted Noise Levels at Receptors (dB L _{Aeq,T})	
	Demolition	D-Wall
R16	75	69
R17	76	70
R18	To be demolished as part of the development and are therefore no longer considered sensitive to noise	
R19	73	67
R20	To be demolished as part of the development and are therefore no longer considered sensitive to noise	
R21	77	72
R22	To be demolished as part of the development and are therefore no longer considered sensitive to noise	
R23		
R24	60	57
R25	74	68
R26	81	78
R27	85	79
R28	54	50
R29	76	72
R30	76	73
R31	75	72
R32	70	68
R33	70	68
R34	48	43

Table 11.35: Predicted Highest Noise Levels at Receptor Locations with Localised Screening and 4m Hoarding Around Site

The predicted cumulative CNLs for demolition activities at the closest receptor façades are between <50 to 85 dB L_{Aeq,T}. During the demolition activities the CNT is exceeded at 12 no. receptors, including closest residential receptors to the west and commercial receptors to the north, east, south and west. The CNT exceedances during demolition activities at the closest site boundaries are between 1 to 10 dB above the CNT.

The predicted cumulative CNLs for D-wall activities at the closest receptor façades are between <50 to 79 dB L_{Aeq,T}. During the D-wall activities the CNT is exceeded at two receptors, namely the Jurys Inn south and east receptors to the nearest northwest boundary of the site. The CNT exceedances during D-wall activities at the closest site boundaries are between 3 to 4 dB above the CNT.

It is reiterated however that the results presented above are based on the highest noise levels at the worst effected façade for each of the receptors and at lower receptor heights may be in compliance with the CNTs.

Table 11.36 below presents the noise impact assessment post-mitigation for the demolition activity for each receptor that exceeded the CNT. The D-wall noise impact assessment for Jurys Inn receptors will be outlined in more detail in Table 11.37. The impact assessment considers the baseline noise level for the individual receptors and using the criteria outlined previously in Table 11.20.

Receptor Ref	Address	Weekday Day (07:00 - 19:00)	
		Demolition Impact Assessment	Height of Receptor Impacted
R8	Hotel Rui	Moderate to Significant	9.5m to 17.5m
R9	19 O'Connell St (Commercial)	Moderate to Significant	9.5m to 17.5m
R10	Savoy Cinema	Moderate to Significant	9.5m to 17.5m
R11	14 O'Connell St (Commercial)	Moderate to Significant	9.5m to 17.5m
R12	9 - 12 O'Connell St (Commercial)	Moderate to Significant	13.5m to 17.5m
R17	34 - 41 Henry St (rear) (Commercial)	Moderate to Significant	10.5m
R21	13 - 16 Moore St (Rear) (Commercial)	Moderate to Significant	7.5m
R25	Greeg Court (residential)	Moderate to Significant	13.5m to 21.5m
R26	Jurys Inn (S)	Significant to Very Significant	5.5m to 21.5m
R27	Jurys Inn (E)	Significant to Very Significant	5.5m to 21.5m
R29	72 Parnell St (Commercial)	Not Significant	9.5m
R30	AIB (West)	Not Significant	9.5m

Table 11.36: Predicted Noise Impact Assessments at Receptor Locations with Localised Screening and 4m Hoarding Around Site During Demolition Activities

As presented in Table 11.36, during demolition activities there are two commercial receptors with a Not Significant predicted noise impact to the north of the site once baseline noise levels have been considered at these locations along Parnell Street. There is one residential receptor to the west and seven commercial receptors to the east, south and west with a Moderate to Significant predicted noise impact. However it must be noted that these post mitigation impacts are presented for the worst affected receptor and as shown in the table may be at a receptor height from 9.5m upwards. Those receptors at a lower height within these buildings will have a lower noise impact due to the benefits from the 4m site hoarding and localised screening. The Jurys Inn commercial receptors (R26 and R27) to the northwest of the site, have a Significant to Very Significant predicted noise impact from 5.5m height upwards. All of the above impacts include the noise reduction provided by 4m site hoarding and localised screening.

Whilst this construction stage will be intermittent and transient, specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during all construction activities to the east, south and west of the MEW construction site.

Comment on Jurys Inn Receptors

As outlined in Table 11.33 previously, pre-mitigation CNLs associated with reduced level excavation, piling, D-wall, concrete works and general site works exceeded the CNT at the Jurys Inn South (R26) and east (R27) receptors. Table 11.37 below presents the post mitigation predicted noise levels for these two receptors, the impact assessment at the worst affected façade and the receptor height range to which these impact assessments apply.

MEW Construction Phase	Receptor Ref	Weekday Day (07:00 - 19:00)		
		Maximum Predicted Noise Level	Construction Impact Assessment	Height of Receptor Impacted
Reduced Level Excavation	R26	72	Slight to Moderate	5.5m to 17.5m
	R27	77	Moderate to Significant	5.5m to 17.5m
Piling	R26	77	Moderate to Significant	9.5m to 17.5m

MEW Construction Phase	Receptor Ref	Weekday Day (07:00 - 19:00)		
		Maximum Predicted Noise Level	Construction Impact Assessment	Height of Receptor Impacted
	R27	80	Moderate to Significant	5.5m to 17.5m
D-wall	R26	78	Moderate to Significant	9.5m to 17.5m
	R27	79	Moderate to Significant	5.5m to 17.5m
Concrete Works	R26	75	Slight to Moderate	5.5m to 17.5m
	R27	76	Moderate to Significant	5.5m to 17.5m
General	R26	74	Slight to Moderate	5.5m to 17.5m
	R27	75	Slight to Moderate	1.5m to 17.5m

Table 11.37: Predicted Noise Levels at Jurys Inn Hotel Receptor Locations R26 and R27 with Localised Screening and 4m Hoarding Around Site

During piling and D-wall activities the two Jurys Inn receptors exceed the CNT and have a Moderate to Significant predicted noise impact.

The Jurys Inn South (R26) receptor predicted noise level is at or below the CNT during reduced level excavation, concrete works and general work activities, and has a Slight to Moderate noise impact. At receptor heights below 5.5m at this location the predicted noise impact is Not Significant.

The Jurys Inn east (R27) receptor predicted noise level is at or below the CNT during general work activities and has a Slight to Moderate noise impact. During reduced level excavation and concrete works at this receptor, the predicted noise level is 1 to 2 dB above the CNT and has a Moderate to Significant noise impact.

All predicted noise levels above have included localised screening and 4m hoarding around the site as a mitigation measure.

Whilst this construction stage will be intermittent and transient specific noise mitigation measures in line with the DCC GPG for high risk sites will be required to control construction noise levels during all construction activities to the west of the MEW construction site.

Once the below-ground works are complete the construction of the Proposed Development buildings structure will be commenced. The closest noise sensitive receivers will be the same as those described in the Masterplan assessment in Section 11.5.1.1.2.

During the Proposed Development construction, the closest NSLs within the development site are:

- Hotel rooms in Site 1 building, located adjacent to Site 2C northern boundary.
- Hotel rooms in Site 3 Block A, located approximately 10m from Site 2AB southern boundary.
- Residential apartments in Site 3 Block B, located approximately 15m from Site 2AB southern boundary.
- Residential dwellings in Site 4, located adjacent to Site 2AB western boundary.

These construction works are expected to be consistent with activities and source noise levels set out in Table 11.22, i.e. general site work during construction of buildings. The predicted impact of this construction phase is assessed using these values.

Comment on Proposed Development General Site Works

During general site work with combined site works up to 78 dB L_{Aeq} at 10m, the recommended construction noise threshold value of 75 dB L_{Aeq} Monday through Friday (08:00 to 18:00hrs) is likely to be complied with at the closest commercial receivers 15m from works.

For the closest residential properties located at distances of greater than 20m, calculated noise levels during this stage are below the construction noise threshold value and below the measured ambient baseline environment in the area (65 dB L_{Aeq}).

For the closest clinical receptors, calculated noise levels during this stage are below the construction noise threshold value and below the measured ambient baseline environment in the area (71 dB L_{Aeq}).

Comment on Residential NSLs within the Masterplan Development

With reference to the Masterplan phasing schedule, heavy, intrusive MEW will be completed by the time the residential receptors within the Masterplan site become occupied. Therefore the ongoing construction works will be those associated with general site works, described above.

With reference to Table 11.22 it is predicted that the construction criteria at residential receptors at 10-15m distance from works will be exceeded. The associated impact is expected to be negative, moderate to significant and short-term.

At distances of 20m and greater it is predicted that the construction noise criteria for residential receptors can be complied with. Therefore the associated impact is negative, slight to moderate, and short-term.

Comment on Commercial NSLs within the Masterplan Development

With reference to Table 11.22 it is predicted that the construction criteria at commercial receptors at 10m distance from works will be exceeded. The associated impact is expected to be negative, moderate to significant and short-term.

At distances of 15m and greater it is predicted that the construction noise criteria for residential receptors can be complied with. Therefore the associated impact is negative, slight to moderate, and short-term.

Mitigation measures and recommended good practices have been outlined in Section 11.6.1.1.

11.5.2.2.3 Construction Traffic

The noise levels associated with mobile plant items such as concrete mixer trucks, loaders etc. operational on site have been included as part of the construction calculation noise levels in Table 11.22. Consideration should also be given to the addition of construction traffic along the site access routes. Based on provisional information provided by Waterman Moylan Consulting Engineers Limited (WM), access to the development site for construction traffic will potentially be via Parnell Street, O'Rahilly Parade, Moore Lane, Moore Street, Henry Place, Henry Street and O'Connell Street. Construction traffic will be required to travel on designated routes only agreed by DCC.

An initial high level review of the baseline and construction AADT PCU traffic data provided by WM indicates that the links (Links 1-11) i.e. along Parnell Street, Dominick Street, O'Connell Street Upper, Moore Street, O'Rahilly Parade and Moore Lane, have small increases in traffic volumes (up to 21%). An increase of 25% in traffic is required to increase overall traffic noise levels by 1 dB, which is insignificant in the overall context of the noise environment along the vicinity of the site. Therefore, the short-term noise environment assumed for this project is expected to be within at least 1 dB of the baseline scenario, which would give a magnitude of increase in traffic noise that is **negative, not significant** and **short-term**.

11.5.2.3 Vibration Impact at Proposed Development Site 2

It is not anticipated in a worst-case Proposed Development vibration assessment that the limit values presented in 11.5.1.1.3, would be exceeded i.e. the impact from vibration would be relative to the closest phase of construction, and the distance to the next phase would be negligible. Therefore, it is

expected that there will be a **neutral, not significant** and **temporary** impact at the closest receptors during the Proposed Development.

Notwithstanding the above, any cumulative construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 11.6, Table 11.8 and Table 11.9. Mitigation measures and recommended good practices have been outlined in Section 11.6.1.1.

11.5.2.4 Operational Stage

The various sites within the Dublin Central Masterplan will be completed and become operational on a staged basis. This section of the EIAR chapter will assess the operational noise and vibration impacts of Sites 2AB and 2C cumulatively.

The noise criteria detailed in Sections 11.5.1.1.1 and 11.5.1.1.3 also apply to the Proposed Development. As per the Dublin Central Masterplan, noise levels during the operational phase will be controlled through the use of appropriate noise criteria for mechanical plant noise. In this regard, the design and selection of mechanical plant items will be done so as to ensure noise criteria values are not exceeded.

With respect to the Proposed Development and entertainment noise, e.g. music / hospitality noise, areas where entertainment noise may be present are contained within the proposed buildings. Noise levels will be designed so as not to impact the adjacent spaces within the development and therefore it is not anticipated that there will be breakout to sensitive receivers outside of the development.

Regarding traffic noise associated with the Proposed Development there are 33 no. car parking spaces provided for at basement level. This represents a small number of potential traffic movements in the context of the surrounding road network and therefore there is no significant impact associated with this aspect of the operation of the Proposed Development.

With respect to inward noise on the development during this operational stage, appropriate mitigation is specified to ensure that suitable internal noise levels are achieved.

11.5.2.5 Operational Noise Impact at Proposed Development Site 2

The anticipated operational activities set out in Section 11.5.1.1.2 are also applicable to the proposed Sites 2. The methodology presented for the Dublin Central Masterplan site are also applicable to 2AB and 2C with respect to noise levels experienced at the nearest sensitive locations external to the site, which are common to the Dublin Central Masterplan sensitive locations, the variables to consider are the distances to specific site boundaries, the prevailing noise environment at various locations surround the site and the number of noise sources.

11.5.2.5.1 Sensitive Receivers

The nearest noise sensitive receivers (NSLs) to the Proposed Development site, i.e. Site 2, are described above and illustrated in Figure 11:13. It is noted that commercial NSLs (excluding hotels) are not designated as noise sensitive at night-time (23:00 – 07:00hrs).

Once all Dublin Central Masterplan sites are operational, the closest NSLs to the Proposed Development will be: -

- Residential apartments on Moore Street located approximately 80m to the west of the Site 2 boundary.
- Hotel rooms located in Jurys Inn Hotel Parnell Street, located approximately 10m to the west of the Site 2 boundary.
- Hotel rooms located in Lynams Hotel on Henry Place, located approximately 20m to the south of the Site 2 boundary.

- Commercial properties located on Henry Street, located approximately 80m to the south of the Site 2 boundary.

In addition to those listed above there will be future noise sensitive locations located within the Masterplan Development. As outlined in previous sections, these locations will be subject to appropriate noise criteria, separate to those specified for existing sensitive locations

- Hotel rooms within the proposed Site 1 development, some 20m north of the Site 2 boundary.
- Residential units within the proposed Site 3 and Site 4 development some 10m to the south and west, respectively.

11.5.2.5.2 Operational Noise Associated with Proposed Development – Site 2AB and Site C

Mechanical Plant Noise

Once operational, building services plant items will be required to serve the commercial and residential aspect of the development. It is anticipated that ventilation services serving the Metro Station below the Proposed Development will also be in operation. The cumulative operational noise level, from the Proposed Development, at the nearest external noise sensitive locations will be designed and attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods.

Given the baseline noise levels measured and presented in Section 11.3.1.2 and on review of published noise maps, appropriate criteria for plant noise levels at the nearest NSLs have been derived. Based on the varying baseline noise levels across the site, the following criteria are appropriate.

With respect to locations within the proposed Masterplan site, appropriate noise criteria are set out, i.e. Group C.

Receptor Group	Day, dB L _{Aeq,1hr}	Night, dB L _{Aeq,15min}
Group A	55	47 – 49
Group B	55	42
Group C	50	45

Table 11.38: Proposed Noise Criteria for Plant Noise

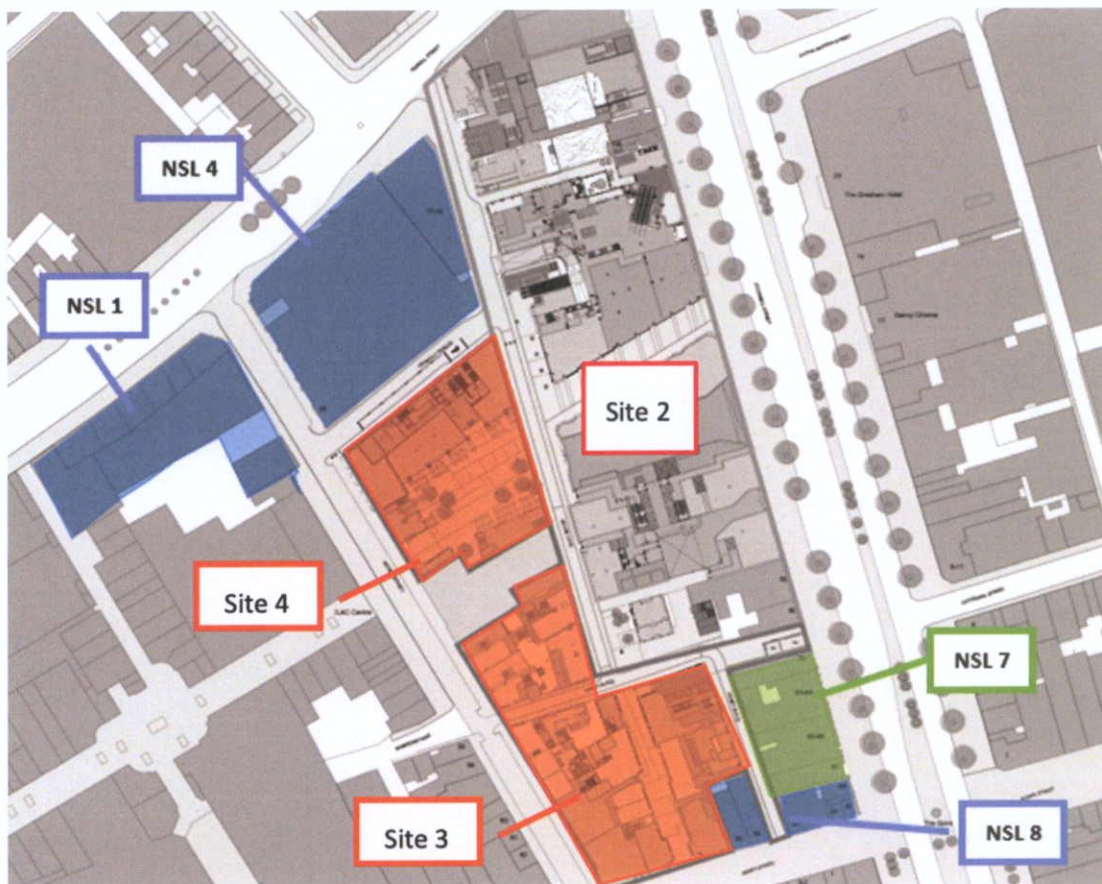


Figure 11:13: Plant Noise Criteria – External Sensitive Locations

The majority of plant items are expected to be housed internally in plant rooms or at basement level, whereby noise breakout is expected to be minimal. Items of plant with the potential for outward noise impact include chillers, AHUs and Metro vents located at roof level.

It is acknowledged that the selection of the specific plant items is subject to change during the detailed design stage and this is normal industry practice. However, noise from any new plant items will be designed and / or controlled so as not to give rise to any adverse effects at the nearest noise sensitive locations.

Furthermore, it is confirmed that no plant item will emit significant tonal or impulsive characteristics which may increase the potential for annoyance at the nearby noise sensitive locations.

These plant items will be designed and attenuated so as not to impact on sensitive receptors within the development itself, therefore there is not expected to be an impact on receivers outside the development, which are further away.

Entertainment Noise Breakout

In any development there is potential for noise breakout from internal areas of the restaurant / bar areas which will have background music playing. As a result, it is considered appropriate to review the potential for entertainment noise impact.

There are no external entertainment areas proposed within the Proposed Development. Areas such as retail and food and beverage units, where there may be entertainment noise generated, are located internally in the development buildings and therefore there is minimal potential for significant noise breakout. Therefore it is not determined that mitigation is necessary for this aspect of the operation on the development.

Delivery and Servicing Traffic

It is understood that deliveries to the Proposed Development will take place each day. Existing servicing times for the area surrounding the Proposed Development site are 06:00 to 11:00hrs. Certain areas to the north at O'Rahilly Parade operate 24 hours a day.

Information contained in the assessments prepared by Sweco¹¹ relates to the predicted number of delivery movements associated with the Proposed Development: -

Site	Daily Trip Generation (two-way)		
	LGV	OGV	Total per Day
Site 2AB	24	10	34
Site 2C	18	6	24

Table 11.39: Proposed Development Delivery Flows.

Deliveries will be conducted during the daytime period for the most part however some deliveries may occur between 06:00 – 07:00hrs (night-time period ends 07:00hrs). Deliveries will be unloaded at several locations across the development depending on the destination. Designated loading areas include: -

- Site 2AB – Loading areas on Henry Place and Moore Lane.
- Site 2C – 24-hour loading bay at O'Rahilly Parade and Parnell Street.

To consider a worst case scenario, it is assumed that 50% of deliveries were to occur during the current delivery hours, i.e. 06:00 to 11:00hrs. Considering the large numbers of vehicles currently using the public roads surrounding the Proposed Development, the addition of an average of 12 no. deliveries per hour does not represent a significant increase in vehicle movements or change in noise levels. These deliveries will be spread among the loading areas listed above. Deliveries will take place one at a time in a given loading area. Therefore, considering the additional traffic no significant noise impact is predicted as a result of delivery traffic serving the development.

Additional Traffic associated with Proposed Development

As outlined in previous sections, based on the small number of car parking spaces provided for and the low number of potential vehicle movements associated with the Proposed Development it is determined that there is not a significant impact associated with this aspect of the operation on the development. No mitigation measures are proposed.

Inward Noise Impact

The subject phase of the development is located in the city centre in a busy commercial area. There are main roads and infrastructure located nearby to the east. Baseline noise levels across the development site have been measured to be used in the assessment of inward noise impact on the Proposed Development.

Appropriate internal noise criteria have been set for the commercial spaces within the Proposed Development are set out in Section 11.5.1.2.1.

The table below summarises the predicted noise levels at the various proposed building facades as per the site layout provided.

¹¹ Dublin Central – Site 2 Servicing Management Plan

Location	Façade	Period	Predicted Noise Level (dB, L _{Aeq,T})
Site 2	Eastern Façade – O'Connell Street	Daytime	66 – 72
	Western Façade – Moore Lane	Daytime	59 – 60

Note Commercial units in Site 2 are designated noise sensitive during the daytime only (07:00 to 19:00hrs).

Table 11.40: Façade Noise Levels

It will be possible to achieve the appropriate internal noise levels once appropriate glazing systems are provided for on the facades of the development buildings. Details of the required glazing acoustic specifications are set out in Section 11.6.2.2.

11.5.3 Proposed Development – No. 61 O'Connell Street Upper

11.5.3.1 Construction Stage

Construction works associated with the proposed development are anticipated to be of a lesser scale to other sites within the Masterplan. Review of required works indicate that the majority of works will take place within the building structure and comprise refurbishment work, therefore it is expected that noise from construction noise will be limited and that noise breakout to the surroundings will be minimal. In the overall context of the Masterplan construction this works at 61 O'Connell Street are deemed to have negligible impact.

Notwithstanding the above, the noise and vibration criteria detailed in Sections 11.5.1.1.1 and 11.5.1.1.3 also apply to the Proposed Development. As per the Dublin Central Masterplan, the construction phase will be controlled through the use of construction noise and vibration threshold values which the contractor will be required to work within. In this regard, the choice of plant, scheduling of works on site, provision of localised screening and other best practice control measures will be employed in order to ensure noise and vibration threshold values are not exceeded.

11.5.3.2 Operational Stage

The potential construction activities detailed in Section 11.5.1.1.2 are also applicable to the proposed Development. The indicative noise calculations presented in Table 11.22 are valid for works occurring on 61 O'Connell Street, at the nearest sensitive locations external to the site, which are common to the Dublin Central Masterplan development sensitive locations, the only variable are the distances to specific site boundaries.

There are numerous residential, commercial and clinical receptors surrounding the Proposed Development, as illustrated in Figure 11:11.

Mechanical Plant Noise

As is the case for Site 2, noise from plant items serving the proposed development will be designed to be within the noise criteria set out in Section 11.5.2.5.2.

Entertainment Noise Breakout

As is the case for Site 2, entertainment noise from the gym area is required to be designed/managed in line with the noise criteria set out in Section 11.5.1.2.1.

Inward Noise Impact

Baseline noise levels across the development site have been measured to be used in the assessment of inward noise impact on the Proposed Development.

Appropriate internal noise criteria have been set for the commercial spaces within the Proposed Development are set out in Section 11.5.1.2.1.

The table below summarises the predicted noise levels at the various proposed building facades as per the site layout provided.

Location	Façade	Period	Predicted Noise Level (dB, L _{Aeq,T})
61 O'Connell Street	Eastern Façade – O'Connell Street	Daytime	66 – 72
		Night-time	62 – 65

Table 11.41: Façade Noise Levels

It will be possible to achieve the appropriate internal noise levels once appropriate glazing and ventilation systems are provided for on the facades of the development buildings. Details of the required glazing and ventilation acoustic specifications are set out in Section 11.6.2.2.

11.5.4 Cumulative

11.5.4.1 Construction Stage

The construction stages of the Dublin Central Masterplan will occur on a phased basis. There are no expected cumulative impacts associated with external construction works to the Dublin Central Masterplan. The closest construction work relative to the site is more than 40m from the closest site boundary. As illustrated in Table 11.22, the contribution from any secondary site external to the Dublin Central Masterplan is likely to be more than 10 dB below noise contribution from the closest site within the Dublin Central Masterplan and will not add to the noise impact at the nearest sensitive receptor.

Notwithstanding the above, any cumulative construction activities undertaken will be required to operate below the recommended noise and vibration criteria set out in Section 11.5.1.1.1 and Section 11.5.1.1.3. Mitigation measures and recommended good practices have been outlined in Section 11.6.1.1.

11.5.4.2 Operational Stage

The different sites within the Dublin Central Masterplan will be designed so that the cumulative noise emissions from processes and activities are within the relevant noise criteria set out. In the same way, Proposed Developments external to the Dublin Central Masterplan site will in turn be designed in order to comply with appropriate noise criteria.

Any major development in close proximity to the Dublin Central Masterplan site will be required to prepare an EIAR wherein cumulative impacts will also be considered.

11.6 MITIGATION MEASURES (AMELIORATIVE, REMEDIAL OR REDUCTIVE MEASURES)

11.6.1 Dublin Central Masterplan

11.6.1.1 Construction Stage

Mitigation measures for the construction phase are set out below in order to reduce potential impacts as far as practicable to within the adopted design goals for noise and vibration. These mitigation measures should be read in tandem with the specific noise mitigation measures in line with the DCC GPG for high risk sites, as presented in Appendix 11.2.

11.6.1.1.1 Noise Mitigation Measures

The contract documents will clearly specify the construction noise criteria included in this chapter which the construction works must operate within. The Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise* and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that: -

- 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;
- Any plant, such as generators or pumps that is required to operate outside of normal permitted working hours will be surrounded by an acoustic enclosure or portable screen.

BS 5228 -1:2009+A1 2014 includes guidance on several aspects of construction site practices, which include, but are not limited to: -

- Selection of quiet plant.
- Control of noise sources.
- Screening.
- Hours of work.
- Liaison with the public.

Further comment is offered on these items in the following paragraphs.

Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring. The contractor will be required to conduct construction noise predictions prior to works taking place and put in place the most appropriate noise control measures depending on the level of noise reduction required at any one location.

Selection of Quiet Plant

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever possible. Should a particular item

of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

For static plant such as compressors and generators used at work areas such as construction compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where possible.

General Comments on Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise.

In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. It is therefore proposed to adopt the concept of "Best Available Techniques" as defined in EC Directive 96/61. In this context "best" means "the most effective in achieving a high general level of protection of the environment as a whole".

Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations: -

- 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 will be switched off when not in use and not left idling.
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover.
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials, where relevant.
- Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/ areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact.
- Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary.
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening

Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source. BS 5228 -

1:2009+A1 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice, screens constructed of materials with a mass per unit of surface area greater than 10kg/m² will give adequate sound insulation performance.

Construction noise calculations have assumed a partial line of sight (-5dB) is achieved using a solid 2.4m high standard construction site hoarding. It will be a requirement for works occurring immediately in proximity to the closest noise sensitive locations along the site boundary, that the line of sight is further blocked such that a reduction of at least 10dB is achieved between the noise sensitive façade and construction activities. A reduction of this order can be achieved using a higher perimeter screen or using localised screening around specific items of plant.

Annex B of BS 5228-1:2009+A1:2014 (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials.

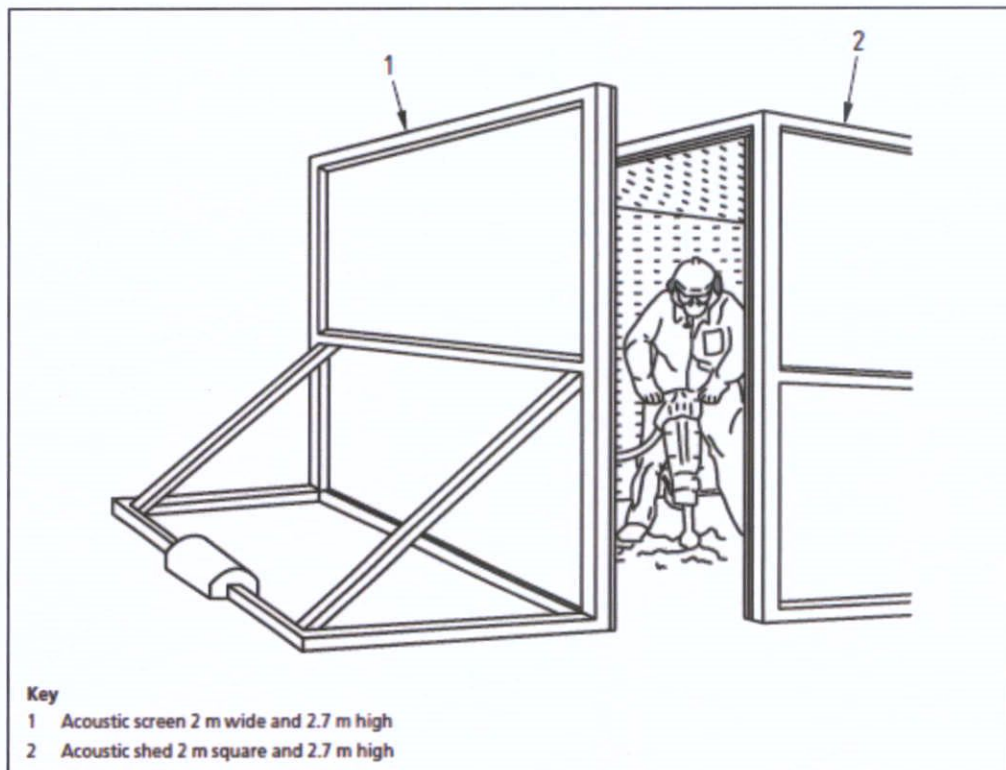


Table B.4 Measured sound reduction given by types of partial enclosure

Type of enclosure (see Figure B.3)	Reduction dB(A)		
	Facing the opening(s)	Sideways	Facing rear of shed
Open-sided shed lined with absorbent material; no screen	1	9	14
Open-sided shed lined with absorbent material; with reflecting screen in front	10	6	8
Open-sided shed lined with absorbent material; with absorbent screen in front	10	10	10

Figure 11:14: Typical Acoustic Screen / Shed Detail.

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

Hours of Work

Construction activity will mostly take place during daytime hours Monday to Friday and a half day on Saturdays. In the event of it being deemed necessary to undertake works outside these, it will be necessary to obtain prior written approval from Dublin City Council. Such approval would typically only be granted on submission of details of the activity accompanied by an assessment of potential noise impact.

Consideration should be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity should be considered on its individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control.

Depending on the noise emission levels experienced and associated noise impact, the contractor should be flexible and able to conduct certain works at hours which reflect periods when the neighbouring properties have lower sensitivities to noise.

Liaison with the Public

Clear forms of communication will be established between the contractor and noise sensitive areas in proximity so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration.

The duration of piling, excavation and other high noise or vibration activities works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period. Subjective impacts during these phases can be significantly reduced if timelines and potential impacts are known in advance.

Noise Control Audits

It is recommended that noise control audits be conducted at regular intervals throughout the demolition/construction programme. In the first instance, it is recommended that such audits take place on a monthly basis. This is subject to review, however, and the frequency of audits may be increased if deemed necessary.

The purpose of the audits will be to ensure that all appropriate steps are being taken to control construction noise emissions. To this end, consideration should be given to issues such as the following (note that this list is not intended to be exhaustive): -

- Hours of operation being correctly observed.
- Opportunities for noise control “at source”.
- Optimum siting of plant items.
- Plant items being left to run unnecessarily.
- Correct use of proprietary noise control measures.
- Materials handling.
- Poor maintenance.
- Correct use of screening provided and opportunities for provision of additional screening.

Piling

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

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

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

It should be remembered that a decision regarding the type of pile to be used on a site will normally be governed by such criteria as loads to be carried, strata to be penetrated and the economics of the system, for example the time it will take to complete the installation and other associated operations such as soil removal. It may not be possible for technical reasons to replace a noisy process by one of the 'quieter piling' alternatives. Even if it is possible, the adoption of a quieter method may prolong the piling operation; the net result being that the overall disturbance to the community will not necessarily be reduced.

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

Noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover.

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

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

All mechanical plant should be well maintained throughout the duration of the piling works. When a site is in a residential environment, lorries should not arrive at or depart from the site at times incontinent to residents.

Metro Enabling Works

As discussed in previous sections, a 4m tall hoarding will be required at the north west site boundary in the vicinity of O'Rahilly Parade and the Jury's Inn hotel. Localised screening is required around breakers and static plant items.

11.6.1.1.2 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.
- Appropriate vibration isolation shall be applied to plant, where feasible.
- Monitoring will be undertaken at identified sensitive buildings, where proposed works have the potential to be at or exceed the vibration limit values.

11.6.1.2 Operational Stage

Mitigation measures for the operational phase are set out to ensure that operational noise sources associated with the Dublin Central Masterplan will operate within the relevant noise criteria so that there is no resultant negative impact on nearby noise sensitive receivers.

11.6.1.2.1 Noise Mitigation Measures

Mechanical Plant Noise

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.
- All mechanical plant items e.g. fans, pumps etc. shall be regularly maintained to ensure that excessive noise generated 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.
- Installed plant will have no tonal or impulsive characteristics when in operation.

Inward Noise Impact

Inward noise impacts across the development are assessed and appropriate mitigation specified across the Dublin Central Masterplan to ensure that, when window are closed that the internal noise level targets are achieved.

Assessment of Site 1 will follow the methodology set out in this document once the design is finalised. Measured noise levels across the development will be used to assess the levels of noise intrusion and to ascertain the need for appropriate mitigation.

11.6.2 Proposed Development – Site 2

11.6.2.1 Construction Stage

The mitigation measures outlined in Section 11.6.1.1 for general, above-ground construction works associated with the Masterplan construction stage are also applicable for the Proposed Development. These mitigation measures should be read in tandem with the specific noise mitigation measures in line with the DCC GPG for high risk sites, as presented in Appendix 11.2.

Regarding below-ground construction associated with Site 2 and the MEW, the assessment has concluded that the following should be implemented: -

- 4m site hoarding in the north west sector of the Proposed Development site.
- Localised screening around breakers and static plant.

11.6.2.2 Operational Stage

Mechanical Plant Noise

The mitigation measures outlined in Section 12.6.1.2 are also applicable to the Proposed Development.

Inward Noise Impact

In the context of the Proposed Development, the facades highlighted in Figure 11:15 and Figure 11:16 will be provided with glazing that achieves the minimum sound insulation performance as set out in Table 11.34.

The specification applies only to office spaces on the facades indicated. Retail and food & beverage units along these facades do not have a sound insulation requirement. Other facades in the development have no minimum requirement for sound insulation.

The overall R_w values outlined in this section are provided for information purposes only. The overriding requirement is the Octave Band sound insulation performance values which may also be achieved using alternative glazing configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 11.42.

Site	Façade	Glazing Octave Band Centre Frequency (Hz)						
		125	250	500	1000	2000	4000	R_w
Site 2	RED	19	27	34	39	35	40	35
	ORANGE	20	22	27	32	32	37	30

Table 11.42: Glazing Specification

Façade specifications are marked up in Figure 11:15 and Figure 11:16 below.

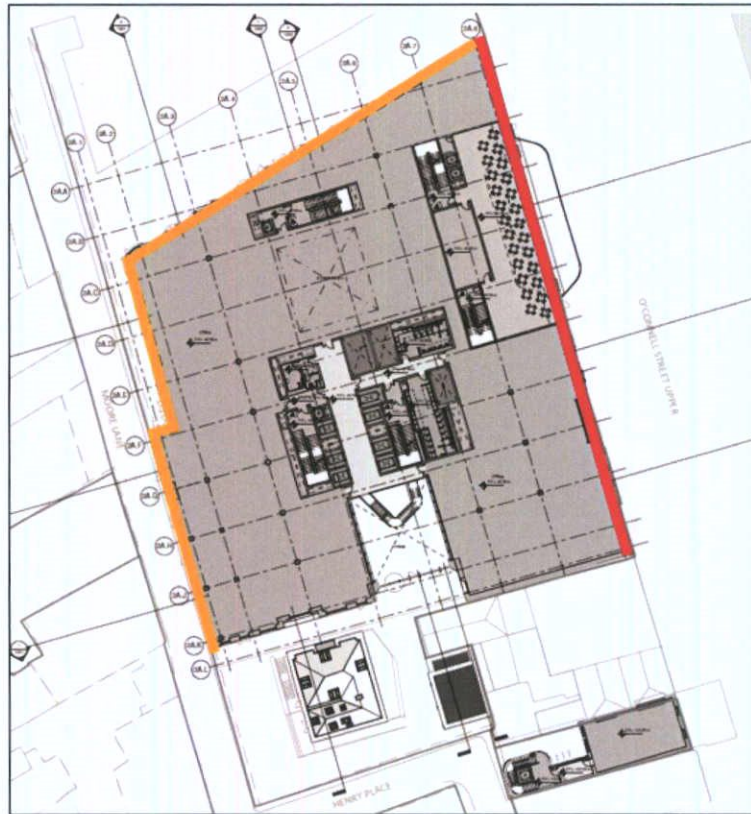


Figure 11:15: Glazing Requirement – Site 2AB.

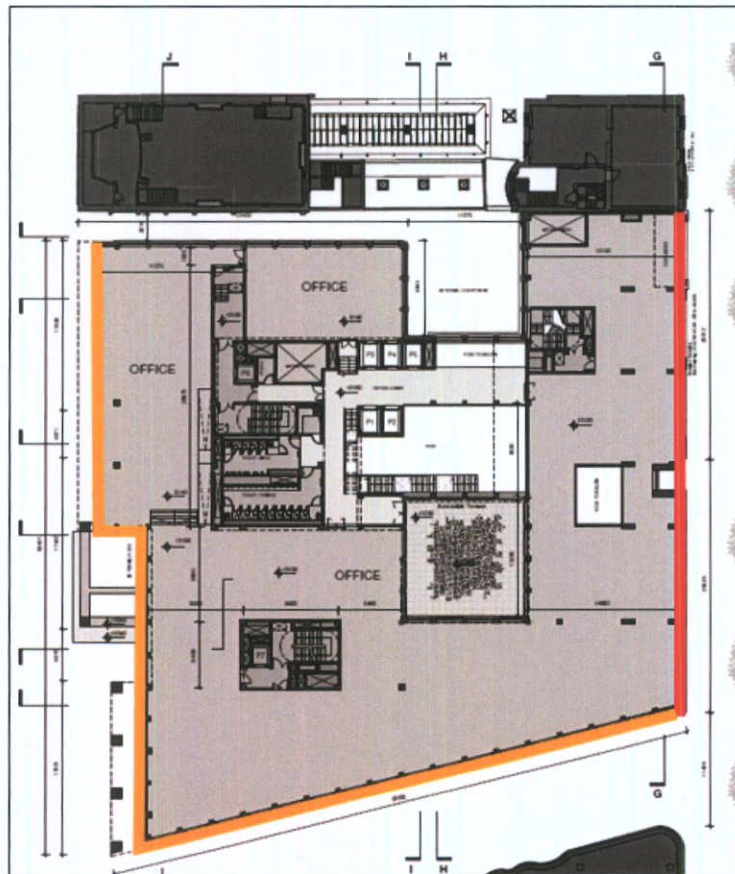


Figure 11:16: Glazing Requirement – Site 2C.

11.6.3 Proposed Development – 61 O'Connell Street

11.6.3.1 Construction Stage

The mitigation measures outlined in Section 11.6.1.1 for the construction stage are also applicable for the Proposed Development. These mitigation measures should be read in tandem with the specific noise mitigation measures in line with the DCC GPG for high risk sites, as presented in Appendix 11.2.

11.6.3.2 Operational Stage

Mechanical Plant Noise

The mitigation measures outlined in Section 12.6.1.2 are also applicable to the Proposed Development.

Inward Noise Impact

Facades marked up in Figure 11:17 will be provided with glazing and ventilators that achieves the minimum sound insulation performance as set out in Table 11.43.

Site	Façade	Glazing Octave Band Centre Frequency (Hz)						Ventilator	
		125	250	500	1000	2000	4000	R _w	D _{n,e,w}
61 O'Connell Street	RED	21	29	36	41	37	42	38	39

Table 11.43: Glazing Specification

The overall R_w and D_{ne,w} outlined in this section are provided for information purposes only. The overriding requirement is the Octave Band sound insulation performance values which may also be achieved using alternative glazing and ventilation configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 11.43.

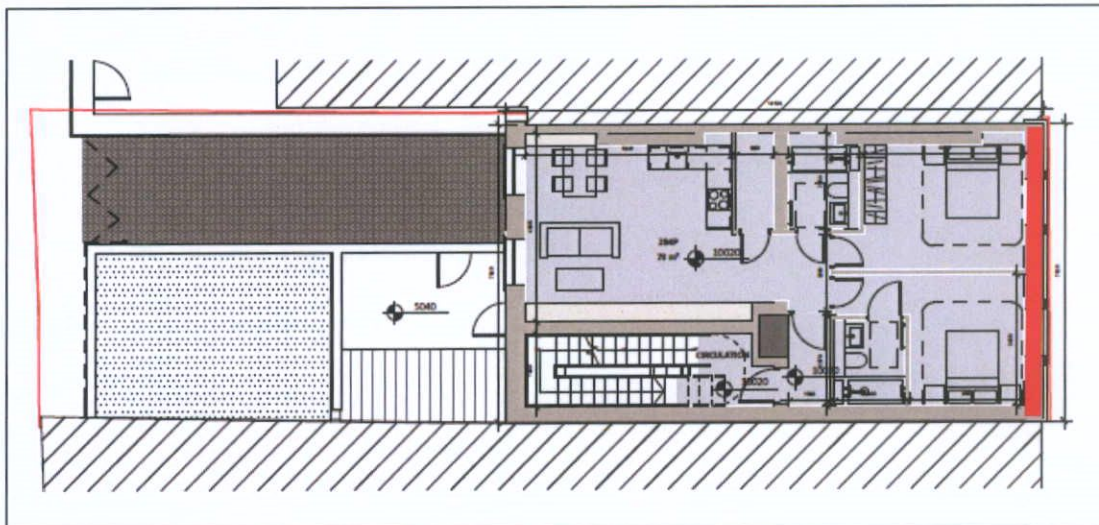


Figure 11:17: Glazing Requirement – 61 O'Connell Street

11.7 RESIDUAL IMPACT

11.7.1 Dublin Central Masterplan

11.7.1.1 Construction Stage

11.7.1.1.1 Noise

All cumulative Dublin Central Masterplan construction activities are predicted to exceed the noise threshold value when they occur at the closest proximity to the residential, commercial and clinical receptors closest to the proposed site boundary. However, it should be noted that the assessment can be considered highly worst case and it is unlikely that all items of plant assessed will be in operational simultaneously, or that two adjoining sites of the development will be under construction simultaneously. Additionally, the predictions only indicate a potential significant effect (based on a worst-case scenario) when working at the closest location to the dwellings, with lesser impacts predicted at all other locations across site.

The implementation of the mitigation measures outlined in Section 11.6.1.1.1, and detailed in Appendix 11.2, will aim to minimise impact of construction noise experienced at nearby residential, commercial and clinical receivers.

Due to the nature of construction noise and the proximity of noise sensitive receivers, it is predicted the residual construction noise levels will be at or above the relevant noise criteria while works are within 15m of commercial receptors and less than 20m of residential receptors during initial site works. There will be a **negative, moderate to significant** and **short-term** residual noise impact during the initial site works activities at commercial and residential receptors within 10m and 15m respectively.

As the initial construction works move greater than 15m and 20m from commercial and residential receptors respectively, the predicted residual noise levels are at or below the relevant noise criteria but above the existing baseline noise levels, there will be a **negative, slight to moderate** and **short-term** noise impact. As the works move further away than 30m, the predicted noise levels are below the relevant noise criteria and existing baseline noise levels there will be a **neutral, not significant** and **short-term** noise impact.

All commercial receptors are predicted to have residual construction noise levels below the relevant noise criteria during utilities and structural construction works. The closest residential receptors are at 15m distance, which have residual noise levels below the relevant noise criteria during works but above the existing baseline noise level. There will be a **negative, slight to moderate** and **short-term** residual noise impact during the utilities and structural construction works at the commercial and residential receptors within 15m. As the works move further away than 20m from commercial and residential receptors, the predicted residual noise levels are below the relevant noise criteria and existing baseline noise levels there will be a **neutral, not significant** and **short-term** noise impact.

All commercial and residential receptors are predicted to have residual construction noise levels below the relevant noise criteria during general construction work activities and below the existing baseline noise levels. At all commercial and residential receptors there will be a **neutral, not significant** and **short-term** impact during general construction work activities.

The closest clinical receptor is at 20m distance with an existing baseline noise level above 70 dB $L_{Aeq,T}$, therefore there will be a **neutral, not significant** and **short-term** residual noise impact during all works activities at closest boundaries to the clinical receptors.

11.7.1.1.2 Vibration

No predicted significant adverse impact arising from vibration during construction provided works are carried out so as to fall under the relevant vibration criteria.