

- Site Preparation & Demolition.
- Façade Demolition.
- Secant Piled Wall.
- Basement Excavation.
- Retaining Wall.
- Piling & Basement Foundation Slab Construction.
- Super-Structure Construction.
- General Construction.

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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**

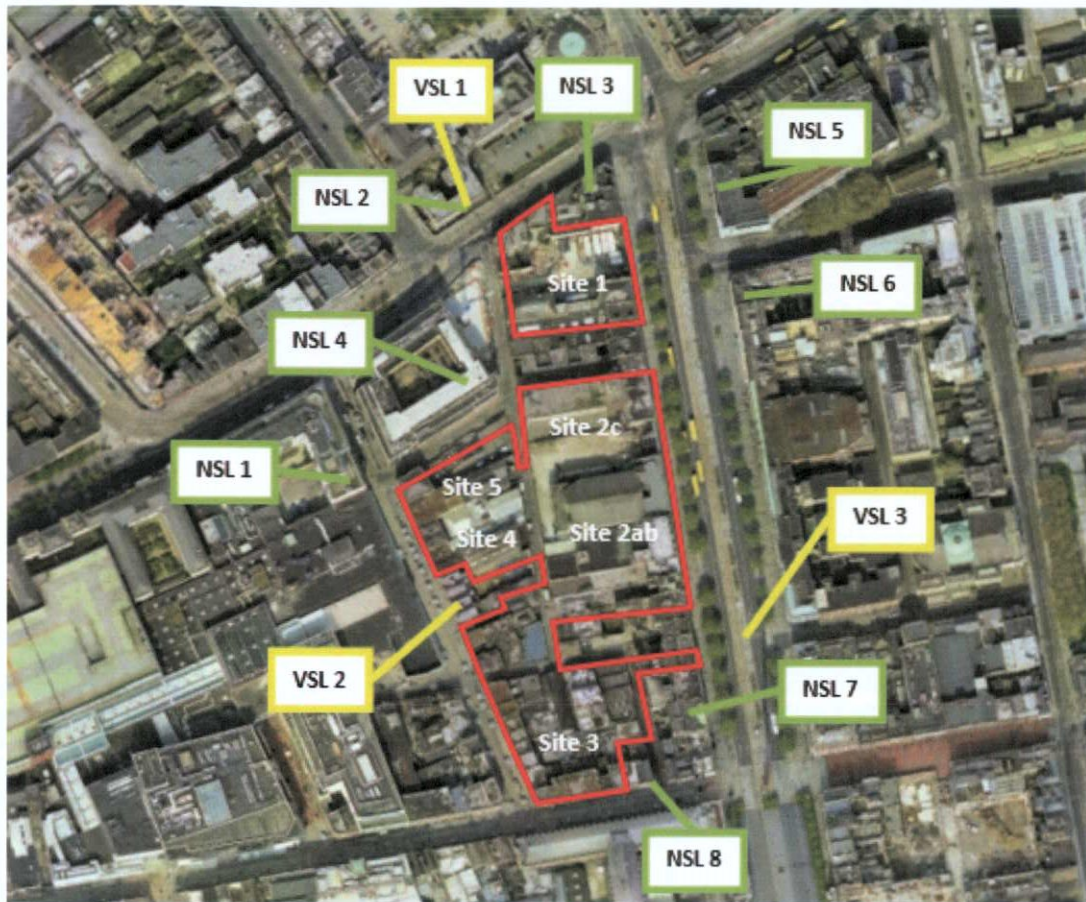
Noise and vibration impacts will be assessed to the nearest sensitive locations to the Dublin Central Masterplan site boundaries i.e. a worst-case assessment of the closest sensitive locations during any

of the construction stages of the five sites. These closest locations are identified in



Figure 11.11.

- 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 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 5 southern boundary.
- Office spaces in Site 2AB, located approximately 10m from Site 2C southern boundary.
- Office spaces in Site 2C, located approximately 10m from Site 5 eastern boundary.

**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.

DCC PLAN NO. 2861/21  
RECEIVED: 01/06/2021Indicative 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%<sup>10</sup> 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 LAeq at 10 m	Cumulative Predicted Construction Noise Level at a Specific Distance with plant operating at 66% On-Time (dB LAeq,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).

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, 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.

<sup>10</sup> 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.

*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  $L_{Aeq}$ ).

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*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.

### Comment on Cumulative Assessment of Site 2AB, Site 2C & MetroLink Station

The final nature and extent of the below ground works required to facilitate the development of the MetroLink Station under Site 2AB and Site 2C is subject to on-going discussions with TII. As a result, for all Dublin Central Masterplan construction impact assessments it has been assumed that the MetroLink Station construction and associated construction activities would not give rise to noise levels in excess of those discussed in the section above. The full assessment of Site 2AB and Site 2C and the cumulative impact of the development of the MetroLink Station by TII will be assessed fully as part of a subsequent planning application.

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

### **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 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 (5m), 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

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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 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. Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in the Table. 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, 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". **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

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 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 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 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.

#### Clinical Buildings

Due to the MetroLink Station works there may be additional limits set for clinical receptors. The full assessment of Site 2C and the cumulative impact of the development of the MetroLink Station by TII will be assessed fully as part of a subsequent planning application.

#### 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 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 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 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 +10dB 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 +5dB 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 11.26 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)
		$L_{Aeq,16hr}$	$L_{Aeq,8hr}$
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 11.26 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 L <sub>A10</sub> )	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 - Residential Inward Noise Impact

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

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

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

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk



based on the pre-existing noise environment. Figure 11.2 presents the basis of the initial noise risk assessment; it provides appropriate risk categories for a range of continuous noise levels either measured and / or predicted on site.

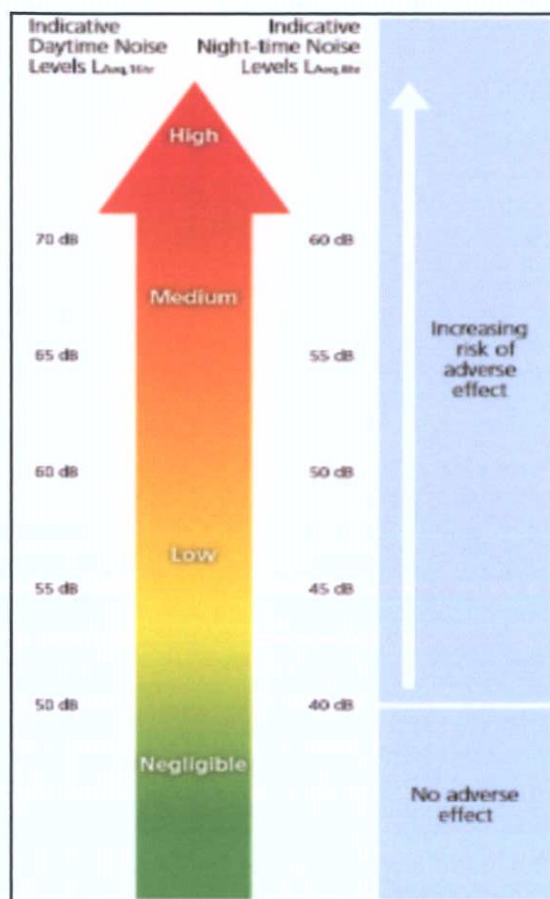


Figure 11.12: ProPG Stage 1 - Initial Noise Risk Assessment.

It should be noted that a site should not be considered a negligible risk if more than 10 no.  $L_{AFMax}$  events exceed 60 dB during the night period and the site should be considered a high risk if the  $L_{AFMax}$  events exceed 80 dB more than 20 times a night.

Element 2 of the ProPG document sets out recommended 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 above and are based on annual average data, that is to say, they omit occasional events where higher intermittent noisy events may occur.

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

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

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

#### 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.

#### 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 3, 4 & 5

#### 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 Sites 3, 4 and 5 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.

#### 11.5.2.2 Noise Impact at Proposed Development – Site 3, 4 & 5

The potential construction activities detailed in Section 11.5.1.1.2 are also applicable to the proposed Sites 3, 4 and 5. The indicative noise calculations presented in Table 11.22 are considered valid for works occurring on Site 3, 4 and 5 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.

##### 11.5.2.2.1 Sensitive Receptors

Noise and vibration impacts will be assessed to the nearest sensitive locations to the Proposed Development Site 3, 4 and 5 boundaries. These closest locations are identified in Figure 11.13.

- NSL1 Residential apartments on Moore Lane located approximately 15m to the west of the Site 5 boundary.
- NSL 2 The Rotunda Hospital on Parnell Street located approximately 100m to the north of the Site 5 boundary.
- NSL 3 AIB Bank offices on O'Connell Street / Parnell Street located approximately 90m to the northeast of the Site 5 boundary.
- NSL 4 Hotel rooms located in Jurys Inn Hotel Parnell Street, located approximately 10m to the north of the Site 5 boundary.
- NSL 5 Hotel rooms located in Holiday Inn Express on O'Connell Street Upper, located approximately 140m to northeast of the Site 5 boundary.
- NSL 6 Hotel rooms located in Gresham Hotel on O'Connell Street Upper, located approximately 115m to east of the Site 5 boundary.
- 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 100m to the north of the Site 5 boundary.
- VSL 2 Protected buildings at 14 to 17 Moore Street, located directly adjacent to the Site 4 boundary.
- VSL 3 The Luas Line rail tracks located on O'Connell Street, located approximately 50m to the east of the Site 3 boundary.



**Figure 11.13:** Proposed Development Sites 3, 4 & 5 Redline Boundary, Dublin Central Masterplan Blue Line Boundary, with Noise (Green) and Vibration (Yellow) Sensitive Locations (Image Source: Google Earth).

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

- Hotel rooms in Site 3 Block A, located approximately 15m from Site 4 southern boundary.
- Residential apartments in Site 3 Block B, located approximately 10m from Site 4 southern boundary.

#### 11.5.2.2.2 Construction Noise Activities of Proposed Development Site 3, 4 & 5

##### **Comment on Proposed Development 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 within 20m from the east and southeast of Site 3 boundary and north of the Site 5 boundary 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 greater than 20m 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 30m), with the presence of existing buildings and distance attenuation, the construction threshold value for residential receivers are likely to be achieved during the various stages of works. For the closest residential properties 15m west of the Site 5 boundary, 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 5 are at 100m distance to the north of the Proposed Development boundary and therefore the clinical receptor is significantly 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 Proposed Development Utilities and Structural Works**

During utilities and structural works etc. with combined site works up to 85 dB  $L_{Aeq}$  at 10 m, 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 within 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 Site 5 Proposed 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 15m 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 significantly 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 utilities and structural works at the east and southeast of Site 3 boundary and north of the Site 5 boundary.

#### **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) at commercial receivers is likely to be complied with at the closest Proposed Development site boundaries and beyond.

For the closest residential properties, calculated noise levels during this stage are below the construction noise threshold value and within 3 dB of the measured ambient baseline environment in the area (65 dB  $L_{Aeq}$ ).

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 Proposed Development**

During all activities with the exception of the general construction works, the commercial receivers (in Site 3) within the Proposed Development 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 20m of the immediate site boundaries to the south of Site 4, would exceed the recommended construction threshold value. At distances beyond 20m of the immediate site boundary noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Site 3 commercial receptors during the initial site works at Site 4 southern boundary.

During utilities and structural works, at distances within 15m of the immediate site boundaries to the south of Site 4 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 Site 3 commercial receptors during the utilities and structural works Site 4 southern boundary.

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 at Site 4 southern boundary.

#### **Comment on Residential NSLs within the Proposed Development**

During all activities the residential receivers (in Sites 3) within the Proposed Development 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 up to 30 m of the immediate site boundaries to the south of Site 4 would exceed the recommended construction threshold value. At distances beyond 30m of the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Site 3 commercial receptors during the initial site works at Site 4 southern boundary.

During utilities and structural works, at distances up to 15m of the immediate site boundaries to the south of Site 4 would exceed the recommended construction threshold value. At distances greater

than 15m and beyond the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value is likely to be achieved at the Site 3 commercial receptors during the utilities and structural works at Site 4 southern boundary.

During general site works, at distances within 10m of the immediate site boundaries to the south of Site 4 would exceed the recommended construction threshold value. At distances beyond 10m of the immediate site boundaries noted above, with distance attenuation, the construction noise threshold value will be achieved at the Site 3 commercial receptors during the general construction works at Site 4 southern boundary.

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 Site 4.

#### Comment on Cumulative Assessment of Site 2AB and Site 2C Metro Box

The final nature and extent of the below ground works required to facilitate the development of the MetroLink Station in Site 2AB and Site 2C is subject to on-going discussions with TII. As a result, for all Dublin Central Masterplan construction impact assessments it has been assumed that the MetroLink Box Station construction and associated construction activities would not give rise to noise levels in excess of those discussed in the section above.

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 **negligible, not significant** and **short-term**.

#### 11.5.2.3 Vibration Impact at Proposed Development Site 3, 4 & 5

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 3, 4 and 5 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 and entertainment noise, e.g. music / hospitality noise. There are no car parking spaces provided within the Proposed Development therefore there is not predicted to be an increase in private vehicles on public roads travelling to and from the development.

In this regard, the design and selection of mechanical plant items will be done so as to ensure noise criteria values are not exceeded. Similarly, for entertainment noise, music levels will be managed and building envelopes designed to ensure no negative impact as a result of breakout noise.

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

#### 11.5.2.5 Noise Impact at Proposed Development Site 3, 4 & 5

The anticipated operational activities set out in Section 11.5.1.1.2 are also applicable to the proposed Sites 3, 4 and 5. The methodology presented for the Dublin Central Masterplan site are also applicable to Site 3, 4 and 5 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 3, 4 and 5 are described above and illustrated in Figure 11.13. It is noted that commercial, non-hotel NSLs 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 Lane located approximately 15m to the west of the Site 5 boundary.
- Hotel rooms located in Jurys Inn Hotel Parnell Street, located approximately 10m to the north of the Site 5 boundary.
- Hotel rooms located in Lynams Hotel on Henry Place, located approximately 10m to the east of the Site 3 boundary.
- Commercial properties located on Henry Street, located directly adjacent to the southeast of Site 3 boundary.

##### 11.5.2.5.2 Operational Noise Associated with Proposed Development – Site 3, 4 & 5

###### Mechanical Plant Noise

Once operational, building services plant items will be required to serve the commercial and residential aspect of the development. 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.

Receptor Group	Day, dB L <sub>Aeq,1hr</sub>	Night, dB L <sub>Aeq,15min</sub>
Group A	55	47 – 49
Group B	55	42

Table 11.31: Proposed Noise Criteria for Plant Noise



Figure 11.14: Plant Noise Criteria.

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 and AHUs 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 assess the potential entertainment noise impact against typical assessment methods for music noise nuisance.

Potential sources for entertainment noise include the hotel bar and restaurant, residential communal amenity spaces, retail units and convention / display spaces.

The best practice approach in terms of limiting music noise emissions typically involves the concept of inaudibility of noise from music at nearby noise sensitive locations. This is in-line with the previously discussed Draft IOA Code of Practice Guide on the Control of Noise from Pubs and Clubs (November 1999): -

*“When the  $L_{Aeq}$  level measured over 5 minutes, when measured in a habitable room, garden or open space at a time when an outside area would be expected to be used, when entertainment is taking place at the Proposed Development, shall show no increase when compared with the representative  $L_{Aeq,5min}$  level measured from the same position, under the same conditions during a comparable period with no entertainment taking place.”*

Where necessary, consideration should be given to controlling noise emissions emanating from bars, conference spaces and restaurant within the Proposed Development. The entertainment sound shall be so controlled that its level at any adjacent noise sensitive location shall not cause the ambient (measured in the absence of said entertainment sound) to increase, when assessed over 5 minute back to back periods. Similar criteria shall apply to the 63Hz and 125Hz octave band levels.

Taking into account that sensitive receivers within the development are much closer than off-site sensitive receivers, once the relevant noise criteria is achieved within the development it is expected that there will be no negative impact at sensitive receivers off site.

### 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 Sweco<sup>11</sup> 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 3A	5	2	7
Site 3B	9	3	12
Site 4 (N)	1	1	2
Site 4 (S)	5	2	7
Site 5	8	3	11

**Table 11.32:** 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

<sup>11</sup> Dublin Central – Site 3 Servicing Management Plan – Revision 3.0  
Dublin Central – Site 4 Servicing Management Plan – Revision 2.0  
Dublin Central – Site 5 Servicing Management Plan – Revision 2.0

at several locations across the development depending on the destination. Designated loading areas include: -

- Existing loading areas on Henry Street.
- Proposed Passageway loading area.
- Proposed Phase 3B Courtyard.
- Existing shared loading area on Moore Street.

Considering the large numbers of vehicles currently using the public roads surrounding the Proposed Development, the addition of an average of 8no. 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.

### 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.

With reference to the Noise Risk Assessment outlined in ProPG the noise levels for relevant periods have been derived in order to classify the Proposed Development site. 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 <sub>Aeq,T</sub> )	"Noise Risk" Category
Site 3	Southern Façade – Henry Street	Daytime	65 – 67	Medium
		Night-time	52 – 54	Low – Medium
	Western Façade – Moore Street	Daytime	62 – 64	Low – Medium
		Night-time	49 – 53	Low – Medium
	Northern / Eastern Facades – Henry Place	Daytime	60 – 62	Low – Medium
		Night-time	49 – 51	Low – Medium
Site 4	Western Façade – Moore Street	Daytime	64 – 69	Medium
		Night-time	51 – 54	Low – Medium
	Southern Facades – Henry Place	Daytime	60 – 62	Low – Medium
		Night-time	49 – 51	Low – Medium
	Eastern Façade – Moore Lane	Daytime	59 – 61	Low – Medium
		Night-time	53 – 56	Low – Medium
Site 5	O’Rahilly Parade – Northern Façade	Daytime	59 – 61	Low – Medium
		Night-time	53 – 56	Low – Medium
	Western Façade – Moore Street	Daytime	64 – 69	Medium – High
		Night-time	51 – 54	Low – Medium
	Eastern Façade – Moore Lane	Daytime	59 – 61	Low – Medium
		Night-time	N/A	N/A
	Southern Façade – Proposed Courtyard	Daytime	58 – 59	Low
		Night-time	N/A	N/A

**Note** Commercial units in Site 5 not designated noise sensitive outside of office hours.

**Table 11.33:** Categorising Proposed Site.

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the  $L_{AFmax}$  noise levels. Review of the numbers of  $L_{AFmax}$  levels show the number of instances is below the 80dB threshold, therefore the High Risk classification is not triggered.  $L_{AFmax}$  levels typically do not exceed 70 dB  $L_{Amax}$  over a given night time period. Individual events above this level were also measured but did only occur once or twice per night.

ProPG states the following with respect to *Low, Medium and High Risk* categories: -

<i>Low Risk</i>	<i>At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.</i>
<i>Medium Risk</i>	<i>As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.</i>
<i>High Risk</i>	<i>High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.</i>

Given the above it can be concluded that the development site may be categorised as *Low to High Risk* and as such an Acoustic Design Statement will be required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impact will be avoided in the final development.

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

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

The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

### Acoustic Design Statement – Part 1

#### *Façade Noise Levels*

Noise levels have been predicted across the Proposed Development site during day and night-time periods.

Where façade noise levels are less than 55 dB  $L_{Aeq,16hr}$  during the day and 50 dB  $L_{Aeq,8hr}$  at night it is possible to achieve reasonable internal noise levels while also allowing for supplementary ventilation of dwellings by opening windows. Therefore, for those units where the façade noise levels are less than 55 dB  $L_{Aeq,16hr}$  during the day and 50 dB  $L_{Aeq,8hr}$  at night no further mitigation is required, e.g.

Façade levels are above the levels whereby it is possible to achieve reasonable internal noise levels while also allowing for supplementary ventilation of dwellings by opening windows, therefore the

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

Predicted noise levels on several facades are above a level whereby internal noise levels are achieved with standard double glazing and therefore mitigation in the form of enhanced glazing and ventilators will be required. These facades are located along the western and southern boundaries. The specification of this enhanced façade is discussed in Section 11.7.2.

#### *External Noise Levels*

External noise levels within communal open space across the development site are predicted to be within the recommended range of noise levels from ProPG of between 50 – 55 dB  $L_{Aeq,16hr}$ . The position of existing buildings allows for screening of noise from transport noise sources in areas close to the main road and rail line. The location of the amenity space at 6<sup>th</sup> Floor Level creates distance separation from noise sources at ground level. It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site, therefore no further mitigation is required to control external noise levels across amenity areas.

### **11.5.3 Cumulative**

#### **11.5.3.1 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.

#### **11.5.3.2 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 Proposed 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/m<sup>2</sup> 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.

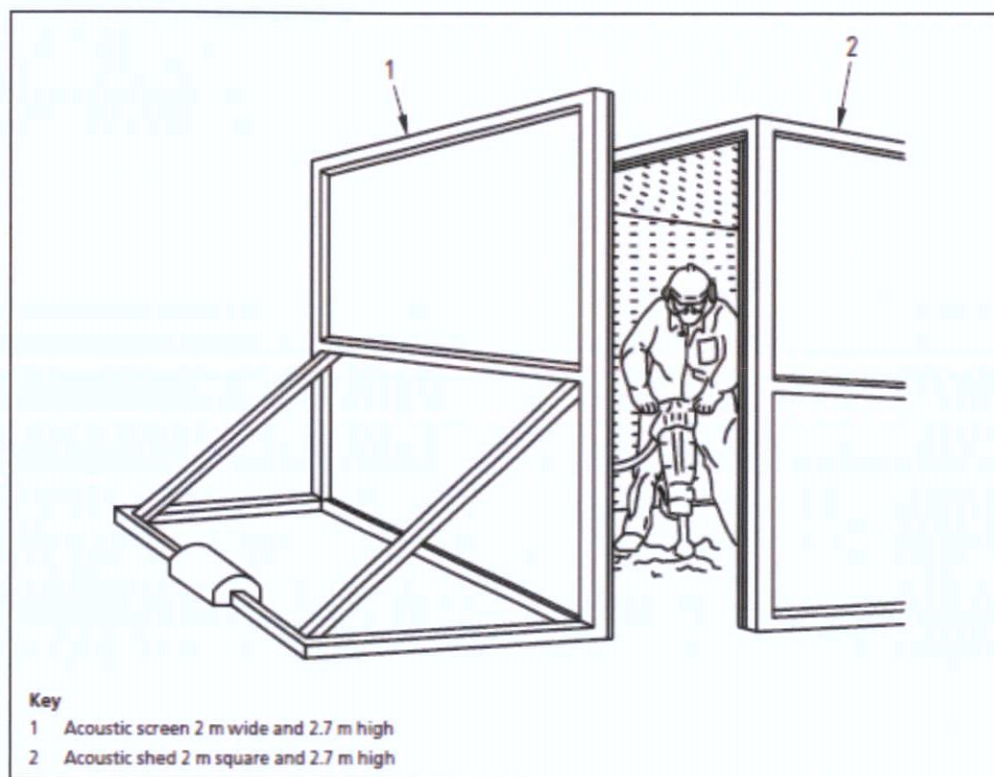


Table B.4 Measured sound reduction given by types of partial enclosure

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 11.15: 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.

#### 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 and Site 2AB and Site 2C 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 3, 4 & 5

### 11.6.2.1 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.

### 11.6.2.2 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 11.16 will be provided with glazing and ventilators that achieves the minimum sound insulation performance as set out in Table 11.34.

The specification applies only to residential units, hotel rooms and office space 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  $R_w$  and  $D_{n,e,w}$  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 11.34.

Site	Façade	Glazing Octave Band Centre Frequency (Hz)						Ventilator	
		125	250	500	1000	2000	4000	$R_w$	$D_{n,e,w}$
Site 3	Henry St (RED)	26	27	34	40	38	46	37	39
	Moore St. / Henry Pl (ORANGE)	19	27	34	39	35	40	35	36
Site 4	Moore St (RED)	26	27	34	40	38	46	37	39
	Moore Lane / Henry Place (ORANGE)	19	27	34	39	35	40	35	36
Site 5	Moore St. (RED) Residential	26	27	34	40	38	46	37	39
	All Facades (ORANGE) Office	20	22	27	32	32	37	30	N/A

**Table 11.34:** Calculated Construction Traffic Noise Levels at Edge of Road.

Façade specification are marked up in Figure 11.16 below. Ventilator requirements are 39 dB  $D_{n,e,w}$  and 36 dB  $D_{n,e,w}$  for facades marked up in red and orange respectively.

With respect to the hotel, façade recommendations have been presented here so that the internal noise level requirements set out in BS 8233 are met. It may be the case that the future operator of the hotel will have their own brand standard with associated acoustic considerations that must be achieved. This will be assessed at detailed design stage.

**Error! Reference source not found.:** Glazing and Ventilator Requirement.

## 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.

### 11.7.1.2 Worst Case Impact

In terms of potential noise and vibration impacts, the assessment has considered a range of worst case scenarios to determine the potential impacts of the Proposed Development.

During the construction phase, a range of worst case scenarios have been assessed assuming all plant items are operating along the closest noise sensitive boundaries. The assessment has determined impacts associated with these scenarios can be controlled through the best practice measures outlined in Section 11.6.

### 11.7.1.3 Operational Stage

#### 11.7.1.3.1 Noise

##### Mechanical Plant Noise

Once cumulative plant noise emissions from the various sites of the Dublin Central Masterplan are designed to achieve the appropriate noise criteria the cumulative noise impact will be **neutral, imperceptible** and **permanent**.

##### Entertainment Noise

Once entertainment noise is designed and managed to achieve the criteria set out, i.e. inaudibility, the residual noise impact will be **neutral, imperceptible** and **permanent**.

##### Delivery and Servicing Traffic

Delivery activity has been considered in the context of the existing environment of a serviced, city centre location. The cumulative noise impact will be **neutral, not significant** and **permanent**.

##### Inward Noise Impact

With respect to inward noise impacts, the specification of noise mitigation has been recommended so that the internal noise criterion will be met. The residual noise impact will be **neutral, not significant** and **permanent**.

#### 11.7.1.3.2 Vibration

There are no significant sources of vibration associated with the operational phases of the Dublin Central Masterplan. There is therefore a **neutral, imperceptible** and **permanent** cumulative impact associated.

## 11.7.2 Proposed Development – Site 3, 4 & 5

### 11.7.2.1 Construction Stage

#### 11.7.2.1.1 Noise

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 10m of commercial receptors and 15m 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. When the initial construction works are between 10m to 15m of the commercial receptors the residual noise levels are 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 more than 20m from commercial and residential receptors the predicted residual noise levels are below the relevant noise criteria and below the 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 utilities and structural construction works. At commercial receptors within 10m of the works, the residual construction noise level is predicted above the existing baseline noise level. There will be a **negative, slight to moderate** and **short-term** residual noise impact during works at the commercial receptors within 10m. As the works move further away than 10m from commercial receptors and 15m from the closest residential receptors, the predicted residual noise levels are below the relevant noise criteria and existing baseline noise levels, therefore 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.

#### 11.7.2.1.2 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.

### 11.7.2.2 Operational Stage

#### 11.7.2.2.1 Noise

##### Mechanical Plant Noise

Once cumulative plant noise emissions from the various sites of the Dublin Central Masterplan are designed to achieve the appropriate noise criteria the cumulative noise impact will be **neutral, imperceptible** and **permanent**.

##### Entertainment Noise

Once entertainment noise is designed and managed to achieve the criteria set out, i.e. inaudibility, the residual noise impact will be **neutral, imperceptible** and **permanent**.

##### Delivery and Servicing Traffic

Delivery activity has been considered in the context of the existing environment of a serviced, city centre location. The cumulative noise impact will be **neutral, not significant** and **permanent**.

##### Inward Noise Impact

With respect to inward noise impacts, the specification of noise mitigation has been recommended so that the internal noise criterion will be met. The residual noise impact will be **neutral, not significant** and **permanent**.

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#### 11.7.2.2.2 Vibration

##### Vibration

There are no significant sources of vibration associated with the operational phases of the Dublin Central Masterplan. There is therefore a **neutral, imperceptible** and **permanent** cumulative impact associated.

### 11.7.3 Cumulative

#### 11.7.3.1 Construction Stage

The similar magnitude of residual noise and vibration impacts discussed in Section 11.7.1 for the Dublin Central Masterplan are relevant to the cumulative assessment of construction works external to the proposed site given it is anticipated that the same construction noise and vibration criteria would apply to these external construction sites.

#### 11.7.3.2 Operational Stage

The different sites within the Proposed Development 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 Proposed Development will in turn be designed in order to comply with appropriate noise criteria.

Any major proposed development in close proximity to the Proposed Development will be required to prepare an EIAR wherein cumulative impacts will also be considered.

## 11.8 MONITORING

### 11.8.1 Dublin Central Masterplan

#### 11.8.1.1 Construction Stage

Should the construction noise and vibration risk assessment identify the need for monitoring the following actions are recommended during demolition and construction.

Noise Monitoring Terminals (NMT), number and locations to be agreed, to be installed with the following specifications (or similar approved): -

- Logging of two concurrent periods, e.g. 15-minute & hourly.
- Daily CIC automated calibrations.
- E-mail alert on threshold exceedance.
- E-mail alert on low battery and low memory.;
- Remote access to measured data.
- Live display of noise levels.

Vibration monitoring stations should continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with *BS ISO 4866: 2010: Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures*.

The mounting of the transducer to the vibrating structure will need to comply with *BS ISO 5348: 1998: Mechanical vibration and shock – Mechanical mounting of accelerometers*. In summary, the following ideal mounting conditions apply: -

- The transducer and its mountings should be as rigid as possible.

- The mounting surfaces should be as clean and flat as possible.
- Simple symmetric mountings are best.
- The mass of the mounting should be small in comparison to that of the structure under test.

In addition, it is recommended that spot check noise and vibration measurements are conducted on a monthly basis. These spot checks can be organised to coincide with works that have potential to generate high levels of noise or vibration on site in order to confirm the potential extent of impact.

A monthly noise and vibration monitoring report should be prepared by the contractor. Reports should identify any exceedances above nominal limit values and attempts to clarify the causes etc. Where remedial measures are required and identifiable these should also be clearly stated.

#### **11.8.1.2 Operational Stage**

Noise monitoring is not required as part of the operational phase of the Proposed Dublin Central Masterplan.

### **11.8.2 Proposed Development – Site 3, 4 & 5**

#### **11.8.2.1 Construction Stage**

Should the construction noise and vibration risk assessment undertaken by the contractor identify the need for monitoring the actions listed for the Dublin Central Masterplan site are also applicable to the Proposed Development.

#### **11.8.2.2 Operational Stage**

Noise monitoring is not required as part of the operational phase of the Proposed Development.

## **11.9 REINSTATEMENT**

### **11.9.1 Dublin Central Masterplan**

Reinstatement is not applicable to this chapter.

### **11.9.2 Proposed Development – Site 3, 4 & 5**

Reinstatement is not applicable to this chapter.

## **11.10 DIFFICULTIES ENCOUNTERED**

No difficulties were encountered in the preparation of this chapter.