Chapter 14
Noise and Vibration

CONTENTS

14. NOISE AND VIBRATION

14.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) assesses noise and vibration impacts of the DART+ Coastal North project ("the Proposed Development"), associated with the construction and operation of the Proposed Development.

This chapter should be read in conjunction with the following chapters, and their appendices (where applicable), which present related impacts arising from the Proposed Development and proposed mitigation measures to ameliorate the predicted impacts:

- Chapter 6: Traffic and Transportation;
- Chapter 7: Population;
- Chapter 8: Biodiversity; and
- Chapter 23: Human Health.

This EIAR chapter identifies, describes and assesses the likely direct and indirect significant effects of the Proposed Development associated with construction and operational noise and vibration. The assessment is based on a reasonable worst-case scenario with respect to likely noise and vibration arising from the Proposed Development as described in Chapter 4 (Description of the Proposed Development) and Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The Proposed Development description is based on the design prepared to inform the planning stage of the project and to allow for a robust assessment as part of the Environmental Impact Assessment (EIA) process.

14.2 Legislation, Policy and Guidance

14.2.1 Legislation

The Transport (Railway Infrastructure) Act 2001 (as amended) (the 2001 Act) provides for the making of a Railway Order application by Córas Iompair Éireann (CIÉ) to An Bord Pleanála. The European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 (S.I. No. 743 of 2021) give further effect to the transposition of the EIA Directive (EU Directive 2011/92/EU as amended by Directive 2014/52/EU) on the assessment of the effects of certain public private projects on the environment by amending the Transport (Railway Infrastructure) Act 2001. The 2001 Act as amended (including by Statutory Instrument No. 743/2021) at section 37 requires, inter alia, that the application be made in writing and be accompanied by:

- A draft of the proposed Railway Order;
- A plan of the proposed railway works;
- A book of reference to a plan describing the works which indicates the identity of the owners and of the occupiers of the lands described in the Plan; and
- A report on the likely effects on the environment of the proposed railway works.

The requirement to submit a report of the likely effects on the environment of the proposed railway works is addressed by the preparation of this Environmental Impact Assessment Report (EIAR) (prior to the amendments effected by S.I. No. 743/2021 this was referred to as an Environmental Impact Statement in section 39 of the 2001 Act). As mentioned, this EIAR is based on a coordinated approach in order to facilitate An Bord Pleanála carrying out a coordinated assessment with any assessment under the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992) or the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009).

By virtue of section 38 of the 2001 Act the development the subject matter of a Railway Order is deemed to be 'exempted development' for the purposes of the Planning and Development Act 2000 (the 2000 Act). Furthermore, the provisions of Part IV of the 2000 Act are disapplied where the works involved are authorised by a Railway Order.

An examination, analysis and evaluation is carried out by the Board in order to identify, describe and assess, in the light of each individual case, the direct and indirect significant effects of the proposed railway works, including significant effects derived from the vulnerability of the activity to risks of major accidents and disasters relevant to it, on: population and human health; biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives; land, soil, water, air and climate; material assets, cultural heritage and the landscape, and the interaction between the above factors.

In accordance inter alia with section 39 of the 2001 Act and the provisions of the EIA Directive, CIÉ, as the applicant for this Railway Order, has ensured that the EIAR is prepared by competent experts; contains a description of the proposed railway works comprising information on the site, design, size and other relevant features of the proposed works; contains a description of the likely significant effects of the proposed railway works on the environment; contains the data required to identify and assess the main effects which the proposed railway works are likely to have on the environment; contains a description of any features of the proposed railway works, and of any measures envisaged, to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment; contains a description of the reasonable alternatives studied by the applicant – here CIÉ – which are relevant to the proposed railway works and their specific characteristics, and an indication of the main reasons for the options chosen, taking into account the effects of the railway works on the environment; contains a summary in non-technical language of the above information; takes into account the available results of other relevant assessments under European Union or national legislation with a view to avoiding duplication of assessments; in addition to and by way of explanation or amplification of the specified information referred above, the EIAR contains such additional information specified in Annex IV to the EIA Directive relevant to the specific characteristics of the particular railway works, or type of railway works, proposed and to the environmental features likely to be affected and in this regard Annex IV sets out the information which is referred to in Article 5(1) of the EIA Directive. Further the EIAR includes the information that may reasonably be required for reaching a reasoned conclusion in accordance with section 42B of the 2001 Act on the significant effects of the proposed railway works on the environment, taking into account current knowledge and methods of assessment. This report has been undertaken in accordance with the above legislative and regulatory regime.

In accordance with the aforementioned legal requirements, this report describes and assesses the likely direct and indirect significant effects of the Proposed Development associated with construction and operational noise and vibration.

The key legislation and guidance referenced in the preparation of the EIAR is outlined in Chapter 1 (Introduction) and specific to Noise and Vibration, the following legislation, policy and guidance documents has informed the assessment as also outlined in Sections 14.2.2 to 14.2.3.

14.2.2 Policy

The Proposed Development extends over the administrative areas of four local authorities, namely Dublin City Council, Fingal County Council, Meath County Council and Louth County Council.

Noise Action Plans have been prepared by the local authorities in accordance with Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (the Environmental Noise Directive) and the European Communities (Environmental Noise) Regulations 2018 (S.I. No. 549 of 2018) ("the Environmental Noise Regulations"), which give effect to the Environmental Noise Directive in Irish law. The following have been considered as part of this chapter:

- Dublin Agglomeration. Environmental Noise Action Plan 2018-2023;
- Noise Action Plan for Fingal County 2019-2023;
- County Meath Noise Action Plan 2019; and
- Louth County Council Noise Action Plan 2018-2023.

The Environmental Noise Regulations have since been amended by the European Communities (Environmental Noise) (Amendment) Regulations 2021 (S.I. No. 663 of 2021).

The Noise Action Plans for Round 4 (under the END) noise mapping are due to commence in April 2024, with final noise action plans due to be completed by July 2024.

14.2.3 Guidance

The assessment has been undertaken in line with relevant guidance relating to environmental noise and vibration which are presented in the following sections. In addition to specific noise and vibration guidance documents, the following guidelines were considered in the preparation of this chapter:

- Environmental Protection Agency (EPA) Guidelines on the Information to be contained in Environmental Impact Assessment Reports (the EPA Guidelines) (EPA 2022).

There are no statutory standards in Ireland relating to noise and vibration limit values for construction works or for environmental noise and vibration relating to the operational phase. In the absence of specific statutory Irish guidelines, the assessment has made reference to non-statutory national guidelines, where available, in addition to international standards and guidelines relating to noise and / or vibration impact for environmental sources. These are summarised below:

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (EPA, 2022);
- EPA Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA 2016)

- World Health Organisation (WHO) Environmental Noise Guidelines for the European Region (hereafter referred to as WHO Environmental Noise Guidelines) (WHO 2018);
- World Health Organisation (WHO) Guidelines for Community Noise (WHO 1999).
- ISO 9613: Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation. (ISO 1996);
- ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as ISO 1996 – 1) (ISO 2016);
- ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels (hereafter referred to as ISO 1996 – 2) (ISO 2017);
- Commission Recommendation of 6 August 2003 concerning the guidelines on the revised interim computation methods for industrial noise, aircraft noise, road traffic noise and railway noise, and related emission data;
- Reken- en Meetvoorschrift Railverkeerslawaai (RMR) '96, Ministerie Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 20 November 1996. (Calculation and Measurement requirements for rail transport noise. Dutch Ministry Housing, Spatial Planning and the Environment 1996);
- Transport Infrastructure Ireland (TII) - Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII 2004);
- Transport Infrastructure Ireland (TII) - Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII 2014);
- Design Manual for Roads and Bridges (DMRB). LA 111 Sustainability & Environmental Appraisal. Noise and Vibration (2019);
- The Department of Transport (UK): Calculation of Railway Noise (CRN). (DfT UK 1996);
- The Department of Transport (UK): Calculation of Road Traffic Noise (CRTN) (DfT UK 1988);
- British Standard BS 5228–1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise;
- British Standard BS5228-2: 2009 + A1: 2014: Code of practice for noise and vibration control on construction and open sites – Vibration;
- British Standard BS 6472-1: Guide to Evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting'. (BS 2008);
- British Standard BS7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (BS 1993);
- British Standard BS8233: Guidance on Sound Insulation and Noise Reduction for Buildings – Code of Practice. (BS 2014); and
- British Standard BS4142: Method for Rating and Assessing Industrial and Commercial Sound. (2014+A1:2019).

14.3 Methodology

14.3.1 Study Area

The Proposed Development will modify the current rail network between Dublin City Centre (north of Connolly Station) and Drogheda MacBride Station including the rail line from Howth Junction to Howth (Howth Branch). The total length of the Proposed Development is approximately 50 kilometres.

The majority of proposed works and interventions are expected to be carried out within the existing railway corridor boundary. Some works and interventions, however, will be required outside of the existing railway boundary for project elements such as:

- Bridge modifications/improvements to facilitate extended electrification;
- Construction of substations (to facilitate the provision of power to the line);
- Utility diversions; and
- Use of land for temporary construction/storage compounds.

The zones are described in greater detail in Chapter 4 (Description of the Proposed Development) in Volume 2 of this EIAR, are illustrated in Figure 4-1, and are summarised as follows:

- Zone A - north of Connolly Station to south of Howth Junction & Donaghmede Station;
- Zone B - south of Howth Junction & Donaghmede Station to north of Malahide Viaduct (including Howth Branch);
- Zone C - north of Malahide viaduct to south of Gormanston Station (Fingal border);
- Zone D - south of Gormanston Station (Fingal border) to Louth/Meath border; and
- Zone E - Drogheda MacBride Station and surrounds.

Consistent with the Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, 2004) the assessment is defined as within 300m of new or altered roads or railways. The study area for the construction noise and vibration assessment is defined as the area where significant noise and vibration impacts due to construction activity may occur. Noise and vibration impacts are assessed at the sensitive receptors within this study area.

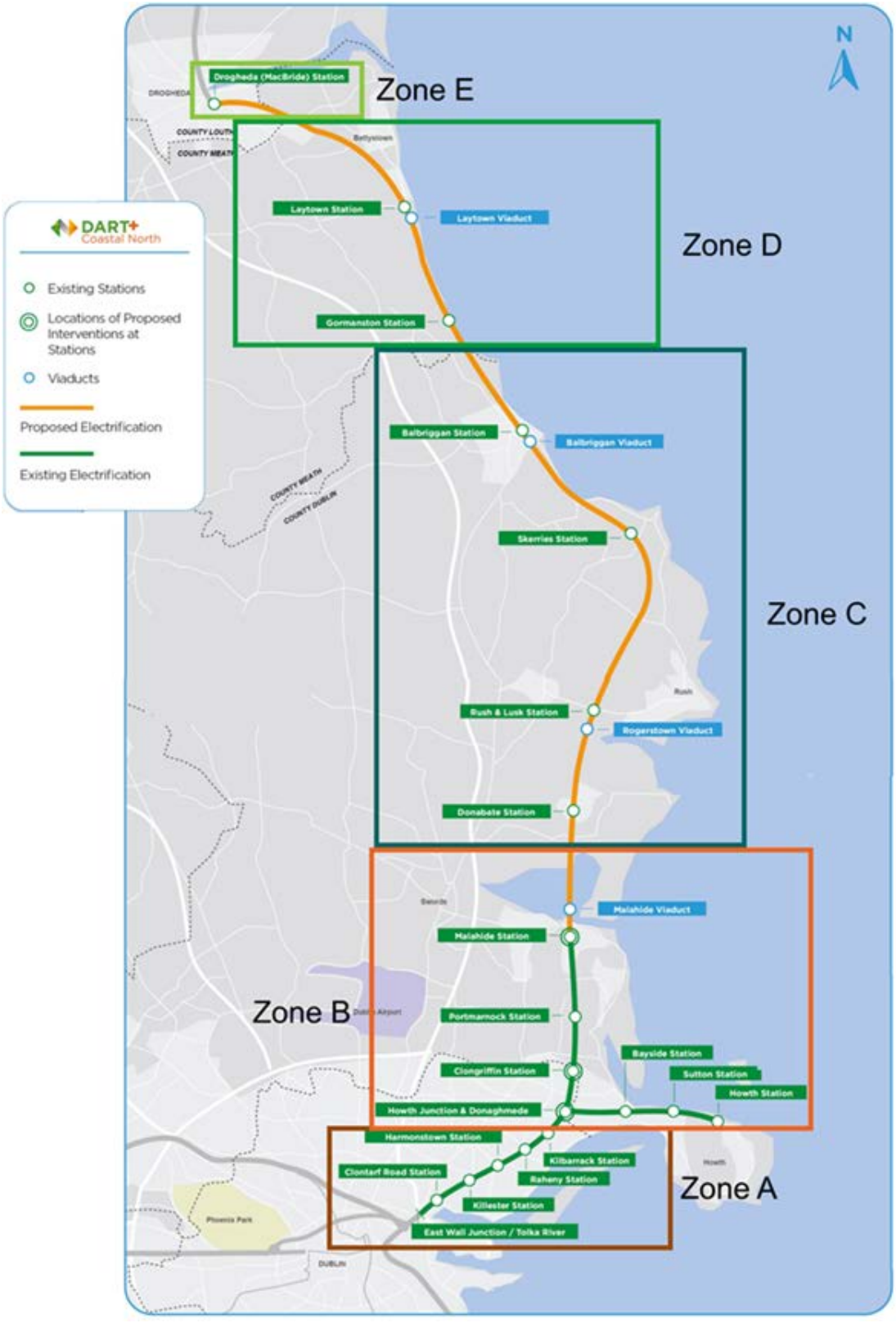

Image 14-1 DART+ Coastal North Geographical Zones

14.3.2 General Assessment Procedure

In order to assess the noise and vibration impact associated with the Proposed Development, the following methodology has been adopted:

- Review of relevant standards and legislation and setting appropriate criteria for noise and vibration, see Sections 14.2 and 14.3.
- Conduct noise and vibration surveys along the length of the study area to determine the existing noise and vibration environment at sensitive locations, see Section 14.4.
- Assess likely noise and vibration effects associated with the Construction Phase, see Section 14.5.1
- Assess likely noise and vibration effects associated with the operational phase, see Section 14.5.2.
- Assess the mitigation measures required to reduce or remove the likely significant effects identified, see Section 14.6.
- Assess residual effects following implementation of mitigation, see Section 14.7.

14.3.3 Sources of information and data

Road traffic flow information has been provided and is informed by surveys undertaken for the traffic impact assessment. Refer to Chapter 6 (Traffic and Transportation) in Volume 2 of this EIAR for more information.

Information related to rolling stock and train operating assumptions has been provided by Iarnród Éireann.

The assessment is also supported by noise and vibration surveys undertaken in 2023 as well as the Round 3 strategic noise maps published by the Environmental Protection Agency as required under the Environmental Noise Directive and the Environmental Noice Regulations.

14.3.4 Operational noise - assessment scenarios

The following scenarios have been considered for the assessment of railway operational noise associated with the Proposed Development.

14.3.4.1 Do Minimum Scenario

The Do Minimum scenario represents the likely future receiving environment where the Proposed Development does not proceed and the sources of noise and vibration and noise sensitive receptors evolve according to current trends. For the Do Minimum scenario, construction activity does not occur.

In advance of the changes that the DART+ Coastal North project will bring in respect of increased capacity and train frequency, Iarnród Éireann plans to purchase Battery Electric Multiple Unit trains (BEMUs). The provision of these BEMUs will allow for the replacement of some existing diesel trains in advance of full electrification. Iarnród Éireann identified the Northern Line as the most suitable route for BEMU deployment, with Drogheda MacBride Station and depot area as the preferred charging location. These BEMU works and the resulting extension of DART services to Drogheda are being delivered under a separate project in advance of the increased service levels and electrification of the line to Drogheda which are to be delivered under the DART+ Coastal North project. Information related to the future mix of rolling stock and train operating assumptions for the Do Minimum scenario is provided by Iarnród Éireann for the purposes of assessment.

The environmental noise and vibration survey and strategic noise maps are considered to be representative of the baseline.

14.3.4.2 Do Something Scenario

The Do-Something scenario represents the situation where the Proposed Development proceeds and the sources of noise and vibration and noise and vibration sensitive receptors evolve according to current trends with the presence of the new development. The Proposed Development will provide an extended electrified rail network to allow for increased passenger capacity and an enhanced train service between Dublin City Centre and Drogheda, including the Howth Branch. This increased rail capacity will be achieved by implementing an extended electrified railway network with high-capacity DART trains and an increased frequency of rail services. The Proposed Development requires track modifications including the provision of turnback facilities at Malahide, Clongriffin and Howth Junction & Donaghmede Stations. The project will also deliver the infrastructure at Howth Junction and Donaghmede Station that will enable the operation of a direct through service to and from Howth to Dublin City Centre together with a DART shuttle service on the Howth Branch Line as required. Further details on the Proposed Development are presented in Chapter 4 (Description of the Proposed Development) in Volume 2 of this EIAR.

14.3.5 Construction noise assessment methodology

The construction noise assessment has been undertaken with reference to BS 5228. This standard includes recommended methodologies for calculating construction noise levels and includes a range of best practice mitigation and management measures for the control of noise and vibration from construction sites.

In terms of calculation, this standard sets out sound power levels for a wide range of plant items encountered on construction sites, which in turn enables the prediction of indicative noise levels at distances from the works. The standard also includes empirical data on vibration levels measured at set distances from specific vibration generating activities in different ground and site conditions as well as a prediction methodology.

Façade noise levels have been predicted in the vicinity of each of the construction work areas for the key phases of work representative of the likely worst-case scenarios associated with each. The assessments have been undertaken based on proposed plant and vehicles, site layouts, proposed works phasing, durations and operational hours.

Construction noise levels are calculated taking into account a range of factors affecting the propagation of sound, including:

- The distance between the source and receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces; and
- The hardness of the ground between the source and receiver.

Noise levels have been assessed over the daytime (07:00 to 19:00hrs), evening (19:00 to 23:00hrs) and night-time (23:00hrs to 07:00hrs) periods as relevant for the construction works in accordance with the proposed construction working hours for the Proposed Development as outlined in Chapter 5 (Construction Strategy) in Volume 2 of the EIAR.

14.3.5.1 Construction traffic noise assessment methodology

An assessment has been made of the impact of construction vehicles on the surrounding road network serving the Construction Compounds. Given that roads where construction traffic will travel are part of the existing road network which already carries traffic volumes, it is appropriate to consider the change in traffic noise level that will arise as a result of changes in traffic flow in terms of volume and fleet mix. This also applies to roads where any traffic is redistributed onto. The key consideration in terms of the assessment therefore relates to the change in traffic noise levels and the related impact/effect associated with the same.

Road traffic noise levels have been calculated with reference to methodology within Calculation of Road Traffic Noise (CRTN) (UK Department of Transport, 1998), which gives methods to calculate traffic noise based on the 18-hour AADT (Average Annual Daily Traffic).

The magnitude of the noise impact due to changes in road traffic noise levels during the Construction Phase is assessed with reference to criteria outlined in the Design Manual for Roads and Bridges (DMRB) Noise and Vibration (UKHA 2020), as outlined in Table 14-1.

Table 14-1 Classification of Magnitude of Noise Impacts in the Short Term (DMRB Noise and Vibration)

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

It is generally accepted that changes in noise levels of 1 dBA or less are imperceptible, and changes of 3 dBA are perceptible to the average human ear for comparable noise sources outside of a controlled laboratory environment. Consequently, the onset of a negative effect is set at a change in traffic noise of +1 dBA and the onset of a significant negative effect is set at +3 dBA.

Construction road traffic noise has been assessed by considering the change in traffic due to construction activities between the following scenarios:

- Scenario 1 – Future year baseline. This represents the year when construction of the Proposed Development will commence and is expected to be the busiest construction year; and
- Scenario 2 – Future year baseline + construction traffic.

Comparison of the calculated traffic noise for Scenario 1 and Scenario 2 allows the impact due to changes in road traffic noise as a result of the construction of the Proposed Development to be derived.

14.3.6 Construction criteria

For construction works reference has been made to BS5228-2 (BSI 2009 +A1 2014b). The potential magnitudes of construction vibration impacts are determined through review of published data and predictions using the methodologies identified in BS5228 for varying construction activities with the potential for generation of vibration beyond the works boundary.

14.3.6.1 Criteria for Assessing Noise Effects Significance

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the Construction Phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. In general, higher noise levels are generally accepted during a short-term Construction Phase of a project compared to its long-term Operational Phase, as construction works are temporary and tend to be varied. The following sections discuss current best practice in determining criteria for rating construction noise impact/effect significance.

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

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

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

- Duration of the works;
- Distance to noise sensitive locations (NSLs);
- Ambient noise levels;
- Site operating hours;
- Location of works;
- Duration of demolition; and
- Intrusive noise activities, including vibration generating activities.

The duration, nature and extent of construction activities associated with the Construction Phase of the Proposed Development would categorise it within the high-risk category. The monitoring section (S.6) of the DCC GPG document identifies that for high-risk category sites:

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

Whilst Fingal County Council (FCC), Meath County Council (MCC) and Louth County Council (LCC) have not produced similar guidance, the approach used by DCC has been applied across the full extent of the Proposed Development to ensure a uniform approach for construction noise assessment. The following sections set out the relevant ABC guidance taken from BS 5228–1 (BSI 2014a), as well as referring to DMRB Noise and Vibration (UKHA 2020) in order to review and set appropriate construction noise significance ratings or significance thresholds for the Proposed Development.

14.3.6.1.2 British Standard BS 5228 – 1:2009+A1:2014 – 'ABC' Method

The 'ABC' method detailed in Paragraph E.3.2 of BS 5228 – 1 (BSI 2009 +A1 2014a) calls for the designation of a noise sensitive location into a specific category (A, B or C) based on the existing rounded ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact associated with the construction activities, depending on context.

Table 14-2 sets out the values which, when exceeded, signify a potential significant effect.

Table 14-2 BS 5228-1 Example of Thresholds of Potential Significant Effect.

Assessment Category & Threshold Value Period (L_{Aeq})	Construction Noise Threshold (CNT) (dB)		
	Category A	Category B	Category C
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75
Evenings & Weekends (19:00 – 23:00hrs weekdays) (13:00 – 23:00hrs Saturdays) (07:00 – 23:00hrs Sundays)	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55
Notes	Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.	Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.	Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

These thresholds have been applied to all residential and non-residential sensitive receptors.

In order to assist with interpretation of significance, Table 14-3 includes guidance as to the likely magnitude of noise impact associated with construction activities, relative to the construction noise level. This guidance is derived from Table 3.16 of DMRB Noise and Vibration and adapted to include the relevant significance effects from the EPA Guidelines.

In accordance with the DMRB Noise and Vibration document, construction noise and construction traffic noise impacts shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; and
- A total number of days exceeding 40 in any six consecutive months.

Durations of less than these are considered temporary in nature with durations in excess considered short-term.

Table 14-3 Construction Noise Significance Ratings.

Range of Construction Noise level	Guidelines for Noise Impact Assessment Significance (DMRB)	EPA EIAR Significance Effects	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration & baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate	
Above CNT and below or equal to CNT +5 dB	Moderate	Moderate to Significant	
Above CNT +5 to +15 dB	Major	Significant, to Very Significant	
Above +15 dB		Very Significant to Profound	

The adapted DMRB Noise and Vibration (UKHA 2020) guidance outlined is used to assess the predicted construction noise levels at NSLs and comment on the likely impacts during the construction stages.

14.3.6.2 Criteria for Eligibility of Temporary Accommodation

In circumstances, where despite the embedded mitigation, construction noise levels at any property lawfully occupied as a permanent dwelling during construction are measured or predicted to exceed the criteria defined in Table 14-4 for the periods defined, then temporary accommodation, or the reasonable costs thereof, will be offered to eligible owners/ occupiers. The construction noise levels for temporary accommodation are the higher[1] of:

- The eligibility criteria presented in Table 14-4, or
- a noise level 10 dB or more above the existing pre-construction ambient noise level for the corresponding times of day.

For a period of ten or more days or nights in any 15 consecutive days or nights, or for a total number of days exceeding 40 in any six consecutive months.

[1] The criteria are referenced from Section E.4 of BS 5228-1:2009+A1:2014

Table 14-4 Criteria for Eligibility of Temporary Accommodation

Time	Relevant time period	Average Time, T	Temporary accommodation trigger level, dB $L_{Aeq,T}$ *
Monday to Friday	07:00 – 08:00	1 hr	80
	08:00 – 18:00	10 hr	85
	18:00 – 19:00	1 hr	80
	19:00 – 22:00	3 hr	75
	22:00 – 07:00	1 hr	65
Saturday	07:00 – 08:00	1 hr	80
	08:00 – 13:00	5 hr	85
	13:00 – 14:00	1 hr	80
	14:00 – 22:00	1 hr	75
	22:00 – 07:00	1 hr	65
Sunday and Public Holidays	07:00 – 21:00	1 hr	75
	21:00 – 07:00	1 hr	65

* All noise levels are predicted or measured at a point 1 m in front of the most exposed of any windows and doors in any façade of any eligible dwelling.

14.3.6.3 Criteria for Rating Construction Vibration Impacts

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. For airborne vibration impacts associated with surface construction activities, in both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

14.3.6.3.1 Building Response Criteria

BS 7385 - 2 (BSI 1993) gives guidance regarding acceptable vibration in order to avoid damage to buildings.

BS 5228 - 2 (BSI 2014b) reproduces these same guidance values.

These standards differentiate between transient and continuous vibration. Surface construction activities are transient because they occur for a limited period of time at a given location. Both documents recommend that, for soundly constructed residential property and similar light framed structures that are generally in good repair, a threshold for minor or cosmetic damage (i.e. non-structural damage) should be taken as a PPV (in frequency range of predominant pulse) of 15 mm/s at 4 Hertz (Hz) increasing to 20 mm/s at 15Hz and 50 mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to be zero. 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 BS 5228 - 2 (BSI 2014b) 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.

Historically, important buildings 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 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 is equal to or up to 50% of those for light framed buildings, 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 more stringent criterion has been applied for transient vibration. It is assumed that known buildings and structures of this kind do not have any existing damage.

Table 14-5 sets out the limits as they apply to vibration frequencies at 4Hz where the most conservative limits are required. At higher frequencies, the relevant limit values for transient vibration within Table B.2 and Figure B.1 of BS 5228-2 (BSI 2014b) will apply, with similar reductions applied for continuous vibration and those for protected structures. For line 2 of Figure B.1 at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded. Taking the above into consideration the vibration criteria for building response is set out in Table 14-5.

Table 14-5 Recommended Construction Vibration Thresholds for Buildings

Vibration Limits for Buildings (PPV) at the closest part of building to the source of vibration, at a frequency of 4Hz		
Building Type	**Transient Vibration**	**Continuous Vibration**
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s	25 mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15 mm/s	7.5 mm/s
Protected and Historic Buildings *Note 1	6 mm/s – 15 mm/s	3 mm/s – 7 mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3 mm/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 values within the range will be used, depending on the specific vibration frequency.

14.3.6.3.2 Human Response Criteria

Humans are sensitive to vibration stimuli, and perception of vibration at high magnitudes may cause concern to building occupants. BS 5228-2 notes that vibration typically becomes perceptible at around 0.15 mm/s to 0.3 mm/s and may become disturbing or annoying at higher magnitudes.

During construction works associated with breaking of ground, piling and excavation, depending on the methodologies involved the vibration limits set within Table 14-6 would be clearly perceptible to building occupants and would have the potential to cause subjective effects.

Higher levels of vibration are, however, typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin of vibration is known. Table 14-6 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS 5228 – 2.

Table 14-6 Human Response Vibration Significance Ratings.

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	None	Imperceptible to Slight

14.3.7 Operational railway noise criteria

There is no applicable national guidance specifying airborne noise limits from rail operations, therefore precedents from other rail projects have been used to determine appropriate criteria. A review of recent operational railway noise criteria for large scale urban rail projects has been undertaken, namely Crossrail 2, DART+ West and DART+ South West in addition to guidance documents relating to environmental noise.

Table 14-7 presents the operational noise thresholds adopted for the assessment of the Proposed Development.

Table 14-7 Operational Noise Threshold

Sensitive Locations	Noise Criteria during Operational Phase
Locations that are highly sensitive during day and night-time periods All residential buildings Health care facilities (hospitals, nursing homes) Hotels, student accommodation, hostels etc.	Daytime: 55dB$L_{Aeq,16hr}$ (07:00 – 23:00hrs) Night-time: 45dB$L_{Aeq,8hr}$ (23:00 – 07:00hrs)

Where operational rail noise is predicted to be below the threshold values in Table 14-7, the effect is determined to be not significant. Where operational rail noise levels are above these threshold levels, the effects rating is dependent on the magnitude above the threshold value and the increase above the baseline noise environment.

Where existing noise levels are already high (well above the threshold value), a small change in noise levels may not cause disturbance and a larger change may cause disturbance and be significant. The scale of the impact can depend on the degree of noise change (difference between the Do Something and Do Minimum levels).

If the ambient noise level is currently low (below the threshold), then the scale of impact is dependent on the extent to which the predicted noise levels exceed the thresholds. The change criteria and associated effects ratings are summarised in Table 14-8.

Table 14-8 Impact magnitude and significance rating

Predicted noise level above threshold or Do Minimum level	Magnitude of impact	Significance Rating
Greater than 10dB	Substantial	Significant
> 5 dB and <= 10 dB	Major	Potentially Significant
> 3 dB and <= 5 dB	Moderate	Potentially Significant
> 1 dB and <= 3 dB	Minor	Not significant
Less than or equal to 1 dB	Negligible	Not significant

The World Health Organisation (WHO) published in October 2018 the Environmental Noise Guidelines for the European Region (WHO 2018). The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health impacts.

The WHO guideline values referred to here are recommended to serve as the basis for a policy-making process to allow evidence based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines:

> *"The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices."*

It is therefore not intended to refer to the WHO guidelines in an absolute sense as part of this assessment and it will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits for use. Notwithstanding this the following recommendations are noted from the WHO guidelines:

- For average noise exposure, the WHO strongly recommends reducing noise levels produced by railway traffic below 54dBL_{den}, as railway noise above this level is associated with adverse health effects; and
- For night noise exposure, the WHO strongly recommends reducing noise levels produced by railway traffic during night time below 44dBL_{night}[3], as night-time railway noise above this level is associated with adverse effects on sleep.

The recommended noise exposure levels are similar to the absolute levels proposed in Table 14-8 however as this Proposed Development is an existing operational railway it is not practical to achieve these absolute levels for all noise sensitive locations.

14.3.8 Operational stationary noise sources criteria

Stationary noise sources to be considered during the Operational Phase noise assessment include:

- fixed building services;
- Public Alarm and Voice Alarm (PA/VA) systems;
- stationary trains; and
- noise sources associated with train maintenance.

The assessment of operational noise from fixed plant serving the stations and depots is undertaken at the sensitive receptors closest to the Proposed Development following the guidance outlined within BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound and BS8233:2014 Guidance of sound insulation and noise reduction for buildings.

The BS4142 assessment procedure, bases the impact of fixed noise sources upon the difference between the measured background sound level without the sound of the Proposed Development, and the 'rating level' of the Proposed Development, at the receiver location.

The 'background sound level' ($L_{A90,T}$) is defined in BS4142 as the typical noise existing in the absence of the 'specific sound level' at the receiver location. The 'specific sound level' ($L_{Aeq,Tr}$) from the fixed source can be subject to a certain weighting (penalty) where it displays an identifiable character (such as tonality, impulsivity, intermittency or otherwise distinctive character) to provide a 'rating level' ($L_{Ar,Tr}$). The 'background sound level' is subtracted from the rating level and the difference used to inform the assessment of the effects.

BS4142 advises:

> "*The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs*".

[3] dBL_{night} results from the global A-weighted $L_{Aeq,8hr}$ average calculated from 23:00 to 07:00, as determined in RMR which refers to ISO 1996-2

BS4142 advises that an initial estimate of the impact of the specific sound be conducted by subtracting the measured background sound level from the rating level and by considering the following:

Typically, the greater this difference, the greater the magnitude of the impact:

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- 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 or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Importantly for locations which experience low background levels, especially at night, BS4142 advises that: "where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following:

> *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
>
> *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night".*

Noise from public address (PA) systems would not normally be assessed using BS 4142 Methods for rating and assessing industrial and commercial sound, given its nature and frequency. In this instance, best practice guidance as noted in section 14.7.2.4 has been set out for this source which will be implemented during detail design of the stations.

The significance of effects is determined based on the methodology presented above and other factors including the acoustic context of the area, magnitude of exceedance, predicted absolute noise levels, number of receptors affected and time of the day where impact occurs.

14.3.9 Operational road traffic noise criteria

In the absence of any Irish guidelines or standards relating to describing the effects associated with changes in road traffic noise levels, reference has been made to the DMRB LA 111 Noise and Vibration document as guidance. This document provides impact magnitude rating tables relating to changes in road traffic noise. The document suggests that during the year of opening (the short-term period), the magnitude of impacts between the Do Minimum and the Do Something scenarios are likely to be greater compared to the longer-term period.

For the Proposed Development, the initial significance criteria are determined based on the magnitude of road traffic noise change above the Do Minimum or operational noise thresholds in Table 14-7. Where operational road noise is predicted to be below the threshold values in Table 14-7, the effect is determined to be not significant. Where operational road noise levels are above these threshold levels, the effects rating is dependent on the magnitude above the threshold value and the increase above the Do Minimum noise environment. Where changes in traffic noise levels in the short-term are less than 3 dB and the long-term are less than 5 dB, the effect is deemed not significant. Where long-term or both short-term and long-term changes in traffic noise levels are equal to or greater than this, the effect on noise sensitive receptors is deemed to be potentially significant.

14.3.10 Operational vibration criteria

There is no statutory Irish guidance relating to the maximum permissible vibration level that may be generated by an operational railway. In the absence of specific vibration limits, a vibration threshold dose is taken as the value that would likely result in a low probability of adverse comment within residential buildings reported in BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting.

Where operational vibration is predicted to be below 0.2 Vibration Dose Value (VDV) during the day (07:00-23:00) and 0.1 VDV during the night (23:00-07:00), the effect is determined to be not significant. Where operational rail noise levels are above these threshold levels, the effects rating is dependent on the magnitude above the threshold value and the increase above the baseline noise environment. Where operation of the scheme is predicted to result in VDV vibration changes equal to or greater than 25%, the effect on people is deemed to be potentially significant.

There are no standard criteria for assessing the potential impact of vibration on sensitive equipment or processes. Generally, the majority of such equipment is not adversely affected at the levels of vibration that occur from railways. A risk assessment based on currently available information is considered the best method for assessing the potential effect of vibration on sensitive equipment or processes.

14.3.11 Operational noise and vibration prediction

Operational railway noise levels have been predicted using the RMR calculation method, which is the Dutch calculation methodology adopted for the assessment of rail noise by Iarnród Éireann. The noise level calculations have been performed using SoundPLAN 9.0 prediction software and take into account the following information:

- rollingstock type in operation along the line;
- train numbers;
- speeds;
- distance attenuation;
- air absorption;
- ground factors (absorbent and reflecting surfaces);
- ground height differences (cuttings/embankments);
- screening effects (boundary treatments, buildings, retaining walls etc);
- meteorological conditions;

- angle of view of the receiver; and
- the number of rail sections within the considered area.

The parameters used in the operational railway noise calculations are presented in Table 14-9 below.

Table 14-9 Noise model inputs

Parameter	Source	Details
Calculation method	RMR	Calculation and Measurement Guidelines for Rail Transport Noise (RMR) 1996
Calculation engine	SoundPLAN 9.0	RMR package
Existing railway horizontal and vertical alignment	OSi	Ordnance Survey (OSi) Dated November 2021
Proposed railway horizontal and vertical alignment	Engineering team	Civil engineering models for the scheme provided by the engineering team
Ground levels (Digital Ground Model)	LiDAR (within 20m of railway) and SRTM data from USGS for wider topography	Light Detection and Ranging (LiDAR) dated November 2021 Shuttle Radar Topography Mission (SRTM) data from United States Geological Survey (USGS) dated May 2023[4]
Building layouts	OSi	Ordnance Survey (OSi) Dated November 2021
Location of sensitive receptors	GeoDirectory	Dated 2023
Absorbent ground	OSi	Ordnance Survey (OSi) Dated November 2021
Rail traffic flows	IÉ	Provided by Iarnród Éireann (IÉ) Dated July 2023
Operational train speeds	IÉ	Train speed limits and track speed limits provide by Iarnród Éireann (IÉ) Dated July 2023

To assess the noise impact resulting from changes in operational road traffic on existing roads, the principles of the methodology set out within the Calculation of Road Traffic Noise (CRTN) has been used to determine the magnitude of the resulting change in road noise to noise sensitive properties along affected roads.

Calculations of vibration levels have been performed by calibrating a vibration prediction model to the measured levels near the existing railway. Calculation procedures within the vibration prediction model are consistent with ISO 148372 and take account of all key parameters, including train design, train speed, train flow, track design, ground conditions, receiving building foundations and receiving building type. The measured and predicted vibration levels from the existing railway are used to determine if sensitive receptors are currently exposed to appreciable levels of vibration. If sensitive receptors are found to be exposed to appreciable levels of vibration, the change in vibration levels is predicted by calculating the Do Minimum and Do Something vibration levels.

[4] Accessed via https://earthexplorer.usgs.gov/ (last accessed 23 May 23)

This percentage change in level is calculated at a nominal distance in each zone of the Proposed Development and is considered representative of the change in vibration to all properties within the study area of each zone.

Sound generated by the Proposed Development's stationary noise sources will be calculated using appropriate international standards (e.g. ISO 9613). Stationary noise sources are generally not finalised until the detailed design phase. As such, where insufficient information is available, the assessment will be based on the design and installation requirements that are adopted to avoid significant adverse effects.

14.3.12 Consultation

The development of the Environmental Impact Assessment Report has been informed by consultation with prescribed bodies, other consultees and the public.

Specifically, regarding noise, Meath County Council (MCC) requested that the EIAR addressed potential impact of increased noise in the vicinity of the rail line.

TII recommended use of TII guidance document Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (TII 2014).

For further information regarding consultation for the overall DART+ Coastal North project refer to Chapter 1 (Introduction) in Volume 2 of this EIAR.

14.3.13 Assumptions and limitations

The effects of operational noise from the Proposed Development have been assessed using validated prediction methods that include multiple input parameters and formulas. Variation in factors such as local meteorological conditions, receiver location and source characteristics means that there is uncertainty in the model predictions. The range of model uncertainty over the different evaluated scenarios for receivers within 300m of the railway would be a standard deviation of 4dB to 5dB depending on distance from the source, position of the receiver, screening and time of day. This prediction model uncertainty would be replicated by measurement uncertainty made up of actual meteorological conditions of the sound propagation, variations in the source due to roughness of the wheels and rails, and uncertainty in the instrumentation system and its installation.

14.4 Receiving Environment

This section includes a description of the likely future receiving environment as it relates to the Do Minimum scenario for the noise and vibration assessment.

Baseline noise and vibration surveys have been conducted at locations near sensitive receptors that have the potential to be impacted by the construction and operation of the Proposed Development. A noise model of the existing baseline representing the existing operational railway has been completed and compared to the Environmental Noise Directive (END) strategic noise maps. This model has also been checked to be consistent with the baseline survey results (see section 14.5.2.2). Therefore, only selective baseline locations have been necessary to ensure a complete coverage of the existing railway baseline. Additional survey locations have been selected specifically for sensitive areas near construction works.

The surveys were undertaken by National Vibration Monitoring Ltd. (NVM) in March, April and May 2023. Full details of the surveys are presented in Appendix A14.1 (Baseline Noise and Vibration Monitoring for DART+ Coastal North) in Volume 4 of this EIAR.

Figure 14.1 in Volume 3A of this EIAR presents the noise and vibration monitoring survey locations. The results of the surveys are presented in Table 14-10 and Table 14-11 below.

The environmental noise survey was a combination of attended and unattended measurements undertaken for the day (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00). The recorded metrics LA_{90} and LA_{10}, are presented for each noise monitoring location shown in Table 14-11 as the arithmetic average over the measurement period. The LAeq,T is presented as the energy average. For the vibration survey, the measured Peak Particle Velocity (PPV) and Vibration Dose Value (VDV) is presented.

The vibration survey results are summarised in Table 14-10 below and it summarises the maximum measured PPV, measured VDV over the measurement period, the estimated 16hr VDV at the measurement position, and the estimated 16hr VDV on the 1st floor of a building.

Table 14-10 Baseline vibration survey results

Location	Maximum PPV (mm/s) ground	VDV 1hr ($ms^{-1.75}$) ground	VDV 16hr ($ms^{-1.75}$) ground	VDV 16hr ($ms^{-1.75}$) 1st floor
VIB 01 – Malahide	0.825	0.046	0.089 (estimated)	0.356 (estimated)
VIB 02 - Clongriffin	0.175	0.020	0.040 (estimated)	0.160 (estimated)

Table 14-11 Noise survey results

Location number and name	Daytime (07:00-19:00)		Evening (19:00-23:00)		Night (23:00-07:00)		L_{den}	Construction noise threshold category		
	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A90,T}$	$L_{Aeq,T}$		Day	Evening	Night
NML 01 – No. 2 Dublin Road, Pines Hamlet, Drogheda, Co. Louth, A92 FD3A	47	56	45	56	38	52	60	A	B	C
NML 02 – No 5. Railway Terrace, Wheaton Hall, Drogheda, Co. Louth	53	64	55	64	49	61	68	B	C	C
NML 03 – 14 Harvest Way, Wheaton Hall, Drogheda, Co. Louth, A92 YFK2	38	47	38	47	32	46	53	A	A	B
NML 04 – St. Mary's Villa, Drogheda, Co. Louth	52	63	49	59	45	54	64	B	C	C
NML 05 – Park Ridge, Grange Rath, Drogheda, Co. Meath	49	58	45	57	37	50	60	A	B	C
NML 06 – 13 Ardmore Cl, Betaghstown, Co. Meath	34	53	28	42	26	37	51	A	A	A
NML 07 – Laytown Viaduct, Co. Meath	49	56	46	54	47	51	59	A	B	C
NML 08 – Irishtown, Gormanston Camp area, Co. Meath	48	61	44	55	46	49	60	A	B	C
NML 09 – Quay Street, Balbriggan, Co. Dublin	50	62	50	66	49	66	72	A	C	C
NML 10 – Flower Power Garden Centre, Skerries, Dublin, K34 VY16	41	64	37	57	29	48	62	B	B	C
NML 11 – 67 St Patricks Close, Townparks, Skerries, Co. Dublin, K34 VY16	39	55	34	53	27	55	61	A	B	C
NML 12 – Skerries Golf Club, Skerries, Co. Dublin	39	51	35	50	28	43	53	A	A	B
NML 13 – Winhook, Effelstown, Lusk, Co. Dublin	53	59	48	57	43	54	62	A	B	C
NML 14 - Rogerstown Lane, Lusk, Co. Dublin	50	55	45	54	43	52	59	A	B	C
NML 15 – 255 Marina Village, Malahide, Co. Dublin, K36 N122	37	62	35	60	32	50	62	A	C	C
NML 16 – 15 Myrtle Close, The Coast, Dublin 13, D13 HX27	38	58	34	54	31	51	59	A	B	C
NML 17 – 37 Carndonagh Lawn, Grande, Dublin 13, D13 WV05	42	62	37	48	32	46	60	A	A	B

14.5 Description of Potential Impacts

14.5.1 Potential Construction Impacts

A detailed description of the proposed construction works and proposed working hours is presented in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR.

14.5.1.1 Construction Activities Noise Impact Assessment

The following sections discuss the potential noise and vibration impacts/effects during the Construction Phase across the five (5) zones defined for the project.

Table 14-12 summarises the approach adopted to construction noise and vibration sources which have been assessed as part of the Construction Phase. The construction assumptions for these works are presented in Appendix A14.2 - Construction plant noise assessment assumptions.

Table 14-12 Overview of Construction Phase Noise and Vibration Assessment Procedures

Source	Prediction Method	Key Considerations	Impact/Effect Assessment
Construction noise at fixed sites & linear sections of cut & cover/ retained cuts/ track laying	Construction calculations using BS 5228-1 Methodology (BSI 2009 +A1 2014a)	Calculations provided at impact distance from the activity.	Results compared against construction noise significance thresholds (CNTs) and baseline noise levels - dependent on duration of impacts, magnitude and sensitivity.
Utility Diversions	Construction calculations using BS 5228-1 Methodology (BSI 2009 +A1 2014a)	Calculations provided at impact distance from the activity.	Results compared against CNLs to determine compliance with criteria
Construction Vibration	Methodology from BS 228-2 (BSI 2009 +A1 2014b) Review of empirical and measured data	Proximity of sensitive buildings/ structures/ construction methodologies and published data and monitored data from comparable works	Comparison against building construction thresholds and human response to vibration to categorize significant effects
Construction Traffic	Methodology from CRTN (UK Department of Transport 1998) Noise & acoustic principals	Changes in noise level with and without Construction Phase- Calculated relating to volume flow changes in AADT (car, LGV and HGV fleet).	Significance of impact dependent on change in traffic noise level. Assessed using DMRB.

Construction calculations are based on BS 5228:2009+2014. This method has the scope to take into account a range of factors affecting the sound propagation, including:

- the magnitude of the noise source in terms of sound power.
- the distance between the source and receiver.
- the presence of obstacles such as screens or barriers in the propagation path.

Noise source data has been taken from BS5228 – 2009+A1(2014): Code of practice for noise and vibration control on construction and open sites Part 1 - Noise where available based on plant and equipment lists provided by the project team.

14.5.1.1.1 Route-wide activities

There are certain construction works that will occur across the scheme. These are summarised as follows:

- Electrification;
- Signalling;
- Roads;
- Site clearance; and,
- Fencing.

Where baseline noise levels are available, see Table 14-11, they have been used to determine the relevant construction noise assessment category. Where baseline noise levels are not available the assessment is based upon the daytime Category A values, and the night-time Category B5 values from Table 14-2, for determining likely significant construction noise effects.

Electrification

The Proposed Development is being electrified from Malahide to Drogheda. The electrification works will require:

- Substations;
- Grid connection routes; and
- Overhead Line Equipment (OHLE).

A total of eight electrical substations are required for the DART+ Coastal North Project. Each substation will be supplied from two independent 38kV circuits. The grid connection route works will involve laying underground cables (UGC), comprising a 38kV electricity connection in the existing road and across greenfield sites. The assessment of these construction activities will be considered in the relevant zone assessment. The Malahide to Drogheda section of the existing project route corridor is not currently electrified and OHLE infrastructure will need to be installed. The OHLE arrangement will vary at different sections along the route depending on the track configuration, clearance to structures and local site conditions. Typical spacing between OHLE support structures will typically be between 40m and 50m, with a maximum spacing of 65m. Further details on OHLE arrangements can be found in Chapter 4 (Description of the Proposed Development). Due to the limited numbers of weekend track possessions these works are expected to take place at night.

The installation of the OHLE system is described in detail in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The works will be carried out in a linear fashion during night-time (4 to 6 hour) shifts in accordance with Appendix A5.1 (CEMP). The process is summarised as follows:

- Foundations for the OHLE support structures will be required throughout the route from Malahide to Drogheda.

[5] Category B values have been selected as in all but one monitoring location the nighttime baseline noise levels correspond with that assessment category.

- Where the OHLE foundation locations clash with utilities, the utilities will be relocated. Some of this work can take place during the day where there is a safe working zone available, however, it may also require night-works.
- The installation of the foundation's close to the live railway will take place at night during temporary closures or during weekend possessions. Further details of this activity are provided in the following paragraphs.

- Mast and cantilever installation will take place once the concrete foundations have cured. Mast and cantilever installation will occur at night in separate processes with the masts first installed along the length of the works followed by the cantilevers.
- Cable installation will take place at night with messenger and contact wire laid in separate processes.
- Final OHLE adjustments will be carried out over night shifts as required to ensure the OHLE system cabling is in the correct position.

The installation of the OHLE foundations will be a critical and key element for the electrification works to be undertaken under the DART+ Programme. The OHLE will require a piled foundation, with the method of pile installation dependent upon the local ground conditions. It is expected that a third of the OHLE piling will be Down the Hole Hammer (DTHH) while the remaining two thirds will be steel driven or rotary bored piles. The bored piling has a lower noise output compared to steel driven piles or DTTH piles, however, the installation of steel driven piles is faster and will result in the works being completed more quickly.

Table 14-13 presents the distance from the OHLE installation activities where a major impact and a moderate impact are predicted.

Table 14-13 OHLE installation – impact distances

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) equal to a moderate or major impact			
	Night (unscreened)		Night (partially screened)	
	Major impact	Moderate impact	Major impact	Moderate impact
Advanced Enabling & Utility Works, Site Preparation Works	<189m	189m - 336m	<106m	106m - 189m
Foundation construction (Rotary Auger Piling)	<335m	335m - 596m	<189m	189m - 335m
Foundation construction (Steel driven Piling)	<466m	466m - 829m	<262m	262m - 466m
Foundation construction (Down The Hole Hammer Piling)	<485m	485m - 862m	<273m	273m - 485m
Installation of support structures, including masts and cantilevers	<197m	197m - 350m	<111m	111m - 197m
Installation of contact wire	<79m	79m - 140m	<44m	44m - 79m

It is expected that during each possession, regardless of piling methodology, at least 2 piles are likely to be installed, such that the impact will be very short term in close proximity to sensitive receptors, given the distance between OHLE masts (i.e. typically 40 - 50 m). The installation of OHLE infrastructure will occur at a later stage.

The noise impact of the OHLE installation will likely be significant at individual properties close to the tracks for periods of a few days while the works are occurring locally. As the works progress, the likely effects will become less significant at individual properties and the effects will follow the work progress linearly along the track. Mitigation measures are limited for these works due to the nature of the sites being temporary worksites for a 4-6 hour period each night and the plant involved is difficult to mitigate. Due to the temporary nature of the works, the impact is considered negative, moderate to profound and temporary. Mitigation measures are discussed in Section 14.6.1. Furthermore, it is proposed that in densely populated areas multiple piling rigs are used per location as the additional noise impact is minor, however, the works will be completed more quickly, thus reducing the overall impact.

Signals and related infrastructure

New physical signalling and low voltage infrastructure comprising of a network of signalling and LV elements including localised control cabinets and cabins are required at several locations.

Signal gantries are proposed for use in stations or in areas with more than two tracks, such as Clongriffin or Malahide and the installation of these has the potential to generate high levels of noise albeit for a short duration. Further details can be found in Chapter 4 (Description of the Proposed Development) and Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. Table 14-14 presents the distance from the signalling installation activities where a major impact and a moderate impact are predicted.

Table 14-14 Signalling installation – impact distances

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) where unscreened activities are equal to a moderate or major impact			
	Day		Night	
	Major impact	Moderate impact	Major impact	Moderate impact
Advanced Enabling & Utility Works, Site Preparation Works	<37m	37m - 66m	<209m	209m - 372m
Foundation construction (Rotary Auger Piling)	<29m	29m - 52m	<163m	163m - 290m

Mitigation measures are limited for these works due to the nature of the sites being temporary worksites for a 4-6 hour period each night and the plant involved is difficult to mitigate. Due to the temporary nature of the works, the impact is considered negative, moderate to profound and temporary. Mitigation measures are discussed in Section 14.6.1.

Roads

Where bridge reconstructions are necessary as part of the Proposed Development, associated roadworks will be necessary (including footpaths or cycle track reinstatement or enhancements). The proposed road reconstructions are short in length as their purpose is only to facilitate bridge reconstruction to accommodate electrification of the railway. A summary of the road reconstruction works is provided in Chapter 4 (Description of the Proposed Development) in Volume 2 of this EIAR.

The locations closest to the road works with the greatest impact currently experience high levels of noise from passing traffic. During these works, there will be no passing traffic and the noise impact is not expected to be over and above the existing noise levels experienced at these locations. Given this, and due to the temporary nature of the works, a slight to moderate impact is predicted. Nonetheless the character of the noise will be different and mitigation measures will be implemented to minimise the impact, and these are discussed in Section 14.6.1.

Site Clearance

Prior to the main works commencing, site clearance will be undertaken during the core working hours across the entire extent of the project. Site clearance will involve the removal of any vegetation, unwanted materials, small structures, and equipment, required to enable the main works to commence. Significant effects from site clearance are unlikely as the duration of this activity at a particular location should not exceed ten or more days or nights in any 15 consecutive days or nights. Where longer durations are anticipated, site clearance has been considered within the specific compound assessment for the relevant Zone. Mitigation measures are discussed in Section 14.6.1.

New Fencing

The installation of the railway fencing is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. Seven locations across the scheme have been identified as requiring new fencing. Five (5) of the locations are either in rural locations, or more than 75m from residential and other noise sensitive properties. For these five (5) locations, the likely effect is negative, slight to moderate, and short-term. The remaining two locations are in the vicinity of Barnageeragh Road, Skerries and Seaport Road, Balbriggan, and they will be considered in the Zone D assessment below.

14.5.1.1.2 Zone A

The construction works specific to Zone A are limited to modifications to Fairview Depot. In the absence of specific baseline noise levels, the assessment for all works in Zone A is based upon the Category A values from Table 14-2, which represents the most onerous assessment category for determining likely significant construction noise effects.

Internal modifications to Fairview Depot

The proposed works at Fairview depot include minor modifications within the depot to provide a greater output of cleaning for the fleet of new trains. These will include the provision of new cleaning platforms on the sidings to the east side of the mainline, along with associated walkways and services. On the west side, modifications are proposed largely within the existing maintenance building to provide suitable access and services for cleaning staff. The works will be undertaken within the depot and aim to minimise disruption to the facility. The overall duration of the works is expected to be approximately 12 months with the majority of the work completed during daytime working hours.

Table 14-15 presents the distance from the Fairview Depot construction activities where a major impact and a moderate impact are predicted.

Table 14-15 Zone A works – impact distances

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Internal modifications New cleaning platforms, walkway and services	<58m	58m - 103m

The closest residential noise sensitive receptors are at a distance of more than 125m from the proposed works and are separated by Fairview Park and the R105 where there is a high level of road noise. The effects at these receptors is likely to be negative, either ‘not significant’ or ‘slight to moderate’, and short-term. The rear façade of the Clasach music centre, overlooks the main railway line and the existing sidings to be modified for the new cleaning activities. It is assumed that the design of the building is suitable to control noise from the existing railway and depot operations to internal activities within the centre, given that the depot and railway were in operation before the construction of the music centre. Therefore, the likely effects will be negative, not significant and short-term at Clasach and all other receptors. Refer to Section 14.6.1 for a description of proposed mitigation measures.

14.5.1.1.3 Zone B

The construction works specific to Zone B can be summarised as follows:

- Howth Junction and Donaghmede Station Works;
- Clongriffin Station turnback;
- Construction of UBB19C;
- Malahide Turnback; and
- Modification of UBB30 Malahide Viaduct.

Where baseline noise levels are available, see Table 14-11, they have been used to determine the relevant construction noise assessment category. Where baseline noise levels are not available the assessment is based upon the Category A values from Table 14-2, which represents the most onerous assessment category for determining likely significant construction noise effects.

Howth Junction and Donaghmede Station Works

The construction approach planned for this work is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. A new platform extension is proposed to be undertaken at Howth Junction and Donaghmede Station. The extension will be to Platform 2 to enable the operation of a shuttle service on the Howth Branch line, if and when required in the future, together with the existing direct service to the city centre. Modifications to the existing station entrances, central access structure and footbridge are proposed to improve visibility and access. The works at Howth Junction and Donaghmede Station will take place over an approximate 24-month duration and will take place during daytime working hours. There will be some exceptions to this when nighttime works will be required for short periods for particular operations close to the railway such as piling and lifting in new precast concrete platform units. Table 14-16 presents the distance from the Howth Junction and Donaghmede Station Works construction activities where a major impact and a moderate impact are predicted.

Table 14-16 Howth Junction and Donaghmede Station works – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Demolition and site preparation	<111m	111m - 198m
Tie-in to existing platform	<79m	79m – 141m
Remaining works	<44m	44m - 78m

The highest predicted construction noise levels are associated with the demolition and site preparation activities which occur at the beginning of the works, however a significant effect is not identified as the duration is likely to be less than ten or more days or nights in any 15 consecutive days or nights. The remaining works will result in moderate or major impacts at approximately 80 residential properties on Carndonagh Lawn, Carndonagh Road (properties overlooking the railway), Saint Donagh's Road, and Saint Donagh's Park. The likely effect at these receptors is negative, moderate to significant / significant to very significant, and short-term.

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary.

Refer to Section 14.6.1 for a description of proposed mitigation measures.

Clongriffin Station turnback

The construction approach planned for this work is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The proposed works include the construction of a new track on the east side of the station, the opening of platform 0 to receive operational traffic, the placement of a new crossover to the south of the station and the installation of new turnouts to connect the new track to the main line. The Clongriffin Station track works will take place over a 12 month period and will take place during daytime working hours. There will need to be a limited number of track possessions to tie in the existing tracks with the new track, either during night possessions or sharing weekend possessions with other works. Table 14-17 Clongriffin Station turnback works – impact distance presents the distance from the Clongriffin Station turnback construction activities where a major impact and a moderate impact are predicted.

Table 14-17 Clongriffin Station turnback works – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Demolition and site preparation	<111m	111m - 198m
All other works	<79m	79m - 141m

The highest predicted construction noise levels are associated with the demolition and site preparation activities which occur at the beginning of the works, however a significant effect is not identified as the duration is likely to be less than ten or more days or nights in any 15 consecutive days or nights. However, the remaining works will result in moderate or major impacts at approximately 70 residential properties including Bridge Street Apartments, Station Hill apartments, 10 Railway Road apartments, properties on Station Way, Station Street, and Railway Road. The likely effect at these receptors is negative, moderate to significant / significant to very significant, and short-term. The first row of the proposed residential developments close to Clongriffin Station, if occupied during the construction works, will also be subject to a likely effect which is negative, moderate to significant / significant to very significant, and short-term.

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary.

Refer to Section 14.6.1 for a description of proposed mitigation measures.

Construction of UBB19C

The works associated with the Clongriffin Turnback require a new loop line to be installed to the east of the existing tracks. This new East Loop extends approximately 500 m north of Clongriffin Station before connecting in with the Main Lines. The East Loop over the Mayne River will require a new bridge adjacent to UBB19 to cross the river and adjacent path. A new embankment is required along the eastern boundary with the railway to accommodate the new track configuration. Additionally, the extension of culvert UBB18 is required.

The proposed bridge comprises a low profiled reinforced concrete arch structure, with a single 17.5 m span. The arch will include spandrel walls that run parallel to the alignment of the tracks. The substructure will comprise reinforced concrete abutments supported on piled foundations. The bridge is set back from the existing structure in plan so as to provide a clear differentiation between the new and existing bridges. The abutments are also set back so as to span the existing wingwalls.

The construction works will take place over an approximately 12-month period. Given the location of the bridge, a small portion of the works will need to be done during track possessions. It is expected that these will be non-disruptive night-time possessions. Table 14-18 presents the distance from the UBB19C construction activities where a major impact and a moderate impact are predicted.

Table 14-18 Construction of UBB19C – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Enabling works (inc. demolition), foundations, piers and abutments	<69m	69m - 122m
Deck reconstruction and finishing works	<44mm	44m – 79m

Moderate or major impacts are not identified at the existing properties in this area. However, if occupied during the construction works, the first row of the proposed residential developments close to UBB19C, will also be subject to a likely effect which is negative, moderate to significant / significant to very significant, and short-term.

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary.

Refer to Section 14.6.1 for a description of proposed mitigation measures.

Malahide Turnback

The construction approach planned for the Malahide turnback is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The overall duration of construction works is expected to be 18 months with the majority of the works completed during daytime working hours.

The majority of sensitive receptors here are residential in nature however, Malahide Marina Creche, Hi5 afterschool care facility, and Malahide Marina offices are close to the works and the proposed Construction Compound at Malahide Marina and these will be sensitive during daytime hours. Off track works such as the construction of the modular reinforced earth wall, and backfilling material will be undertaken during daytime working hours, while other railway works will be undertaken during a small number of single line weekend possessions. OHLE piling will occur during nighttime possessions and will be planned according to the limited durations outlined in the DMRB and Section 14.3.6.1.2.

Table 14-19 presents the distance from the Malahide turnback construction activities where a major impact and a moderate impact are predicted.

Table 14-19 Malahide turnback – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Turnback works	<58m	58m – 103m
Construction compound	<42m	42m – 75m

The works at this location will result in a moderate or major impact at residential properties on approximately 125 properties in Marina Village, The Marina, Strand Court, and Bisset's Strand. The effect at these receptors is likely to be negative, significant to very significant, and short-term. Additionally, there are likely adverse effects on the Malahide Marina Creche, Hi5 afterschool care facility, and Malahide Marina offices.

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary.

Refer to Section 14.6.1 for a description of proposed mitigation measures.

Modification of UBB30 Malahide Viaduct

The modification to UBB30 Malahide Viaduct to install the OHLE is described in Chapter 5 (Construction Strategy) in Volume 2 in this EIAR. It is planned that these works will be undertaken over the course of a weekend possession for each gantry. The gantries are located at Pier 3, 6 and 9 of the viaduct. The gantries would be erected during non-disruptive possessions as part of the wider OHLE gantry erection works. Table 14-20 presents the distance from the UBB30 Malahide Viaduct Pier 3 construction activities where a major impact and a moderate impact are predicted.

Table 14-20 OHLE support at pier 3 Malahide Viaduct – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
All works	<66m	66m – 118m

Further OHLE support is required at piers 6 and 9. It is planned that these works will be done over weekend possessions along with several weeks of preparatory work in daytime working hours for the gantry foundations. The gantries could then be erected during possessions or engineering hours as part of the wider OHLE gantry erection works. Table 14-21 presents the distance from the UBB30 Malahide Viaduct Piers 6 and 9 construction activities where a major impact and a moderate impact are predicted.

Table 14-21 OHLE support at pier 6 and 9 Malahide – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
All works	<59m	59m – 104m
Breaking down concrete nub	<90m	90m – 160m

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect of the OHLE support works at piers 3, 6 and 9, is negative, not significant, and temporary due to the separation from the sensitive receptors. Refer to Section 14.6.1 for a description of proposed mitigation measures.

14.5.1.1.4 Zone C

The construction works specific to Zone C can be summarised as follows:

- Donabate Substation;
- Modification of UBB36 Rogerstown Viaduct;
- Rush and Lusk Substation;
- OBB39 Station Road/R128 Bridge track lowering;
- OBB44 Tyrrelstown Bridge track lowering;
- Skerries South Substation;
- Skerries North Substation;
- OBB55 Lawless Terrace/R127 Bridge track lowering;

- modification of UBB56 Balbriggan Viaduct;
- Balbriggan Substation;
- OHLE and SET line wide works;
- Road overbridge parapet modifications to: OBB32A, OBB35, OBB38, OBB41, OBB46, OBB47, OBB49, OBB55, OBB68; and
- Pedestrian overbridge parapet modifications to: OBB33A, OBB38A, OBB51A, OBB54, OBB57A.

Where baseline noise levels are available, see Table 14-11, they have been used to determine the relevant construction noise assessment category. Where baseline noise levels are not available the assessment is based upon the Category A values from Table 14-2, which represents the most onerous assessment category for determining likely significant construction noise effects.

Donabate Substation

The duration of the works at this location is planned to be up to one year, from start of site clearance to completion of installation and testing. The majority of construction works will be carried out within daytime working hours. The existing noise barrier on the R126 road will provide screening to properties to the north of the substation and compound works. Nighttime / weekend possessions will also be required for some construction activities, such as electrical connections. Table 14-22 presents the distance from the Donabate Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-22 Donabate Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other substation works	<57m	57m – 101m
Construction compound	<42m	42m – 75m

The works at this location will result in a moderate or major impact at 1 residential property on Kilcrea from substation works, access road and compound activities. The effect at this receptor is likely to be negative, moderate to significant, and short-term.

The night-time electrical connection works are very likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary.

Refer to Section 14.6.1 for a description of proposed mitigation measures.

Modification of UBB36 Rogerstown Viaduct

There are two new OHLE supporting frames to be installed on the abutments of Rogerstown Viaduct. It is assumed that these works could be done over the course of two weekend closures/possessions for each gantry foundation or during engineering hours.

The gantries could then be erected during engineering hours as part of the wider OHLE gantry erection works. Table 14-23 presents the distance from the UBB36 Rogerstown Viaduct construction activities where a major impact and a moderate impact are predicted.

Table 14-23 UBB36 Rogerstown Viaduct – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Masonary wingwall demolition	<87m	87m – 155m
All other works	<58m	58m - 104m
Construction compound	<42m	42m – 75m

No properties are located within the impact distances of the works. The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect is negative, not significant, and temporary. No adverse effects are predicted as a result of these works.

Rush and Lusk Substation

This substation site has also been selected as a line-wide Construction Compound. This new substation will be constructed to provide power to the OHLE. There will also be a permanent maintenance compound in this location for the new OHLE. The general duration of the works at this location will be 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive.

Table 14-24 presents the distance from the Rush and Lusk Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-24 Rush and Lusk Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving (substation)	<75m	75m – 133m
All other substation works	<57m	57m – 101m
Construction compound & road works	<42m	42m – 75m

The works at this location will result in a moderate or major impact at a residential property on Rogerstown Lane from the substation and compound activities, and 3 properties on Station Road and Lusk Road from the access road works. The effect at these receptors is likely to be negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

OBB39 Station Road/R128 Bridge track lowering

Works are required to lower the track level under the bridge by approximately 0.1m. These track lowering works (double track) are scheduled to occur during planned weekend possessions lowering one track at a time over a weekend closure whilst utilising the other track for access. The overall duration of the works will depend on the availability of weekend possessions.

The effects are likely to be negative, slight to moderate and temporary due to the duration of works and the separation to sensitive receptors. Refer to Section 14.6.1 for a description of proposed mitigation measures.

OBB44 Tyrrelstown Bridge track lowering

Works are required to lower the track level under the bridge by approximately 0.3m lowering one track at a time over a weekend closure whilst utilising the other track for access. The overall duration of the works will depend on the availability of weekend possessions. The effects are likely to be negative, slight to moderate and temporary due to the duration of works and the separation to sensitive receptors. The construction compound activities in this area will result in a moderate impact at 2 residential properties on Horestown Road. The effect at these receptors is likely to be negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Skerries South Substation

This site is on the opposite side of the railway to Skerries Golf Club, adjacent to a small number of residential properties and a school. The new substation will be constructed to provide power to the OHLE. The general duration of the works at this location will 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-25 presents the distance from the Skerries South Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-25 Skerries South Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other works	<57m	57m – 101m
Road works	<42m	42m - 75m

The works at this location will result in a moderate or major impact at a residential property on Golf Links Road, and at St. Michael's House, Special National School, Skerries. The school has a prefabricated classroom at the closest point to the worksite. The school provides education for pupils with moderate general learning disabilities, some with an added diagnoses of Autism and other complex needs, for pupils from 4 years to 18 years of age. The likely effect is negative, significant to very significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures. Considering the specific needs of the school, if additional mitigation is required, the available mitigation options will be discussed with representatives from the school. Mitigation options may include additional controls on site, provision of cooling and ventilation to ensure windows can be kept closed, cladding the boundary fence, or other acoustic enhancements to the school buildings.

Skerries North Substation

This site is adjacent to a small number of residential properties and a garden centre. The new substation will be constructed to provide power to the OHLE. The general duration of the works at this location will be 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-26 presents the distance from the Skerries North Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-26 Skerries North Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<42mm	42m – 75m
All other works	<32m	32m – 57m

The works at this location will result in a moderate or major impact at approximately 10 residential properties on Hamilton Hill and Barnageeragh Road. The effect at these receptors is likely to be negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

OBB55 Lawless Terrace/R127 Bridge track lowering

Works are required to lower the track level by approximately 0.3m under the bridge, lowering one track at a time over a weekend closure whilst utilising the other track for access. OBB55 is located on the south side of Balbriggan in a built-up residential area. The overall duration of the works will depend on the availability of weekend possessions. The effects are likely to be negative, slight to moderate and temporary.

It is noted that given the number of sensitive receptors in the vicinity, there will be a need to implement suitable noise mitigation measures during the works. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Modification of UBB56 Balbriggan Viaduct

Due to the length of the bridge, at least two OHLE masts are required to be supported on the viaduct. The proposed design involves siting the OHLE posts on a replacement wider section of the pedestrian walkways to either side of the tracks on the viaduct outside the existing fence line. It is assumed that most of the works could be done offline from the railway to avoid closures and that the individual lifts would be done during engineering hours. The walkways would need to be closed for several weeks. It would be preferable to only close one at a time to provide ongoing pedestrian connectivity to either side of the bridge. The effects are likely to be negative, slight to moderate, and temporary. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Balbriggan Substation

This new substation will be constructed to provide power to the OHLE. The general duration of the works at this location will 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-27 presents the distance from the Balbriggan Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-27 Balbriggan Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other works	<57m	57m – 101m

No adverse effects are predicted as a result of these works. Refer to Section 14.6.1 for a description of proposed mitigation measures.

14.5.1.1.5 Zone D

The construction works specific to Zone D can be summarised as follows:

- Gormanston Substation;
- Modification of UBB72 Laytown Viaduct;
- Bettystown Substation;
- OBB78 Colpe Road Bridge track lowering works;
- OHLE and SET line wide works;
- Road overbridge parapet modifications to OBB78; and
- Pedestrian overbridge modifications to OBB74A; and
- The new fencing at Barnageeragh Road, Skerries and Seaport Road, Balbriggan.

Where baseline noise levels are available, see Table 14-11, they have been used to determine the relevant construction noise assessment category. Where baseline noise levels are not available the assessment is based upon the Category A values from Table 14-2 which represents the most onerous assessment category for determining likely significant construction noise effects.

Gormanston Substation

The new Gormanston Substation will be in a relatively remote area (with one property in proximity) on lands currently owned by the Department of Defence adjacent to the railway. This new substation will be constructed to provide power to the OHLE. The general duration of the works at this location will be 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-28 presents the distance from the Gormanston Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-28 Gormanston Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other works	<57m	57m – 101m

The works at this location will result in a moderate or major impact at 2 residential properties on Irishtown road. The likely effect is negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Modification of UBB72 Laytown Viaduct

The viaduct has four piers along its length with two new OHLE proposed gantries being installed on piers A and D. Table 14-29 presents the distance from the Laytown Viaduct construction activities where a major impact and a moderate impact are predicted.

Table 14-29 UBB72 Laytown Viaduct – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
All works	<58m	58m - 103m

The works at this location will result in a moderate or major impact at 6 residential properties on Riverbank and Coastview Cottages. The effect at these receptors is likely to be negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Bettystown Substation

The new Bettystown Substation will be located to the southwest of Bettystown close to a residential area adjacent to the railway. The new substation will be constructed to provide power to the OHLE. The general duration of the works at this location will be 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-30 presents the distance from the Bettystown Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-30 Bettystown Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other works	<57m	57m – 101m

The works at this location will result in a moderate or major impact at approximately 30 residential properties at Ardmore Gardens and Ardmore Avenue. The effect at these receptors is likely to be negative, moderate to very significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

OBB78 Colpe Road Bridge track lowering works

OBB78 is located on the south side of Drogheda on the edge of a built-up residential area. Works are required to lower the track level by approximately 0.1m under the bridge. The track lowering works will follow the construction methodology of lowering one track at a time over a weekend closure whilst utilising the other track for access. The overall duration of the works will depend on the availability of weekend possessions. The effects are likely to be negative, slight to moderate and temporary due to the duration of works. Refer to Section 14.6.1 for a description of proposed mitigation measures.

New fencing – Barnageeragh Road, Skerries

New fencing is required to increase the height of an existing stone boundary wall near Barnageeragh Road close to a small group of properties. The fencing works will be undertaken where practicable during daytime working, although there may be a need to undertake some activities within track closure periods. At the 6 properties on Barnageeragh Road, the effects are likely to be negative, slight to moderate and temporary due to the duration of works. Refer to Section 14.6.1 for a description of proposed mitigation measures.

New fencing – Seaport Road, Balbriggan.

New fencing is required to increase the height of an existing stone boundary wall near Seaport Road and Fancourt Road, Balbriggan. The fencing works will be undertaken where practicable during daytime working, although there may be a need to undertake some activities within track closure periods.

At the residential properties on Seaport Road and Fancourt Road, Balbriggan, the effects are likely to be negative, slight to moderate and temporary due to the duration of works. Refer to Section 14.6.1 for a description of proposed mitigation measures.

14.5.1.1.6 Zone E

The construction works specific to Zone E can be summarised as follows:

- Reconstruction of OBB80/80A/80B Railway Terrace Bridge (triple span);
- Widening of UBK01 Dublin Road Bridge;
- Span replacement of OBB81 Drogheda Station footbridge;
- Construction of Platform 4 (on Drogheda Freight Line) and associated trackwork;
- Construction of Drogheda Substation;
- Works on Light Maintenance Roads and Under Frame Cleaning (UFC) facility within the station;
- Works on Stabling Roads 7a and 7b within the station;
- Works on Northern Headshunt within the station; and
- OHLE and SET line wide works.

Where baseline noise levels are available, see Table 14-11, they have been used to determine the relevant construction noise assessment category. Where baseline noise levels are not available the assessment is based upon the Category A values from Table 14-2, which represents the most onerous assessment category for determining likely significant construction noise effects.

Reconstruction of OBB80/80A/80B Railway Terrace Bridge (triple span)

The existing three-span Railway Terrace Bridge (OBB80/80A/80B) does not provide enough clearance to allow installation of the OHLE needed for electrification. It is proposed therefore to demolish and replace this bridge with a new bridge in the same location. The proposed replacement bridge is a 47m long, three-span, reinforced concrete structure. It will have piled foundations, wingwall retaining walls and parapets.

The construction approach planned for this work is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The construction works will take place over an approximately 18-month period. Given the location of the bridge, much of the work will need to be done during track possessions. It is expected that these will be a combination of weekend and night-time possessions. Table 14-31 presents the distance from the Railway Terrace Bridge construction activities where a major impact and a moderate impact are predicted.

Table 14-31 Railway Terrace Bridge – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact			
	Day		Night	
	Major impact	Moderate impact	Major impact	Moderate impact
Bridge demolition	<130m	130m - 231m	<410m	410m - 729m
Foundations, piers and abutments	<64m	64m -113m	<201m	201m - 357m
All other works	<45m	45m – 80m	<143m	143m - 254m

The works at this location will result in a moderate or major impact at residential properties on approximately 110 existing residential properties at Acorn Way, Foxhill, McGrath's Way, Avondale, Harvest Way, and Railway Terrace, McGrath's Lane. The effect at these receptors is likely to be negative, significant to very significant, or very significant to profound, and short-term. The first row of the proposed residential development close to the depot, if occupied during the construction works, will also be subject to a likely effect which is negative, significant to very significant / very significant to profound, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Widening of UBK01 Dublin Road Bridge

The railway bridge over the R132 Dublin Road is to be widened in two phases. A new span with one track is to be added to the south side first, and then the deck of the existing bridge will be removed and a new deck installed. The construction approach planned for this work is described in Chapter 5 (Construction Strategy) in Volume 2 of this EIAR. The Dublin Road Bridge works will take place over an approximately 18-month period. The road will need to be fully closed during certain Construction Phases. It is also likely that there will be a period when both railway lines are closed during certain operations, such as piling, excavation and heavy lifting works. Table 14-32 presents the distance from the Dublin Road Bridge construction activities where a major impact and a moderate impact are predicted.

Table 14-32 Dublin Road Bridge – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact			
	Day		Night	
	Moderate impact	Major impact	Moderate impact	Major impact
Bridge demolition	<130m	130m - 231m	<410m	410m - 729m
Foundations, piers and abutments	<64m	64m -113m	<201m	201m - 357m
All other works	<45m	45m – 80m	<143m	143m - 254m

The works at this location will result in a moderate or major impact at approximately 90 residential properties at Saint's Mary's Villa, Mount Auburn Close, Railway Terrace, Bryanstown Manor, and Dublin Road. The first row of the proposed residential developments close to Dublin Road namely Bayview, Cromwells Lane (application reference 201086) and development at Knockmount (application reference 201022), if occupied during the construction works, will also be subject to a likely effect which is negative, significant to very significant / very significant to profound, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

The effect at these receptors is likely to be negative, significant to very significant / very significant to profound, and short-term. The duration of the effect is up to 30 months based upon the programme information presented in Section 5.2 of the Chapter 5 - Construction Strategy. It should be noted that there will be variability in construction activities throughout this period which suggests that there may be times when noise levels are materially lower than those which contribute to the likely significant effect. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Span replacement of OBB81 Drogheda Station footbridge

The deck of OBB81 Drogheda Station Footbridge will be replaced as the existing structure does not provide sufficient clearance for the proposed OHLE for electrification.

The construction of this bridge includes two primary phases, namely the removal of the existing bridge superstructure and the construction/erection of the new superstructure. A selection of preparatory works will occur over nighttime possessions followed by the removal of the old bridge over the course of a weekend possession. More preparatory works for the new bridge will occur during nighttime and the new bridge will be installed over another weekend possession. Daytime works will occur throughout for offline works. Table 14-33 presents the distance from the Drogheda Station footbridge construction activities where a major impact and a moderate impact are predicted.

Table 14-33 Drogheda Station footbridge – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact			
	Day		Night	
	Moderate impact	Major impact	Moderate impact	Major impact
Footbridge works	<12m	12m-21m	<37m	37m-66m

The engineering and possession works are likely to be less than ten or more days or nights in any 15 consecutive days or nights, therefore short-term. The likely effect of these activities, is negative, not significant, and temporary. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Construction of Platform 4 (Drogheda Freight Line) and associated trackwork

A new platform, Platform 4, is to be constructed at Drogheda in conjunction with turnback works on the Drogheda Freight Line. This entails trackwork, platform works, the installation of ticketing gates, CCTV, protected waiting areas, fencing and rearranged parking areas. This will require removal of the BEMU walkway, cable trough and retaining wall to allow construction of a new retaining wall further into the slope. Once the new wall is in place, new ballast, sleepers and track can be laid, along with the new cable trough and walkway. The new platform would then be built by preparing the ground and then lowering precast units into place with either a small crane or excavator. Ductwork, pipework and cabling would then be installed, and the second (northern) track slewed across.

Some works will take place at weekends to minimise disruption to weekday station activities. The track works will be undertaken during weekend and night-time possessions over an approximate 20-week period. Works to install most lineside civil works will be undertaken using a variety of trackside construction plant. Table 14-34 presents the distance from the Platform 4 and associated trackwork activities where a major impact and a moderate impact are predicted.

Table 14-34 Platform 4 and associated trackwork – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact			
	Day		Night	
	Moderate impact	Major impact	Moderate impact	Major impact
Removal of BEMU walkway, cable trough and retaining wall	<136m	136m – 242m	<431m	431m - 766m
New platform construction	<82m	82m – 146m	<259m	259m - 460m
All other works	<57m	57m - 102m	<181m	181m - 322m

The works at this location will result in a moderate or major impact at approximately 90 residential properties at Saint's Mary's Villa, Mount Auburn, Railway Terrace and Dublin Road. The effect at these receptors is likely to be negative, significant to very significant / very significant to profound, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Construction of Drogheda Substation

The new Drogheda Substation will be in agricultural land adjacent to the existing depot. The new substation will be constructed to provide power to the OHLE. Construction of the substation will follow the scheme outlined in Section 5.3.8.

The general duration of the works at this location will be 3 months for civil works and 3 months for equipment installation. Most of the disruptions will come from the civil works, whereas the installation of the equipment and the tests will be less disruptive. Table 14-35 presents the distance from the

Drogheda Substation construction activities where a major impact and a moderate impact are predicted.

Table 14-35 Drogheda Substation – impact distance

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
Surface paving	<75m	75m – 133m
All other works	<57m	57m – 101m

The works at this location will result in a moderate or major impact at 2 residential properties on McGrath's Way. The effect at these receptors is likely to be negative, moderate to significant / significant to very significant, and short-term. The first row of the proposed residential development close to the depot, if occupied during the construction works, will also be subject to a likely effect which is negative, moderate to significant / significant to very significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

The duration of the effect is up to 3 months during the civil works based upon the programme information presented in Section 5.2 of the Chapter 5 (Construction Strategy). It should be noted that there will be variability in construction activities throughout this period which suggests that there may be times when noise levels are materially lower than those which contribute to the likely significant effect.

Works on Light Maintenance Roads and Under Frame Cleaning (UFC) facility within the station

The Light Maintenance Roads in Drogheda Depot numbered 8 and 9 are proposed to be modified. These works can be summarised as:

- Train door replacement;
- Roof access gantry additions for Depot Protection System (DPS);
- OHLE, for Roads 8 and 9;
- Installation of DPS; and
- Installation of Under Frame Cleaning (UFC) screen.

Additional overhead electrification (OHLE) will be installed on Roads 8 and 9 of the depot to cater for the new BEMU and EMU fleets. The Depot Protection System (DPS) installation will be phased in a similar way to the OHLE works, inclusive of roof access gantry additions. Table 14-36 presents the distance from the Depot light maintenance roads and UFC facility construction activities where a major impact and a moderate impact are predicted.

Table 14-36 Depot light maintenance roads and UFC facility – impact distances

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
All works	<56m	56m - 99m

The works at this location will result in a moderate or major impact at 2 residential properties on McGrath's Way. The effect at these receptors is likely to be negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures. The first row of the proposed residential development close to the depot, if occupied during the construction works, will also be subject to a likely effect which is negative, moderate to significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

Drogheda Depot External Civils Works

The proposed works at the Drogheda depot include:

- New drivers' and cleaners' provision by creating Stabling Road 7B to the north of the existing Stabling Road 7A by reprofiling the adjacent bund;
- Modification to civils items affected by the new track works for Stabling Roads 7A and 7B; and
- New drivers' and cleaners' provision for the Northern Headshunt.

The stabling road works will involve vegetation clearance over the entire bund and earthworks to reprofile the existing bund (~10,000m^3 un-bulked volume to be removed), after which drainage, ballast and track will be laid and the new walkways and cleaning facilities installed. Some services relocation will be required. Table 14-37 presents the distance from the Drogheda Depot External Civils Works where a major impact and a moderate impact are predicted.

Table 14-37 Drogheda Depot External Civils Works – impact distances

Activity	Distance where the Predicted Noise Level L_{Aeq} (dB) in the unscreened case is equal to a moderate or major impact	
	Major impact	Moderate impact
All works	<75m	75m – 133m

The works at this location will result in a moderate or major impact at approx. 25 residential properties on Pine's Hamlet. The effect at these receptors is likely to be negative, significant to very significant, and short-term. Refer to Section 14.6.1 for a description of proposed mitigation measures.

14.5.1.2 Construction Traffic

During the Construction Phase the addition of construction related traffic has the potential to generate noise impacts on the existing road network. The traffic flows with and without construction traffic have been assessed to determine the likely change in noise level on each link provided as a result of the Construction Phase. Traffic flow data in terms of the Annual Average Daily Traffic (AADT) figures has been assessed with and without construction traffic and diverted traffic and the calculated change in noise levels are summarised in Table 14-38. Links are considered where the increase in heavy vehicles is predicted to be 200 or more AADT as lower increases are not considered significant. Figure 12.1 in Volume 3A of this EIAR presents the locations of the modelled road links (note - a road link is a segment of road between two junctions). The methodology used to calculate the change in noise level and significance rating are outlined in Section 14.3.5.1 of this chapter.

Table 14-38 Change in Traffic Noise Levels Due to Construction Traffic

Link Number	Name	Without Construction		With Construction		Change in Noise Level (dB)	Significance Rating
		Total AADT	% Heavy Vehicles	Total AADT	% Heavy Vehicles		
36381_36010	**R132 South**	4,913	3%	5,660	8%	+1.6	Minor
36011_36010	**R132 North**	4,335	2%	5,082	8%	+1.9	Minor
36010_36011	**R132 Drogheda Rd South**	4,550	3%	5,297	8%	+1.7	Minor
35506_36011	**R132 Drogheda Rd North**	4,335	2%	5,082	8%	+1.9	Minor
35504_35505	**Balbriggan Bypass**	12,594	9%	13,342	11%	+0.5	Negligible
36773_35505	**R132 North**	13,364	8%	14,111	9%	+0.5	Negligible
35505_36773	**R132 South**	12,594	9%	13,342	11%	+0.5	Negligible
36771_36772	**R132 South**	10,731	10%	11,478	12%	+0.6	Negligible
38502_36772	**R132 North**	12,896	7%	13,643	9%	+0.6	Negligible
36765_38502	**R132 Main Street**	10,682	8%	11,429	10%	+0.7	Negligible
36772_38502	**R132 south**	12,193	8%	12,940	10%	+0.6	Negligible
38502_36765	**R132 Main St South**	10,380	9%	11,128	11%	+0.7	Negligible
38534_36765	**R150 Laytown Rd**	4,841	1%	5,587	6%	+1.8	Minor
36765_38534	**R150 Laytown Rd West**	4,681	1%	5,428	7%	+1.8	Minor
37115_38534	**Ministon Rd**	2,848	4%	3,595	12%	+2.9	Minor
38732_38534	**R150 Laytown Rd East**	2,346	2%	3,093	11%	+3.0	Moderate
36798_37115	**Pilltown Rd West**	159	25%	906	38%	0	No Change
37116_37115	**Pilltown Rd East**	2,977	6%	3,724	13%	+2.6	Minor
38534_37115	**Ministown Rd**	2,706	7%	3,454	14%	+2.7	Minor
36012_36014	**L5362**	1,267	11%	2,014	22%	+4.4	Moderate
38557_36014	**R150 Triton Rd**	919	18%	1,667	28%	0	No Change
36012_36013	**R150 Coast Rd**	159	1%	906	33%	0	No Change
36014_36013	**R150 Triton Rd**	919	18%	1,667	28%	0	No Change
36799_36013	**Golf Links Rd**	148	1%	895	34%	0	No Change
36013_36012	**R150 Coast Rd North**	1,070	15%	1,817	26%	+5.9	Major
36776_36012	**R150 coast Rd South**	1,426	10%	2,174	20%	+5.0	Major
37115_37116	**L5615 Pilltown Rd**	2,925	7%	3,671	14%	+2.4	Minor

Link Number	Name	Without Construction		With Construction		Change in Noise Level (dB)	Significance Rating
		Total AADT	% Heavy Vehicles	Total AADT	% Heavy Vehicles		
38459_37116	**R150 Eastham Rd**	6,487	6%	7,235	9%	+1.2	Minor
38550_37116	**Bettystown Rd**	3,432	12%	4,179	17%	+1.6	Minor
30027_37129	**Costal Scenic Drive**	3,895	10%	4,642	15%	+1.7	Minor
37128_37129	**Colpe Rd**	3,274	8%	4,022	14%	+2.0	Minor
37142_37129	**Mill Rd**	548	8%	1,294	27%	0	Neutral
29721_37142	**Marsh Rd West**	3,388	4%	4,135	10%	+2.1	Minor
37129_37142	**Mill Rd**	686	10%	1,434	26%	0	Neutral
29360_29983	**R132 Dublin Rd South**	7,483	4%	8,230	7%	+1.4	Minor
29997_29983	**R132 Dublin Rd North**	6,025	6%	6,773	9%	+1.5	Minor
30231_29983	**Bryanstown Village**	2,214	2%	2,962	11%	+4.0	Moderate
29984_29985	**Blackbush Lane**	1,216	1%	1,963	16%	+6.9	Major
30231_29985	**Meadow View East**	2,687	0%	3,435	9%	+4.1	Moderate
29985_29984	**Blackbush Lane**	1,129	0%	1,876	16%	+7.5	Major
30350_29984	**Sunnyside Cottages**	1,216	1%	1,963	16%	+5.8	Major
29359_29997	**R132 Dublin Rd North**	6,025	6%	6,773	9%	+1.5	Minor
29983_29997	**R132 Dublin Rd South**	5,912	5%	6,659	9%	+1.6	Minor
29358_30350	**R132 Dublin Rd East**	5,912	5%	6,659	9%	+1.6	Minor
29984_30350	**Sunnyside Cottages**	1,129	0%	1,876	16%	+8.3	Major
30344_30350	**R132 Dublin Rd West**	7,239	5%	7,986	8%	+1.3	Minor

Moderate adverse impacts are predicted at worst-case sensitive receptors located in proximity to three links: L5362, Bryanstown Village and Meadow View East. Major impacts are predicted at worst-case sensitive receptors located in proximity to three links: R150 Coast Road, Blackbush Lane and Sunnyside Cottages.

These worst-case impacts are predicted to be short-term with construction traffic only accessing when works are occurring in the area. It is estimated that most works will have a duration of less than 12 months, with some lasting for a period of approximately one month.

14.5.1.3 Construction Vibration - Impact Assessment

Prediction of vibration propagation is a complex task and requires detailed geotechnical information, which will developed at the detailed stage. To ensure vibration levels during the Construction Phase are controlled and remain at low impact levels, a monitoring programme will be implemented by the appointed contractor to assess compliance of the construction works with the limits set out in Section 14.3.6.3. The selection of monitoring locations (number and location) will be agreed with the relevant local authorities, but will be based on the nearest representative sensitive locations to the working areas which will progress along the length of the Proposed Development. The potential magnitudes of construction vibration impacts are determined through review of published data for varying construction activities with the potential for generation of vibration beyond the works boundary and empirical calculations based on this data. Baseline vibration measurements were carried out and are reported in Appendix A14.1 (Baseline Noise and Vibration Monitoring for DART+ Coastal North) in Volume 4 of this EIAR. Figure 14.1 in Volume 3A of this EIAR presents the noise and vibration monitoring survey locations. More information on the receiving environment is presented in section 14.4.

The activities with the greatest potential to generate vibration will be percussive demolition, vibratory compaction, vibratory piling for OHLE installation and retaining structures.

Where there are vibration sensitive properties in close proximity to construction activity, the lower vibration thresholds defined in Table 14-6 will apply. In addition, the mitigation measures outlined in Section 14.6.1 will be applied, including in particular, monitoring of vibration levels to avoid significant impacts occurring.

Piling

Considering the construction assumptions for the Proposed Development, the greatest risk of vibration effects is associated with piling works. The piling methodology to be employed for the Proposed Development involves a combination of rotary bored piling, DTHH piling, steel driven piling and mini piling.

Bored piling

Review of measured data from BS 5228-2 (BSI 2009 +A1 2014b) and Wiss (1981) pertaining to rotary or auger driven piles, confirms that at distance of 3.5 m to 7 m, piling activities (including augering, driving and auger hitting base of hole) do not result in any significant vibration levels (i.e. typically <1 to 3 mm/s PPV). At distances greater than 10m, the resultant vibration levels are below the criteria set for this scheme for significant effects to people within buildings or to protected or vulnerable structures as outlined in Table 14-5 and Table 14-6. These values are also in line with measured results from other construction projects.

Driven piling (inc. DTHH)

Vibration levels associated with driven piles are assessed in order to determine potential worst-case impacts. BS 5228-2 (BSI 2009 +A1 2014b) includes measured magnitude of vibration associated with different piling types. Table 14-39 reproduces those associated with steel sheet piling.

Table 14-39 Vibration Magnitudes Associated with Sheet Steel Piling.

Soil Condition	Pile Dimension	Distance, m	PPV, mm/s
Made ground 0 – 3m, loose and very dense sand and silt 3 – 17m, firm to stiff clay 17 – 25m	244mm diameter driven tubular steel piles	5 10 20	12.32 - 13.9 8.45 – 8.76 4.32 – 5.4
Made ground 0 – 3m, loose and very dense sand and silt 3 – 17m, firm to stiff clay 17 – 25m	275mm driven square piles	5 10 20	10.16 - 11.4 6.41 4.32 – 5.6

The vibration magnitudes outlined in Table 14-39, and other guidance in BS 5228-2 (BSI 2009 +A1 2014b), indicates that at residential properties the thresholds in Table 14-5, linked to cosmetic building damage, are unlikely to be exceeded at a distance of greater than 5m for transient vibration sources and 15m for continuous vibration sources. At distances beyond 25m, vibration magnitudes are reduced to the thresholds associated with buildings with a low vibration threshold. At this stage, no vulnerable buildings have been identified within 25m of piling activities, and the risk of cosmetic damage to buildings due to the Proposed Development is very low.

Human response to vibration occurs at much lower levels than building damage and it is likely that during piling activities high vibration levels, as defined in Table 14-6 would occur whilst activities are within 30m of residential properties. In the case of the OHLE piling activities this is likely to be limited to a few nights only as the foundation bases are typically 40 to 50m apart.

Percussive ground-breaking activities

During ground-breaking activity, there is also potential for vibration to be generated through the ground. Empirical data for this activity is not provided in the BS 5228- 2:2009+A1:2014 standard, however the likely levels of vibration from this activity are expected to be significantly below the vibration criteria for building damage on experience from other sites. At distances of 20 m from this activity, vibration magnitudes are expected to be well below those associated with any form of cosmetic damage to protected, historic and identified vulnerable buildings. Vibration impacts during ground-breaking activities have the potential to generate a moderate effect, with a negative, moderate significance rating within 10m of the works. A negative, slight to moderate effect, is likely for people in buildings within 20 m of this activity. At increasing distances impacts to structures and people are likely not significant from this type of activity with a not significant to slight significance rating for human perception.

Vibratory rollers

Vibration effects from vibratory rollers also have the potential to affect nearby sensitive receptors. It is expected that the vibration levels from the rollers will be similar to or lower than those from ground-breaking activities.

Demolition

Demolition of existing structures will involve careful deconstruction using controlled techniques. There may be a requirement for breaking ground as part of specific demolition procedures, depending on the structure. Vibration levels associated with this activity will be of similar or lower magnitude to rock breaking discussed above. Notwithstanding the information above, any activities undertaken at the construction sites will be required to operate below the vibration limits set out within Table 14-5.

Other Activities

Vibration during other construction activities includes earthmoving equipment including dozers, excavators and trucks, use of handheld breakers, and drilling activities. A review of construction vibration by Wiss (1981) provides typical vibration data on several low vibration construction sources, which are reproduced in Image 14-2.

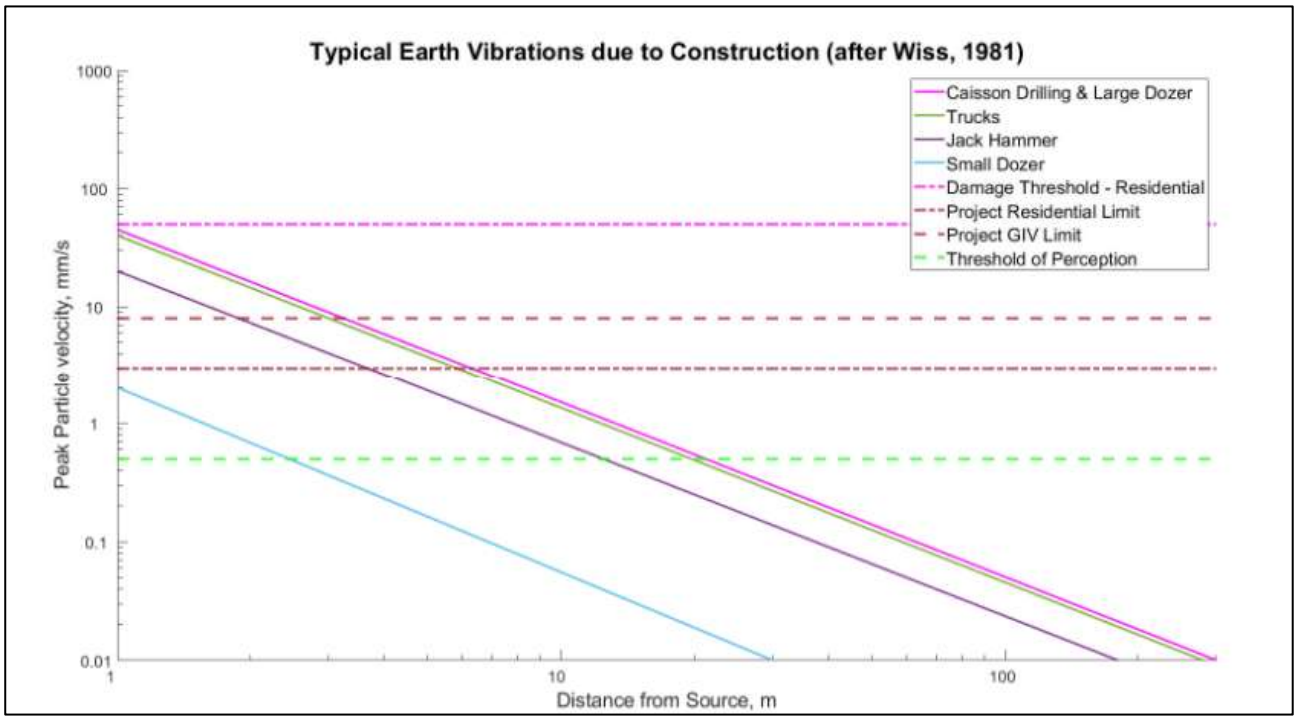

Image 14-2 Typical Earth Vibrations due to Construction

The information from Wiss, indicates that for low vibration / non-vibratory activities, typical construction vibration levels are less than the recommended construction vibration thresholds presented in Table 14-5 for residential properties at a distance of less than 5m. Furthermore, for properties identified as 'potentially vulnerable structures with a low vibration threshold' the recommended construction vibration thresholds are not exceeded at a distance of less than 7m.

Human response to vibration occurs at much lower levels than building damage and it is likely that during these activities a low or medium effect, as defined in Table 14-6, would occur whilst activities are greater than 13m and 11m respectively, from residential properties.

This information is consistent with the data presented in the UK's Transport Research Laboratory report 429, *Groundborne vibration caused by mechanised construction works*, Figure 50. Reviewing the Proposed Development there are very few locations where construction will be undertaken within these distances and therefore no adverse effects are anticipated.

14.5.2 Potential Operational Impacts

The assessment of noise and vibration impacts associated with the Operational Phase of the Proposed Development are presented in this section.

14.5.2.1 Operational railway noise impact

Details of the input railway flows are presented in Table 14-40.

Table 14-40 Railway flow assumptions

Zone	Location	Train type	Max speed (km/h)	No. of Carriages[6]	Scenario 1 – Do Nothing		Scenario 2 – Do Minimum (~10 years in future)		Scenario 3 – Do Something (~10 years in future)	
					Day train movements	Night train movements	Day train movements	Night train movements	Day train movements	Night train movements
Zone A	North of Connolly Station to south of Howth Junction & Donaghmede Station	Existing DART EMU	100	8	181	26	181	26	22	3
		Future DART EMU / BEMU	110	10	0	0	50	3	176	24
		Cross border train (Enterprise)	110	8	16	0	16	0	16	0
		29000 class diesel	110	8	50	1	0	0	0	0
		ICR diesel train	110	7	15	1	38	3	38	3
		Tara mines train	80	13	3	1	3	1	3	1
Zone B1	South of Howth Junction & Donaghmede Station to Clongriffin Station.	Existing DART EMU	100	8	88	9	100	12	22	3
		Future DART EMU / BEMU	145	10	0	0	50	3	176	24
		Cross border train (Enterprise)	145	8	16	0	16	0	16	0
		29000 class diesel	120	8	50	1	0	0	0	0

[6] It is noted that the 10-car future DART trains have an equivalent operational noise level using RMR to a 6-car train since they are articulated (one bogie for joining cars).

Zone	Location	Train type	Max speed (km/h)	No. of Carriages[6]	Scenario 1 – Do Nothing		Scenario 2 – Do Minimum (~10 years in future)		Scenario 3 – Do Something (~10 years in future)	
					Day train movements	Night train movements	Day train movements	Night train movements	Day train movements	Night train movements
		ICR diesel train	145	7	15	1	38	3	38	3
		Tara mines train	80	13	3	1	3	1	3	1
Zone B2	Clongriffin Station to Malahide Viaduct. MP 5 3/4 - MP 10 3/4	Existing DART EMU	100	8	88	9	100	12	22	3
		Future DART EMU / BEMU	145	10	0	0	50	3	132	18
		Cross border train (Enterprise)	145	8	16	0	16	0	16	0
		29000 class diesel	120	8	50	1	0	0	0	0
		ICR diesel train	145	7	15	1	38	3	38	3
		Tara mines train	80	13	3	1	3	1	3	1
Zone B3	Howth Branch	Existing DART EMU	100	8	96	14	114	18	22	3
		Future DART EMU / BEMU	100	10	0	0	0	0	110	19
Zone C	Malahide viaduct to south of Gormanston Station (Fingal boundary)	DART EMU BEMU	100	8	0	0	0	0	22	3
		Future DART EMU / BEMU	145	10	0	0	50	3	88	12
		Cross border train (Enterprise)	145	8	16	0	16	0	16	0
		29000 class diesel	120	8	50	3	0	0	0	0
		ICR diesel train	145	7	15	2	38	3	38	3
		Tara mines train	80	13	3	1	3	1	3	1

Zone	Location	Train type	Max speed (km/h)	No. of Carriages[6]	Scenario 1 – Do Nothing		Scenario 2 – Do Minimum (~10 years in future)		Scenario 3 – Do Something (~10 years in future)	
					Day train movements	Night train movements	Day train movements	Night train movements	Day train movements	Night train movements
Zone D	South of Gormanston Station (Fingal border) to Louth/Meath border	DART EMU BEMU	100	8	0	0	0	0	22	3
		Future DART EMU / BEMU	145	10	0	0	50	3	88	12
		Cross border train (Enterprise)	145	8	16	0	16	0	16	0
		29000 class diesel	120	8	48	3	0	0	0	0
		ICR diesel train	145	7	15	2	38	3	38	3
		Tara mines train	80	13	3	1	3	1	3	1
Zone E	Drogheda MacBride Station and surrounds	DART EMU BEMU	50	8	0	0	0	0	22	3
		Future DART EMU / BEMU	50	10	0	0	50	3	88	12
		Cross border train (Enterprise)	50	8	16	0	16	0	16	0
		29000 class diesel	50	8	48	3	0	0	0	0
		ICR diesel train	50	7	15	2	38	3	38	3
		Tara mines train	40	13	3	1	3	1	3	1

14.5.2.2 Operational railway noise model validation

A noise model validation exercise has been undertaken by comparing the Do Minimum predicted railway noise levels against the measured noise levels. The survey locations used for validation are those which are closest to the railway lines, where the railway is the dominant source of noise and where there is direct line of sight between the sound level meter and the train. The measured and predicted Do Nothing daytime sound levels at these locations are shown in Table 14-15.

Table 14-41 Results of noise model validation

Measurement location	Measured noise levels (dBL_{day})	Predicted noise levels Do Nothing scenario (dBL_{day})
Location 7 – Laytown Viaduct, Co. Meath	54.8dB	56.7dB
Location 12 – Skerries Golf Club, Skerries, Co. Dublin	49.8dB	49.8dB

At these locations, the noise levels predicted by the Proposed Development model are within 2dB of the measurements.

The night noise predictions have been validated by visually checking the predicted sound levels to the predicted night noise levels published in the Environmental Noise Directive (END) strategic noise maps. The noise levels predicted by the model appear to be 5dB greater than the END noise maps. This is likely a result of adopting conservative input assumptions on train type, length, flow and speeds within the model.

The predicted noise levels, within 5dB of END noise mapping at night and within 2dB of the measurements during the day, are considered acceptable and demonstrates the confidence, uncertainty and conservative input assumptions used in the Proposed Development noise model.

14.5.2.3 Assessment of operational railway noise

The assessment of potential railway noise effects associated with the operation of the Proposed Development, is undertaken by comparing the Do Minimum predicted levels against the Do Something predicted levels. As noted in section 14.3.5, the following criteria are applied to determine whether likely significant effects occur at receptors:

- Noise impacts at receptors predicted to be subject to noise levels below $55dBL_{Aeq,16hr}$ (daytime) and below $45dBL_{Aeq,8hr}$ (night-time), are assessed as not significant; and
- Noise impacts at receptors predicted to be subject to noise levels above $55dBL_{Aeq,16hr}$ (daytime) and above $45dBL_{Aeq,8hr}$ (night-time), are assessed based on the change in noise relative to the baseline.

Table 14-42 below, shows the total number of residential receptors per zone which are predicted to be subject to noise levels above $55dBL_{Aeq,16hr}$ and $45dBL_{Aeq,8hr}$ in the Do Something scenario.

Table 14-42 Number of residential receptors with a potential impact

Zone	Residential receptors above 55dBL$_{Aeq,16hr}$ or 45dBL$_{Aeq,8hr}$ (façade level)	Beneficial Impacts		Negligible	Adverse Impacts	
		Moderate or Major Beneficial Impact	Minor Beneficial Impact		Minor Adverse Impact	Moderate or Major Adverse Impact
Zone A	1712	0	0	1712	0	0
Zone B	1069	0	0	59	1010	0
Zone B Branch	603	0	0	602	1	0
Zone C	1940	0	0	0	1940	0
Zone D	550	0	0	0	550	0
Zone E	250	0	0	0	250	0

As noted above, the residential receptors within the study area are predicted to experience negligible, or minor adverse impacts. There are no residential receptors where a moderate or major adverse impact has been predicted. In line with the proposed methodology, it is therefore concluded that noise impacts upon residential receptors are assessed as not significant.

The non-residential noise sensitive receptors with the potential to be impacted are presented below:

Table 14-43 Number of non-residential receptors with a potential impact

Zone	Schools	Hospitals	Places of worship	Hotels
Zone A	7	5	4	1
Zone B	4	2	1	0
Zone B Branch	2	1	1	0
Zone C	7	3	1	2
Zone D	0	0	0	0
Zone E	0	0	0	1

The non-residential receptors in the table above are predicted to experience negligible or minor adverse impacts. There are no non-residential noise sensitive receptors where a moderate or major adverse impact has been predicted. In line with the proposed methodology, it is therefore concluded that noise impacts upon non-residential receptors are assessed as not significant.

The following local development plans (LDP) and strategic housing developments (SHD), documented prior to September 2023, have the potential to be impacted by the operation of the Proposed Development. For the areas of the LDP/SHD which are closest to the railway line, the noise levels may exceed the 55dBL_{Aeq16r} for the day or 45dB$L_{Aeq,8hr}$ for the night-time. However, the operation of the Proposed Development is unlikely to result in moderate or major impacts and therefore the operational phase is unlikely to result in significant effects.

- Zone A
  - Construction of 105 apartments and associated works (reference ABP-308552-20)
- Zone B
  - Construction of 882 residential units (135 houses and 747 apartments) (reference ABP-310418-21)
  - Construction of 1221 apartments, creche and associated site works (reference ABP-311016-21)
  - 1030 apartments (352 residential, 678 Build to Rent units), 2 creches, 10 retail units and all associated site works (reference ABP-305316-19)
  - 500 apartments (235 residential, 265 build to rent), creche and all associated site works. (reference ABP-305319-19)
  - 153 residential units (113 houses and 40 apartments), 3 retail units, cafe, restaurant, medical unit and associated site works. (reference ABP-305619-19)
  - 345 residential units (39 houses, 306 apartments), creche and all associated site works. (reference 313268)
- Zone B Branch
  - Construction of 512 apartments, childcare facility and associated site works (reference ABP-306102-19)
  - Construction of 162 apartments and associated site works (reference ABP-310413-21)
- Zone C
  - 1365 units (346 houses, 1019 apartments), creche and associated site works (reference ABP-311059-21)
  - Amendments to part of a permitted residential development under Reg. Ref: F17A/0113 to replace 35 houses and 62 apartments with 174 apartments and associated site works. (reference ABP-304289-19)
  - 144 apartments and associated site works (reference ABP-306794-20)
  - Demolition of buildings, construction of 415 residential units (252 houses, 163 apartments) creche and associated site works (reference 313361)
  - 10 year planning permission for construction of 817 residential units (377 houses, 440 apartments), childcare facilities and associated site works. (reference 313210)
  - Demolition of existing buildings, construction of 101 Build to Rent apartments and associated site works. (reference ABP-311095-21)
- Zone D
  - 357 residential units (169 houses and 188 apartments), a childcare facility and associated site works. (reference ABP-305703-19)
- Zone E

- 450. no residential units (81 houses and 369 apartments), creche and associated site works. (reference ABP-305110-19)
- 275 apartments, creche and associated site works. (reference ABP-309668-21)

14.5.2.4 Road traffic noise

In terms of road traffic changes during the Operation Phase, the scheme is not likely to significantly alter the traffic patterns and natural traffic growth on the road network. As such, the likely noise increase in the short term and long term are predicted to result in a negligible noise impact that would not result in any likely significant noise effects.

14.5.2.5 Assessment of operational railway vibration

The baseline vibration measurements indicate that the nearest properties to the railway currently experience appreciable levels of vibration. Therefore, the assessment of operational railway vibration at residential properties is undertaken by comparing the Do Minimum predicted levels against the Do Something predicted levels. As noted in section 14.3.10, a vibration dose value (VDV) increase of 25% is used to determine the potential likely significant effects at receptors.

Calculations of vibration levels have been performed by calibrating a vibration prediction model to the measured levels at Malahide. The model parameters that require corrections between the Do Minimum and Do Something scenarios include train design, speed and flow as shown in Table 14-66.

The predicted change in vibration resulting from the source changes for each zone are presented in Table 14-44 below:

Table 14-44 Rail vibration levels for DART+ Coastal North

Location	% VDV change Day	% VDV change Night	Significance of effect
Zone A	<5%	<5%	Not Significant
Zone B	5 to 10%	5 to 10%	Not Significant
Zone B Branch	<5%	5 to 10%	Not Significant
Zone C, D and E	5 to 10%	15 to 20%	Not Significant

The predicted increase in vibration from the railway at residential properties is assessed as not significant.

A risk assessment of non-residential vibration sensitive receptors has been performed by estimating the peak vibration velocity levels from the Do Minimum operation compared to the Do Something operation. The greatest vibration levels from train pass-bys are not likely to increase due to the Proposed Development. Therefore, the predicted vibration from the railway at non-residential vibration sensitive receptors is assessed as not significant.

14.5.2.6 Assessment of maintenance activities

During the operation of the Proposed Development there will be several ongoing maintenance activities associated with the operation of the railway to ensure its safe and efficient operation. To maintain the service provision, several maintenance activities need to be carried out at night. Some of the activities have the potential to generate noise with a risk of noise disturbance during the activity. It is understood that the railway maintenance activities that can result in adverse noise impacts are generally: alignment and levelling of tracks; track tamping; and rail grinding / reprofiling.

There is a risk of brief and short term adverse significant noise effects at sensitive locations near the rail line during essential maintenance works. Section 14.6.2 outlines recommended mitigation measures to be implemented during the operation of the Proposed Development to control noise effects during maintenance works.

14.5.2.7 Assessment of operational depot noise

The main sources of environmental noise from Fairview and Drogheda Depots consist of moving trains and stationary sources such as stationary trains, light and heavy works within the maintenance shed, the train wash and wheel lathe.

The installation of the new wheel lathe and a new train wash will be part of a separate project to DART+ Coastal North. No modifications are required to the existing wheel lathe or the existing train wash as a result of the Proposed Development. The new wheel lathe and train wash are expected to be completed in time for when the Proposed Development Depot works are completed. Daily operation of the new wheel lathe and new train wash would be similar to the existing arrangements.

The movement and stabling of trains within the depots occur at lower speeds than the main line resulting in noise levels that are estimated to be 10dB to 20dB quieter than the operation of trains on the mainline railway.

The proposed works to Drogheda Depot include the construction of a new rail siding that requires the removal of a landscaped bund. This bund is situated in front of the main maintenance shed with visual screening provided by tree planting. The tree planting and the height of the existing bund are not likely to be providing any measurable noise reduction to the maintenance shed, therefore, it is considered likely that noise from the Proposed Development would result in negligible noise impact from the maintenance shed.

As a result, noise from the operation of the depot is not considered likely to result in a significant adverse effect on residential receptors.

14.5.2.8 Assessment of operational stationary sources

14.5.2.8.1 Public voice alarm systems (PA)

There are no national standards or guidance documents directly applicable for assessing overspill from PA systems to residential receptors. The approach has been based on procedures used for Transport for London, Crossrail and HS2.

The key attributes that affect the likelihood of adverse effects from PA overspill are:

- the level during an announcement at the noise-sensitive receptor, (relating to the system design and commissioning) considered within the context of the typical ambient noise from other sources; and
- the frequency and duration of operation, set by the station operator.

The PA level during an announcement predicted at the nearest residences:

- The typical daytime announcement level on the platforms is expected to be approximately 70dBA.
- The predicted PA level during such an announcement at the nearest residences (approximately 50m-200m away) is approximately 52 – 62 dBA.
- Based on baseline noise measurements undertaken, the daytime background noise level at the nearest residences is expected to be approximately 40 - 55dB $L_{A90,T}$ depending on the location and time of day.

PA overspill is hence expected to be audible at the nearest residences during quieter time periods, and depending on the frequency of announcements has the potential to result a significant adverse effect. Section 14.6.2.4 outlines recommended mitigation measures to be implemented to control noise effects from the PA system. The PA system is already in operation and is part of the current noise climate.

14.5.2.8.2 Substation and fixed plant

The future design and installation of stationary systems will include measures such as attenuators, acoustic louvres, screening, anti-vibration mounts and others to avoid significant adverse noise effects.

14.5.2.9 Assessment of indirect sources of noise and vibration

North of Drogheda there is the potential for the number of trains operating at night to be doubled between the Do Minimum and Do Something scenarios. This would result in a 3dB increase in noise and a 25% increase in VDV resulting in a moderate indirect adverse noise and vibration impact to residential receptors near the main line of the railway north of Drogheda. In this situation, the source of noise and vibration from each train pass-by is consistent in level and occurs over a similar pattern of time during the night. The noise and vibration increase is a result of a small number of trains (3 in each direction) increasing (to 6 in each direction) over the 8-hour night period, although it is noted the BEMU trains will be quieter than existing diesel trains. The probability of this increase resulting in additional observable noise induced awakenings is considered low and the overall perceived increase in sleep disturbance is considered low. Therefore, this indirect impact is not considered likely to result in a significant adverse effect on residential receptors.

14.6 Mitigation Measures

14.6.1 Construction Phase

During the course of construction, the procedures outlined in Iarnród Éireann operation procedure CCE-QMS-008-002 Noise Management – CCE Activities as well as the DCC GPG (DCC 2016) will be implemented. The Iarnród Éireann and DCC documents include the following noise mitigation measures:

1. The Community Liaison Officer (or other nominated person) will notify affected residents in advance of any planned works commencing with a letter drop in the relevant area.

2. Where planned work occurs over a 72hr weekend shutdown there will be a noise management plan submitted to the local authority in advance.

3. The following measures will be implemented where feasible during construction activities:
    a. Carry out as much preparatory work in daylight as practicable (for example, pre-sawing or drilling rails).
    b. Inspect the worksite in daylight if practicable and look for the best location to position generators, which maximises existing screening.
    c. Position generators and lighting away from residential dwellings.
    d. Take advantage of natural barriers such as vegetation, walls or embankments that can offer noise screening to adjacent neighbours.
    e. Where necessary, use noise attenuation screens. The screens must be located as close to the receiver or source as possible.
    f. Consider using additional supply cables and structures so that the generators can be positioned as far away from housing as practicable.
    g. Where possible, use low-noise plant. Any unsuitable plant should be replaced by higher quality low noise plant or contained by the use of mufflers/silencers.
    h. Do not leave equipment or vehicles running/idling unnecessarily.
    i. Do not shout work instructions when working in residential areas at night unless absolutely necessary.
    j. Plan effectively to ensure timely deliveries of materials.

The following sections outline additional detail with regards noise and vibration mitigation during construction.

14.6.1.1 Communication with Neighbours

The Contractor will be proactive in engaging with the occupants of neighbouring properties in relation to individual and particular concerns that may arise and will notify them of any works forecast to generate appreciable levels of noise, explaining the nature and duration of the works

A designated noise liaison will be appointed by the contractor for the duration of the construction works. This person will log any issues and follow up in a prompt fashion.

Night-works in particular have the potential to generate the most significant noise effects. All affected sensitive locations will be notified of planned works in advance of the works progressing. The notification will include a description of the works, the expected duration and details of how to contact the contractor to log complaints.

14.6.1.2 Noise & Vibration Monitoring

The following ongoing noise monitoring programme is proposed in relation to demolition and construction activities:

Noise Monitoring Terminals (NMT), number and locations to be agreed with the relevant local authority, 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 will 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, mounting conditions should have consideration to the following:

- 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.
- The monitoring equipment should be set to monitor vibration in 5 minute periods.
- E-mail alert on threshold exceedance to the relevant members of the construction team.
- E-mail alert on low battery and low memory.
- Remote access to measured data.
- Live display of vibration levels.

In addition, it is proposed that spot check noise and vibration measurements are conducted on a regular basis to be determine based upon the type and duration of the construction activity. These spot checks can be organized 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 effects.

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

14.6.1.3 Noise Control Audits

It is proposed that noise control audits be conducted at regular intervals throughout the construction programme.

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 will 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.

14.6.1.4 Hours of Work

Where practicable all construction activities will be undertaken during daytime working hours. However, to ensure the continued safe operation of the existing railway services and of the construction operatives, the majority of on track construction works along the railway line itself will take place at night. Works outside of the live railway corridor can progress during the day (i.e. the construction of depots, substations, Construction Compounds), and every effort will be made to minimise night-time activities and avoid, reduce, and/or mitigate negative effects.

Consideration will 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.

14.6.1.5 Selection of Quiet Plant

Careful consideration will be given to the noise emission levels of plant items when they are being considered for use on the site. This practice is proposed in relation to sites with static plant such as compressors and generators. It is proposed that these units be supplied with manufacturers’ proprietary acoustic enclosures where possible. 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 should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

14.6.1.6 Control of Noise Sources

If the use of low noise plant or replacing a noisy item of plant are not viable or practicable options, consideration should 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, often in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

BS5228 states that "as far as reasonably practicable sources of significant noise should be enclosed". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures that could be moved around site as necessary may also be used to screen operatives using hand tools such as angle grinders.

BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are relevant and hence are reproduced below. These proposals will be implemented on the site.

> "*Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas.*
>
> *Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.*
>
> *Machines such as cranes that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.*
>
> *Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.*
>
> *Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.*
>
> *Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material.*"

The following outline guidance in relation to specific considerations is provided below:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can

reduce noise levels by up to 10 dB. 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 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.
- For percussive tools such as pneumatic concrete breakers, rock drills and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed. Erect localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries.
- For all materials handling ensure that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials.
- For compressors, generators and pumps, these can be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation.
- 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.
- Where practicable, metal on metal or rock on metal impacts will be avoided during night works. This can be achieved through the use of rubber mallets or impact linings etc. on site.
- White noise reverse alarms will be utilised on vehicles where practicable to reduce potential annoyance of tonal noise emissions from site.

14.6.1.7 Screening

The use of screens can be effective in reducing the noise level at a receiver location and will be employed as a complementary measure to all other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver. The height and length of any screen will, where practicable, be such that there is no direct line of sight between the source and the receiver.

BS5228 states that on level sites the screen will be placed as close as possible to either the source or the receiver. The construction of the screen 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 barrier rather than the transmission through the barrier itself. Screens constructed of materials with a surface mass greater than 10kg/m typically offer adequate sound insulation performance.

Annex B of BS5228 (Figures B1, B2 and B3) provides typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials. BS5228 Figure B2 is included here for information purposes.

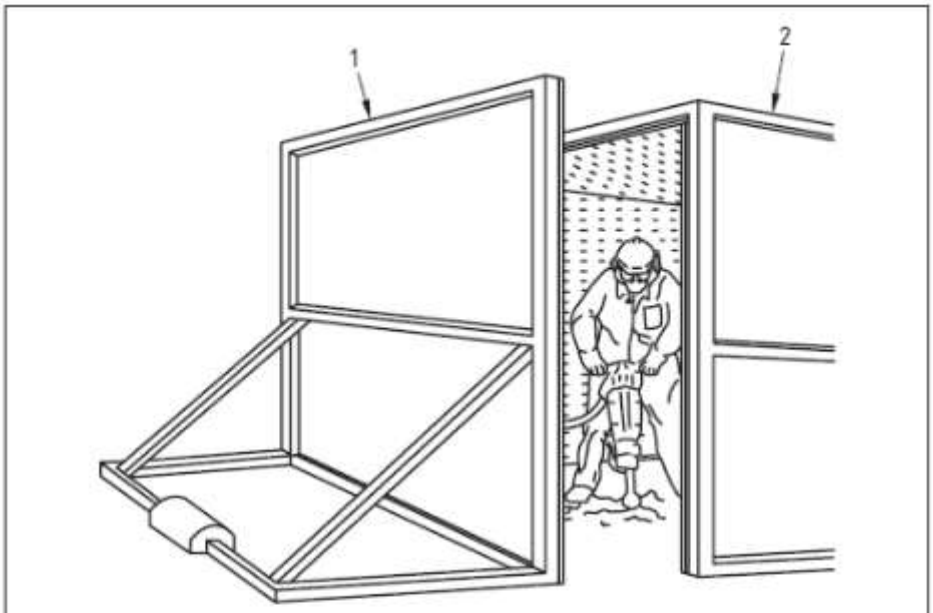

Table B.4 **Measured sound reduction given by types of partial enclosure**

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

Image 14-3 Typical acoustic screen/shed detail.

It is acknowledged that for some worksites it will not be practicable to install localised screens due to the constrained nature of the work area. However, where practicable screens will be installed by the contractor.

In locations where significant effects from construction noise are likely to occur, the contractor will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so they will continue to engage with stakeholders to understand their concerns and the benefit that can be achieved by the mitigation measures.

14.6.1.8 Vibration

The vibration from construction activities will be limited to the values set out within Section 14.3.6.3. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Limit values have been provided for the following building types:

- Soundly constructed residential and commercial properties.

- Protected structures and sensitive buildings such as those with no or minimal foundations.

Consideration will be given to the following methods to further mitigate the vibration levels from bored piling:

- Minimise obstructions between the vibration source and the sensitive receiver, e.g. old basement floors, old foundations etc., which exacerbate the transmission of vibration.
- Reduce the resistance to bored piles by “mudding in”. This technique involves lubricating the borehole with a small amount of bentonite slurry.

14.6.1.9 Piling

Piling programmes will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity.

During the construction planning stage the contractor and engineer, as well as the client, will be made aware of the proposed method of working of the piling contractor. The piling contractor will 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. Steel driven piles can utilise acoustic wrapping mitigation to reduce noise levels at source.

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 will 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 will be taken in location, having due regard also for access routes. When appropriate, screens or enclosures will 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 will be switched off (or during short breaks from duty reduced to idling speed) when not in use.

All mechanical plant will be well maintained throughout the duration of the piling works. To minimise noise impacts at sensitive receptors, piling works will be managed in accordance with the project criteria where works durations will not exceed:

- Ten or more days or nights in any 15 consecutive days or nights; and
- A total number of days exceeding 40 in any six consecutive months.

14.6.1.10 OHLE specific mitigation

There is the potential for significant adverse noise and vibration impacts to arise during the catenary system installation due to the piling requirement, the nighttime nature of the works and the proximity of sensitive receptors. In accordance with the criteria noise impacts shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- Ten or more days or nights in any 15 consecutive days or nights; and
- A total number of days exceeding 40 in any six consecutive months.

As the works are of a brief duration and will move linearly along the track, it is not expected that these durations will be exceeded, i.e. no moderate or major impacts will arise for a duration greater than the periods defined. In addition, the screening of the installation works will be implemented to minimise the noise impacts at sensitive receptors.

14.6.1.11 Eligibility of Temporary Accommodation

Given the proximity of construction activity to some noise sensitive locations and the occasional intensity of works, the mitigation measures proposed may not be sufficient to fully mitigate the noise impact. Temporary accommodation will be offered to eligible owners/occupiers where the construction of the Proposed Development causes, or is expected to cause, a measured or predicted airborne construction noise level that exceeds either of the following at property lawfully occupied as a permanent dwelling:

- A noise level 10 dB above any of the trigger noise levels presented in Table 14-4 (in Section 14.3.6.2) for the corresponding times of day;
- A noise level 10 dB or more above the existing pre-construction ambient noise level for the corresponding times of day; and
- Whichever level is the higher; and for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

14.6.2 Operational Phase

14.6.2.1 Noise barriers

The operational railway is not predicted to result in any significant operational noise effects; therefore, no noise barriers are proposed.

14.6.2.2 Depot noise sources

The railway depot is not predicted to result in any significant operational noise effects; therefore, no noise mitigation is proposed.

14.6.2.3 Maintenance

During the course of ongoing maintenance, the procedures outlined in Iarnród Éireann operation procedure CCE-QMS-008-002 Noise Management – CCE Activities will be implemented. This document outlines the following noise mitigation measures:

- The Community Liaison Officer (or other nominated person) will notify affected residents in advance of any planned works commencing with a letter drop in the relevant area.
- Where planned work occurs over a 72hr weekend shutdown there will be a noise management plan submitted to the local authority.
- All attempts to avoid, prevent or reduce the harmful effects of exposure to environmental noise.
- arising from CCE work activities must be practical and appropriately risk assessed before
- implementation.
- The following measures should be implemented where feasible during maintenance activities:
    - Carry out as much preparatory work in daylight as possible (sawing or drilling rails).
    - Inspect the worksite in daylight if possible and look for the best location to position generators.
    - Position generators and lighting away from residential dwellings.
    - Take advantage of natural barriers such as vegetation, walls or embankments that can offer noise screening to adjacent neighbours.
    - Where necessary, use noise attenuation screens. The screens must be located as close to the receiver or source as possible.
    - Consider using additional supply cables and structures so that the generators can be positioned as far away from housing as practicable.
    - Where possible, use low-noise plant. Any unsuitable plant should be replaced by higher quality low noise plant, or contained by the use of mufflers/silencers.
    - Do not leave equipment or vehicles running/idling unnecessarily.
    - Do not shout work instructions when working in residential areas at night unless absolutely necessary.
    - Plan effectively to ensure timely deliveries of materials.

14.6.2.4 Public Alarm systems

Iarnród Éireann (IÉ) has a standard procedure for the design of station services which includes a procedure for the design of PA systems. Section 5 of Iarnród Éireann Standard I-TEL-3930 Station Services – Design, Install and Commission requires the use of Ambient Noise Sensors to ensure the normal output volume is an average of 10dB(A) above recorded background levels in the station. Considering these mitigation measures, PA system overspill is not expected to result in significant adverse effects.

14.6.2.5 Substations and fixed plant

The operational substations and fixed plant are not predicted to result in any significant operational noise effects; therefore, no noise mitigation is proposed.

14.7 Residual Effects

14.7.1 Construction Phase

14.7.1.1 Construction Noise

The effects per Zone are as follows:

Zone A

Zone A works will include internal modifications to Fairview depot as well as other site-wide works. The resultant residual effects for Zone A will likely be negative, not significant and short-term.

Zone B

Zone B works will include Howth Junction and Donaghmede Station Works, Clongriffin Station track works, construction of UBB19C, New Malahide Turnback, modification of UBB30 Malahide Viaduct, and XB001 user worked level crossing closure. The noise effect is expected to be significant at a number of locations within Zone B where major works occur. The resultant residual effects for Zone B will likely be negative, moderate to significant and temporary to short-term.

Zone C

Zone C works will include parapet modifications, track/bridge lowering, substation constructions. The majority of works are expected to cause a moderate effect, however depending on the receptor distance to the work and the activity being undertaken there will be some significant effects. The resultant residual effects for Zone C will likely be negative, moderate to significant and temporary to short-term.

Zone D

Zone D works will include new substation construction, viaduct/parapet modifications and track lowering works. The works are expected to cause a significant effect where works take place in proximity to sensitive receptors. Following the implementation of mitigation, the resultant residual effects for Zone D will likely be negative, moderate to significant and temporary to short-term.

Zone E

Zone E works will include construction of replacement infrastructure, bridge reconstruction and substation constructions. Where works occur in proximity to sensitive receptors, the resultant residual effects for Zone E will likely be negative, moderate to very significant and temporary to short-term.

Given the proximity of construction activity to some noise sensitive locations, the mitigation measures proposed may not be sufficient to fully mitigate the noise impact. Temporary accommodation will be offered to eligible owners/occupiers where the criteria in Table 14-4 as presented in Section 14.3.6.2 are met.

14.7.1.2 Construction Vibration

The residual effects of vibration during the Construction Phase will be negative, slight to moderate and brief to temporary depending on location. All construction activity will be carried out within the vibration thresholds specified, noting in particular the lower values that apply to more sensitive or protected structures.

14.7.1.3 OHLE specific residual impacts

The implementation of mitigation measures and the limited duration of the works will ensure that no significant adverse noise and vibration impacts arise in proximity.

14.7.2 Operational Phase

14.7.2.1 Railway noise

No significant noise impacts associated with the operation of the railway have been identified; therefore, no residual significant railway noise effects are predicted.

14.7.2.2 Railway vibration

No significant vibration impacts associated with the operation of the railway have been identified; therefore, no residual significant railway vibration effects are predicted.

14.7.2.3 Depot noise sources

No significant depot noise impacts associated with the operation of the depot have been identified; therefore, no residual significant depot noise effects are predicted.

14.7.2.4 Public address systems

No significant airborne noise impacts associated with the operation of the PA systems have been identified; therefore, no residual significant PA noise effects are predicted.

14.7.2.5 Substation and fixed plant

No significant airborne noise impacts associated with the operation of fixed plant have been identified; therefore, no residual significant fixed plant noise effects are predicted.

14.8 Cumulative Effects

14.8.1 Construction noise and vibration

The list of committed developments assessed for cumulative effects is presented in Chapter 26 (Cumulative Effects) in Volume 2 of this EIAR. There is the potential for additional significant construction noise and vibration[8] impacts to arise due to the cumulative construction of the Proposed Development and other major schemes. However, it is assumed that major schemes are likely to be subject to EIA and/or require the preparation of scheme specific CEMPs. The preparation of such documentation will ensure impacts associated with those schemes are minimised. Furthermore, liaison will be required with representatives of adjacent major scheme on a number of issues, and these discussions will include management of construction activities. Through liaison and the implementation of mitigation measures will ensure that any potential significant adverse impacts are minimised.

14.8.2 Operational noise and vibration

The list of committed developments assessed for cumulative effects is presented in Chapter 26 (Cumulative Effects) in Volume 2 of this EIAR. The committed developments are expected to include noise control required by local authorities. Therefore, noise emissions associated with nearby committed developments are unlikely to result in a significant cumulative effect with the Proposed Development.

Noise emissions associated with stationary sources of the depot such as the train wash and wheel lathe are likely to be controlled such that they do not result in a noise increase compared to the Do Minimum scenario. Noise from these sources is unlikely to result in a significant cumulative effect with the Proposed Development.

[8] The likelihood of cumulative vibration impacts is very low, given the limited works result in material vibration levels, the short impact distances, and phasing of the vibration activities.

14.9 References

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BS 4142 (2014+A1 2019) Methods for rating and assessing industrial and commercial sound (hereafter referred to as BS 4142) (BSI 2014 +A1 2019);

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