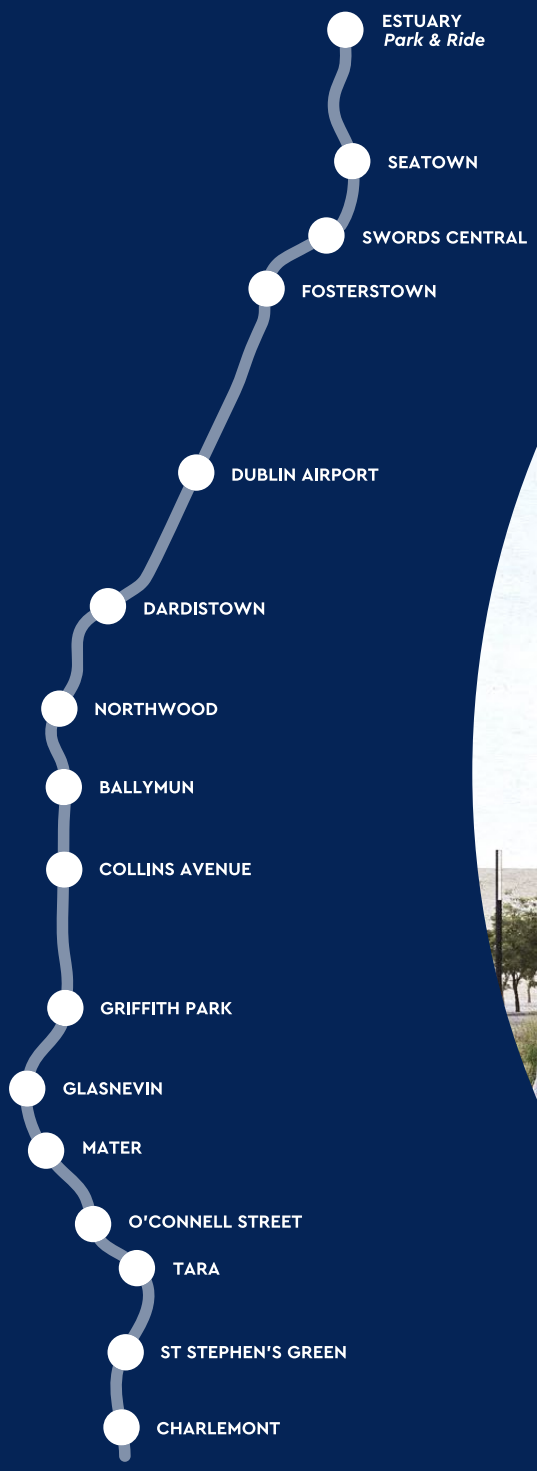


13 Airborne Noise and Vibration

Contents

List of Abbreviations

Acronym	Meaning
AADT	Annual Average Daily Traffic
ANC	Association of Noise Consultants
ATW	Automatic Train Wash
BNL	Basic Noise Level (Calculation)
BS	British Standard
BSI	British Standards Institute
CEMP	Construction Environmental Management Plan
CIE	Córas Iompair Éireann
CNL	Construction Noise Level
CNT	Construction Noise Thresholds
CRTN	Calculation of Road Traffic Noise
DAA	Dublin Airport Authority
DANP	Dublin Airport North Portal
DASP	Dublin Airport South Portal
DCC	Dublin City Council
DCU	Dublin City University
DLRCC	Dún Laoghaire Rathdown County Council
DMRB	Design Manual for Roads and Bridges
D-Walls	Diaphragm Walls
EC	European Communities
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ERM	Eastern Regional Model
ESBN	Electricity Supply Board Networks
EU	European Union
FCC	Fingal County Council
GDA	Greater Dublin Area
HGV	Heavy Goods Vehicle
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
LGV	Large Goods Vehicle
MEP	Mechanical Electrical Plumbing
NDC	North Dublin Corporate Park
NI	Noise Insulation
NSL	Noise Sensitive Location
NTA	National Transport Authority
NVMCP	Noise and Vibration Management and Control Plan
OCC	Operational Control Centre
OHLE	Overhead Line Equipment
PA	Public Address

Acronym	Meaning
PPV	Peak Particle Velocity
RMR	Reken- en Meetvoorschrift Railverkeerslawaai
RO	Railway Order
SCL	Sprayed Concrete Lining
SDCC	South Dublin County Council
STMP	Scheme Traffic Management Plan
TBM	Tunnel Boring Machine
TII	Transport Infrastructure Ireland
TRL	Transport Research Laboratories
TSI	European Standard for safety in railway tunnels
UKHA	UK Highways Agency
VDV	Vibration Dose Value
VRV	Variable Refrigerant Volume
WHO	World Health Organisation

13. Airborne Noise and Vibration

13.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) assesses the impact of the MetroLink Project (hereafter referred to as the proposed Project), on airborne noise and vibration during the Construction Phase and Operational Phase.

This chapter describes and assesses the likely direct and indirect significant effects of the proposed Project on airborne noise and vibration, in accordance with the requirements of Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (i.e. the EIA Directive) (European Union 2014a).

The assessment of noise and vibration of the proposed Project is separated into two EIAR Chapters. This chapter considers airborne noise and vibration, and Chapter 14 considers Groundborne Noise & Vibration. Further clarification on the specific areas assessed under each chapter are described in Table 13.4 in Section 13.2.3.

This Chapter should be read in conjunction with the following Chapters, and their Appendices, which present related impacts arising from the proposed Project and proposed mitigation measures to ameliorate the predicted impacts:

- Chapter 9 (Traffic & Transport);
- Chapter 10 (Human Health);
- Chapter 11 (Population & Land Use);
- Chapter 14 (Groundborne Noise & Vibration);
- Chapter 15 (Biodiversity); and
- Chapter 27 (Landscape & Visual).

Limits of deviation have been set for the proposed Project and this is addressed in the Wider Effects Report annexed at Appendix A5.19.

The assessment is based on identifying and describing the likely significant effects arising from the proposed Project as described in Chapters 4 to 6 of this EIAR. The proposed Project 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.

Where it is required to make assumptions as the basis of the assessment presented here, these assumptions are based on advice from competent project designers and are clearly outlined within the Chapter.

13.1.1 Structure of Chapter

For ease of reference, the relevant sections dealing with airborne noise and vibration impacts of the proposed Project during the Construction and Operational phases are summarised in Table 13.1.

Table 13.1 Chapter Sections References

Element	Study Area/Data Collection Summary	Analysis Methods	Appraisal Method for Assessment of Impacts	Predicted Impacts	Mitigation Measures	Residual Impacts
Baseline Environment	Section 13.2.4 Includes a summary of the data	Appendix A13.1 and Appendix A13.2 include the noise and	n/a	n/a	n/a	n/a

Element	Study Area/Data Collection Summary	Analysis Methods	Appraisal Method for Assessment of Impacts	Predicted Impacts	Mitigation Measures	Residual Impacts
	sources used to characterise the baseline noise and vibration environment.	vibration survey dates, methodologies and results Description of the baseline environment and survey results are summarised in Section 13.3				
Construction Phase	Section 13.2.3.1 defines the study area for the construction phase for each assessment zone and identifies the sensitive locations in these study areas	Section 13.2.5.1 discusses the methodologies used to calculate construction noise and vibration impacts	Section 13.2.6.1 discusses the criteria used to assess the significance of effects associated with Construction Phase impacts	Section 13.5.2 presents the key noise and vibration impacts associated with the Construction Phase of the proposed Project across the four assessment zones.	Section 13.6.1 discusses the mitigation measures along the proposed Project for the Construction Phase	Section 13.7.1 summarises the residual noise and vibration impacts associated with the Construction Phase following the implementation of mitigation measures and sets out the approach for dealing with potential residual significant effects
Operational Phase	Section 13.2.3.2 defines the study area for the construction Phase for each assessment zone and identifies the sensitive locations in these study areas	Section 13.2.5.2 discusses the methodologies used to calculate operational noise and impacts	Section 13.2.6.2 discusses the criteria used to assess the significance of effects associated with Operational Phase impacts	Section 13.5.3 presents the key noise impacts associated with the Operational Phase of the proposed Project	Section 13.6.2 Discusses the identified noise mitigation measures required for the Operational Phase	Section 13.7.2 summarises the residual noise impacts associated with the Operational Phase following mitigation.

13.1.2 Outline Project Description

A full description of the project is provided in the following chapters of this EIAR:

- Chapter 4 (Description of the MetroLink Project);
- Chapter 5 (MetroLink Construction Phase); and
- Chapter 6 (MetroLink Operations & Maintenance).

Table 13.2 presents an outline description of the key Project elements, Diagram 13.1 presents an outline of the main elements of the proposed Construction Phase, Diagram 13.2 presents an outline of the main elements of the Operational Phase.

Table 13.2 Outline Description of the Principal Project Elements

Project Elements	Outline Description	Airborne Noise and Vibration Considerations
Permanent Project Elements		
Tunnels	It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have an 8.5m inside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows: ▪ The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and ▪ The City Tunnel: running for 9.4 km from Northwood Portal and terminating underground south of Charlemont Station.	n/a
Cut Sections	The northern section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with fences along the alignment for safety and security. While other sections are "cut and cover", whereby the alignment is covered.	Construction activities associated with construction of the retained cut and cut and cover sections are assessed as part of the Construction Phase Impact assessment. Airborne rail noise along the open cut sections of rail is assessed as part of the Operational Phase impact assessment.
Tunnel Portals	The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface. There are three proposed portals, which are: ▪ DANP; ▪ DASP; and ▪ Northwood Portal. There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground.	Surface works at tunnel portals are assessed as part of the Construction Phase noise and vibration Impact assessment
Stations	There are three types of stations: surface station, retained cut stations and underground stations: ▪ Estuary Station will be built at surface level, known as a 'surface station'; ▪ Seatown, Swords Central, Fosterstown Stations and the proposed Dardistown Station will be in retained cutting, known as 'retained cut stations'; and ▪ Dublin Airport Station and all 10 stations along the City Tunnel will be 'underground stations'.	Construction activities associated with construction of all station types are assessed as part of the Construction Phase Impact assessment. Airborne rail noise along the surface and retained cut stations are assessed as part of the

Project Elements	Outline Description	Airborne Noise and Vibration Considerations
		Operational Phase impact assessment. Ventilation Noise and PA system from each station are also addressed within this chapter.
Intervention Shaft	An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to 'safety in railway tunnels' of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m. As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel. At other locations, emergency access will be incorporated into the stations and portals or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required.	Surface works required to construct the ventilation shaft are assessed as part of the Construction Phase noise and vibration Impact assessment. Ventilation Noise from the shaft once operational is also addressed within this chapter.
Intervention Tunnels	In addition to the two main 'running' tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels): ▪ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands. ▪ Charlemont Intervention Tunnel: The City Tunnel will extend 360m south of Charlemont Station. A parallel 300m evacuation and ventilation tunnel is required from the end of the City Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.	Surface works required to construct the intervention tunnels are assessed as part of the Construction Phase noise and vibration Impact assessment.
Park and Ride Facility	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.	Surface works required to construct the park and ride facility are assessed as part of the Construction Phase noise and vibration Impact assessment. Traffic noise and day to day activities associated with the Park and Ride facility are assessed as part of the Operational Phase impact assessment.

Project Elements	Outline Description	Airborne Noise and Vibration Considerations
Broadmeadow and Ward River Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations to cross the Broadmeadow and Ward Rivers and their floodplains.	Surface works required to construct the park and ride facility are assessed as part of the Construction Phase noise and vibration Impact assessment Airborne rail noise along viaduct is assessed as part of the Operational Phase impact assessment.
ESBN Substation and Grid Connections	Grid connections will be provided via cable routes with the addition of new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately but are assessed in the EIAR).	Surface works required to construct the ESBN substation and grid connections are assessed as part of the Construction Phase noise and vibration Impact assessment. Operational noise associated with the ESBN Substation is assessed as part of the Operational Noise impact assessment.
Dardistown Depot	A maintenance depot will be located at Dardistown. It will include: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding system for rolling stock; ▪ The Operations Control Centre for the proposed Project; ▪ A substation; ▪ A radio mast; and ▪ Other staff facilities and a carpark.	Surface works required to construct the Dardistown Depot are assessed as part of the Construction Phase noise and vibration Impact assessment. Operational noise associated with the maintenance depot is assessed as part of the Operational Noise impact assessment
Operations Control Centre	The main Operations Control Centre (OCC) will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.	
M50 Viaduct	A 100m long viaduct to carry the proposed Project across the M50 Motorway between the Dardistown Depot and Northwood Station.	Surface works required to construct the M50 Viaduct are assessed as part of the Construction Phase noise and vibration Impact assessment Airborne rail noise along viaduct is assessed as part of the Operational Phase impact assessment.
Temporary Project Elements		
Construction Compounds	There will be 34 construction compounds including 20 main construction compounds, 14 Satellite construction compounds required during the Construction Phase of the proposed Project. The main construction compounds will be located at each of the proposed station locations, the portal	Construction compound and logistic site activities form part of the Construction Phase noise and vibration Impact assessment

Project Elements	Outline Description	Airborne Noise and Vibration Considerations
	locations and the Dardistown Depot Location (also covering the Dardistown Station) with satellite compounds located at other locations along the alignment. Outside of the construction compounds there will be works areas and sites associated with the construction of all elements of the proposed Project including an easement strip along the surface sections.	
Logistics Sites	The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound. (These areas are included within the 14 Satellite construction compounds).	
Tunnel Boring Machine Launch Site	There will be two main tunnel boring machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.	Surface works at the TBM launch sites are assessed as part of the Construction Phase noise and vibration Impact assessment

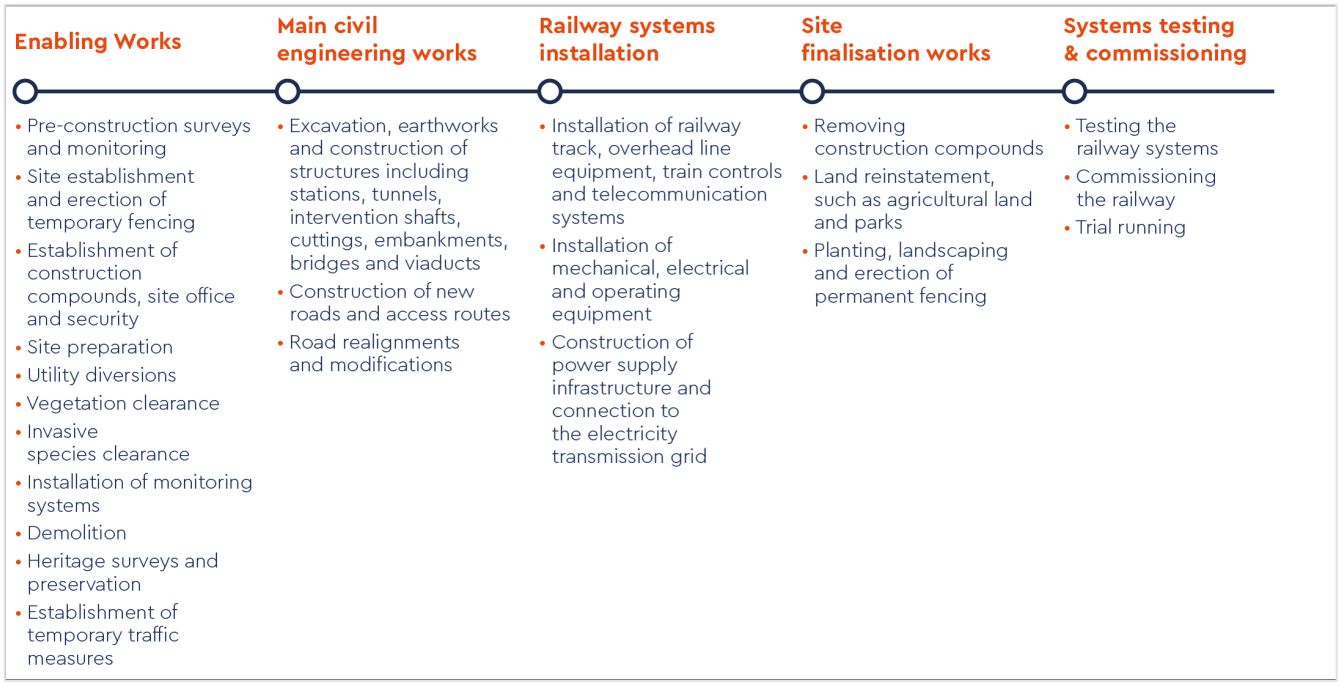


Diagram 13.1: Summary of Key Activities during the Construction Phase of the proposed Project

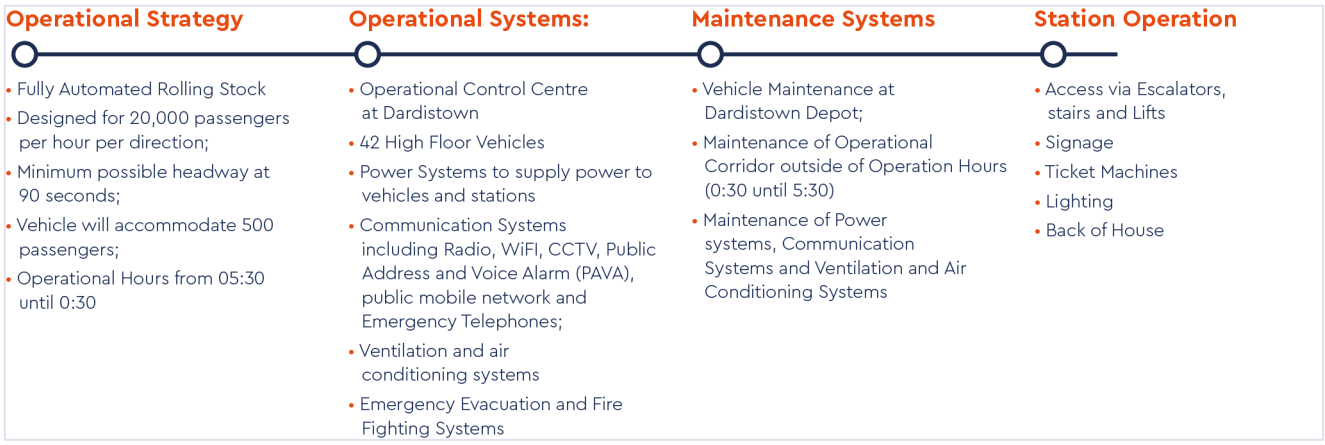


Diagram 13.2: Summary of Key Activities during the Operation Phase of the proposed Project

13.2 Methodology

13.2.1 Overview

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out in the following sections.

The assessment has been undertaken using the following methodology which is expanded on within the relevant section of this chapter dealing with each element:

- A detailed baseline noise study has been undertaken to characterise the existing noise environment at areas most likely to be affected by airborne noise associated with the proposed Project;
- Baseline vibration surveys have been undertaken at locations which are likely to be affected by the proposed Project which are in proximity to existing vibration sources; in particular, existing rail lines;
- A review of the most applicable standards and guidelines has been reviewed in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed Project;

- Predictive calculations relating to potential Construction Phase impacts for noise have been undertaken at the nearest sensitive locations to above ground construction work areas associated with the proposed Project;
- Predictive calculations have been performed to assess the potential impacts associated with above ground noise sources associated the Operational Phase of the proposed Project at the most sensitive locations, and;
- A schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential airborne impacts relating to noise and vibration from the proposed Project.

13.2.2 Relevant Guidelines, Policy and Legislation

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out in the following sections. In addition to specific noise and vibration guidance documents, the following guidelines were considered and consulted in the preparation of this chapter:

- Environmental Protection Agency (EPA) Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as 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 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:

- Association of Noise Consultants (ANC) Measurement and Assessment of Groundborne Noise and Vibration. (ANC, 2020);
- British Standard Institute (BSI) British Standard (BS) 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228 – 1) (BSI 2009 +A1 2014a);
- BS 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228 – 2) (BSI 2009 +A1 2014b);
- BS 7385 (1993) Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as BS 7385 – 2). (BSI 1993);
- BS 6472 (2008) Guide to Evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting (hereafter referred to as BS 6472 – 1). (BSI 2008);
- BS 8233:2014 Sound Insulation and Noise Reduction for Buildings (hereafter referred to as BS 8233 (BSI 2014);
- BS 4142 (2014+A1 2019) Methods for rating and assessing industrial and commercial sound (hereafter referred to as BS 4142) (BSI 2014 +A1 2019);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2, (hereafter referred to as DMRB Noise and Vibration) (UKHA 2020);
- Dublin Local Authorities including Dublin City Council (DCC), Fingal County Council (FCC), South Dublin County Council (SDCC) and Dún Laoghaire Rathdown County Council (DLRCC). Dublin Agglomeration Third Environmental Noise Action Plan December 2018 – November 2023 (hereafter referred to as the Dublin Agglomeration NAP 2018 – 2023) (DCC; FCC; SDCC; DLRCC 2018);
- European Communities (EC) (Environmental Noise) Regulations 2018 (S.I. No. 549 / 2018);
- EC (Environmental Noise) Regulations 2006 (S.I. No. 140/2006);
- EC Noise Emission by Equipment for Use Outdoors (Amendment) Regulations (S.I. No. 241 / 2006);
- International Organization for Standarization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation (hereafter referred to as ISO 9613 – 2) (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);
- Transport Infrastructure Ireland (TII) Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1 (hereafter referred to as the TII Noise Guidelines 2004) (TII 2004);
- Transport Infrastructure Ireland (TII) Code of engineering practice for works on, near, or adjacent the Luas light rail system (TII 2016);
- Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (hereafter referred to as the TII Noise Guidelines 2014) (TII 2014);
- 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) (Hereafter referred to as RMR) (Dutch Housing, Spatial Planning and the Environment 1996);
- The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as CRTN) (UK Department of Transport 1998); and
- World Health Organization (WHO) Environmental Noise Guidelines for the European Region (hereafter referred to as WHO Environmental Noise Guidelines) (WHO 2018).

13.2.3 Study Area

The proposed Project covers an extensive linear study area between Estuary and Charlemont via Dublin City Centre. The study area for the EIAR is split between four distinct assessment zones AZ1 to AZ4 as described in Table 13.3.

Table 13.3 Geographical Split of Assessment Zones

Reference	Geographical Split	Description of Extent of Geographical Section
AZ1	Northern Section	Estuary Station to DANP. It includes the rail line crossing on viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut and cut-and-cover sections. Section AZ1 includes the Park and Ride Facility at Estuary Station as well as stations at Seatown, Swords Central and Fosterstown.
AZ2	Airport Section	Section AZ2 of the proposed Project includes the ESBN connection and new substation, the DANP, the tunnel underneath Dublin Airport, Dublin Airport Station and DASP and associated intervention and ventilation tunnels.
AZ3	Dardistown to Northwood	Section AZ3 of the proposed Project covers from south of DASP to the Northwood Portal. Section AZ3 includes Dardistown station, the Dardistown Depot, the M50 Viaduct, Northwood station and the TBM launch site at Northwood. This section will include open, retained cut, and cut and cover sections of the alignment.
AZ4	Northwood to Charlemont	Section AZ4 extends from a location south of the Northwood Portal to the tunnel termination located south of Charlemont Station, nine underground stations, and the Albert College Park Intervention shaft.

As noted in Section 13.1, the assessment of noise and vibration from the project is separated into two EIAR Chapters. This chapter considers airborne noise and vibration, and Chapter 14 considers Groundborne Noise & Vibration. Table 13.4 outlines the various sources of noise and vibration and which chapter presents the corresponding assessment within each of the four assessment zones.

Table 13.4: Noise Sources and Assessment Chapter

Construction Phase	**AZ1**	**AZ2**	**AZ3**	**AZ4**
Airborne noise Chapter 13 of EIAR	Estuary Park & Ride Cut and Cover Above ground track laying Stations and platforms Construction compounds Utility diversion works Construction traffic	DANP Dublin Airport station DASP Utility diversion works Construction of intervention and ventilation and tunnel Construction traffic	Dardistown Depot Dardistown Station M50 Viaduct Above ground track laying Northwood TBM launch site compound Northwood station Construction traffic	Station box's Heavy rail interchange and rail realignment works at Glasnevin Intervention shaft at Albert Park College Park Utility diversion works Construction of intervention tunnel at Charlemont Construction traffic haul routes
Groundborne noise Chapter 14 of EIAR	n/a	Tunnelling using TBM	n/a	Tunnelling using TBM
		Mechanical excavation using road header		Mechanical excavation using road header
		Blasting (Air overpressure)		Blasting (Air overpressure)
Operation Phase	**AZ1**	**AZ2**	**AZ3**	**AZ4**
Airborne noise Chapter 13 of EIAR	Above ground sub stations			
	Road traffic			
	Surface and retained cut stations	Ventilation systems serving underground stations and intervention shafts	Dardistown station and depot Overground airborne railway noise	Ventilation systems serving underground stations and intervention shafts
	Overground airborne railway noise			
	Park and Ride			
Groundborne Noise Chapter 14 of EIAR	Train operation groundborne noise			

Table 13.5: Vibration Sources and Assessment Chapter

Construction Phase	AZ1	AZ2	AZ3	AZ4
Vibration Chapter 13 of EIAR	Ground Breaking/Excavation Demolition	Ground Breaking/Excavation Demolition	Ground Breaking/Excavation Demolition	Ground Breaking/Excavation Demolition
Vibration Chapter 14 of EIAR	Secant piling along R132	Tunnelling using TBM	n/a	Tunnelling using TBM
		Mechanical excavation using road header		Mechanical excavation using road header
		Blasting		Blasting
Operation Phase	**AZ1**	**AZ2**	**AZ3**	**AZ4**
Vibration Chapter 13 of EIAR	n/a			
Vibration Chapter 14 of EIAR	Train operational vibration			

The study area for potential airborne noise and vibration impacts varies between the Construction and Operational Phase within each section. The key study areas for both phases are described below.

13.2.3.1 Study Area Construction Phase

From an airborne noise and vibration point of view, the key study areas during the Construction Phase include all surrounding sensitive environments to surface construction compounds. This broadly includes noise and vibration sensitive areas adjacent to the Park and Ride Facility, tunnel portals, station boxes, intervention and ventilation shafts, construction compounds, aboveground track, stations and platforms, and construction of ancillary structures (bridges and maintenance depots) and utility works. Noise impact associated with construction traffic along the designated haul routes and surrounding road network is also assessed as part of the study area for this phase of the works.

For the Construction Phase, this study area covers a considerable geographical area in close proximity to high density sensitive residential, educational, amenity, religious and commercial receptors. Depending on the sources in question and the local area under consideration, the study area extends out to between 50m from construction works to 300m from construction works. All impacts discussed in this chapter relate to human receptors. Construction Phase on sensitive ecological receptors are discussed in Chapter 15 (Biodiversity). An outline of the study area is set out below as relevant to the assessment zones AZ1 - AZ4. Construction noise assessment locations across AZ1 to AZ4 are displayed in Figure 13.2.

13.2.3.1.1 AZ1 Northern Section

The AZ1 assessment zone includes construction of the Estuary Park and Ride Facility, station and ancillary infrastructure at Estuary, construction of the aboveground rail system between Estuary Station (along a mixture of surface section, viaduct, retained cut and cut and cover sections) rail stations and platforms, construction compounds and construction of ancillary structures (bridges/structures). In addition, a number of utility diversion works will be required at each of the main work areas. Noise sensitive locations (NSLs) in this assessment zone include residential dwellings to the east and west of the R132 between Estuary and Fosterstown Stations, schools, pre-schools, creches, hotels, retreat centres and offices in proximity to these work areas. The closest sensitive buildings within this assessment zone to above ground noise and vibration sources are along the R132 Swords Bypass at Seatown West, Estuary Court, Swords Business Park, Ashley Avenue, Lakeshore Drive, Swords Veterinary Hospital and residential properties within Nevistown West, which are located within 50m of the working areas. The

closest commercial buildings are the Woodies retail unit and the Hertz Europe Service Centre along the R132 Road at Seatown. The extent of the study area is typically up to 300m from each construction areas with a focus on sensitive receptors within 100m of construction areas which are those most impacted by the works based on modelling results. Beyond 300m most NSLs are substantially screened by construction works by intervening buildings and construction noise levels are well below the construction noise and vibration threshold values and are therefore not assessed beyond this distance. Notwithstanding, each construction work area is considered on its own merits depending on the proximity and sensitivity of noise and vibration sensitive areas and the specific works involved. The construction assessment locations within AZ1 are displayed in Figure 13.2, Sheets 1 to 8.

13.2.3.1.2 AZ2 Airport Section

The AZ2 assessment zone includes construction of the DANP, Dublin Airport Station and the DASP. In addition, a number of utility diversion works will be required at each of the main work areas. Noise sensitive locations within this study area include office and hotel buildings within Dublin Airport, Our Lady Queen of Heaven Church at Dublin Airport and residential buildings along the Old Airport Road. The extent of the study area is typically up to 300m from each construction area with a focus on sensitive receptors within 100m of construction areas which are those most impacted by the works based on modelling results. Beyond 300m most NSLs are substantially screened by construction works by intervening buildings and construction noise levels are well below the construction noise and vibration threshold values and are therefore not assessed beyond this distance. The construction assessment locations within AZ2 are displayed in Figure 13.2, Sheets 8 to 14.

13.2.3.1.3 AZ3 Dardistown to Northwood

The AZ3 assessment zone includes construction activities within the Dardistown Depot and Station, M50 Viaduct and the construction compound at Northwood TBM Launch site and Northwood Station. Noise sensitive locations in this study area include residential buildings along the Old Airport Road, at Ballymun Cross immediately south of the M50 Motorway, along the R108 Ballymun Road and residential buildings within Ballymun North. The extent of the study area is typically up to 300m from each construction area with a focus on sensitive receptors within 100m of construction areas which are those most impacted by the works based on modelling results. Beyond 300m most NSLs are substantially screened by construction works by intervening buildings and construction noise levels are calculated below the construction noise and vibration threshold values and are therefore not assessed beyond this distance. Notwithstanding, each construction work area is considered on its own merits depending on the proximity and sensitivity of noise and vibration sensitive areas and the specific works involved. The construction assessment locations within AZ3 are displayed in Figure 13.2, Sheets 14 to 16.

13.2.3.1.4 AZ4 Northwood to Charlemont

The AZ4 assessment zone includes surface works relating to station box construction at Ballymun, Collins Avenue, Griffith Park, Mater Hospital, O'Connell Street, Tara Street, St Stephens Green and Charlemont, construction of heavy rail interchange, rail realignment and station works at Glasnevin, intervention shaft at Albert Park College Park and the intervention tunnel at Charlemont. In addition, a number of utility diversion works will be required across the extent of the proposed Project at each of the main work areas. Noise sensitive locations in this study area include a mix of residential dwellings, schools, churches, hospitals, hotels, offices and other sensitive building uses adjacent to the construction work areas noted above in this study area. There are a number of heritage buildings within this assessment zone within potential sensitivities to vibration. The extent of the study area is typically up to 300m from each construction areas with a focus on sensitive receptors within 100m of construction areas which are those most impacted by the works based on modelling results. Due to the higher density of buildings within AZ4, beyond 100m from a work area, the majority of NSLs are substantially screened by intervening buildings and construction noise levels are well below the construction noise and vibration threshold values and are therefore not typically assessed beyond this distance. Notwithstanding, each construction work area is considered on its own merits depending on the proximity and sensitivity of noise and vibration sensitive areas and the specific works involved. The construction assessment locations within AZ4 are displayed in Figure 13.2, Sheets 17 to 30.

13.2.3.2 Study Area Operational Phase

Within all assessment zones, the following noise sources have the potential to impact noise sensitive buildings in the immediate vicinity of these sources with a study area extending to up to 100m.

- Ventilation systems serving the underground stations and intervention shafts;
- Operational noise sources from above ground sub stations; and
- Changes in road traffic along the surrounding road network.

All impacts discussed in this chapter relate to human receptors. Construction Phase on sensitive ecological receptors are discussed in Chapter 15 (Biodiversity).

Additional specific sources over and above those noted above are discussed below for each assessment zone.

13.2.3.2.1 AZ1 Northern Section

This assessment zone includes an over ground section of rail line which runs at surface level at the north of the proposed Project at Estuary and along an elevated viaduct section at Broadmeadow and crossing Balheary Bridge. The rail alignment runs alongside the R132 Swords Bypass between Broadmeadow and Fosterstown within a mixture of retained cut and cut and cover sections. The alignment veers west off the R132 at Nevinstown West within a retained cut section and inclines towards a surface section of rail towards DANP. The stations in this assessment zone comprise of a surface station at Estuary and retained cut stations at Seatown, Swords Central and Fosterstown.

Noise and vibration sensitive locations potentially impacted within this assessment zone include the Emmaus Retreat building next to Estuary Station and surface rail line, residential properties which bound both the east and west of the R132 Swords Bypass between Lissenhall and Fosterstown, schools, a preschool and creche buildings, hotel, medical and retail/commercial outlets. The closest sensitive buildings within this assessment zone to above ground noise and vibration sources are along the R132 Swords Bypass at Seatown West, Estuary Court, Swords Business Park (Hertz, Woodies), Ashley Avenue, Lakeshore Drive, Swords Veterinary Hospital and residential properties within Nevinstown West, which are located within 50m of the rail line. The study area for airborne noise extends out to 300m from the rail line depending on the density of NSLs, the line of sight towards the rail line and the alignment profile (i.e. retained cut, surface, elevated) Beyond these distances operational noise levels are determined to be not significant.

The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces. Traffic entering and exiting the facility, car park activities and traffic along the access roads are potential noise sources at adjacent NSLs around all boundaries to this area.

13.2.3.2.2 AZ2 Airport Section

The proposed alignment is fully underground within AZ2. Apart from the above ground sources noted above which are common to all underground stations, there are no other potential sources of airborne noise or vibration in this zone once operational. Noise sensitive locations potentially impacted by operational noise sources in this study area is Our Lady Queen of Heaven Church at Dublin Airport which is closest to the ground station ventilation area of the station and a granted but not constructed hotel building to the south-east.

13.2.3.2.3 AZ3 Dardistown to Northwood

Within AZ3, there is a section of above ground rail between Dardistown Depot and Northwood Station across the M50 Viaduct. Other above ground airborne noise or vibration sources include the Dardistown Station and Dardistown Depot which will be the main control centre for the proposed Project and maintenance depot for rail fleet. Noise and vibration sensitive areas are those residential buildings along the Old Airport Road and at Ballymun cross immediately south of the M50 Motorway. The extent of the study area is typically up to 300m from the rail line and rail depot.

13.2.3.2.4 AZ4 Northwood to Charlemont

The proposed alignment is fully underground within AZ4. Apart from the above ground sources noted above which are common to all underground stations, there are no other potential sources of airborne noise or vibration in this zone once operational. Noise sensitive locations in this study area are residential dwellings, schools, churches, hospitals, hotels, offices and other sensitive building uses immediately adjacent to the station boxes and the ventilation areas serving them.

13.2.4 Baseline Data Collection and Collation

The baseline noise environment has been characterised through a desk study of publicly available published data sources and measured noise and vibration surveys. These are summarised in the following sections.

13.2.4.1 Baseline Desk Study

The key sources of available baseline data comprise published noise mapping studies undertaken by Córas Iompair Éireann (CIE), TII and daa (formerly Dublin Airport Authority) which feed into the strategic noise mapping requirements of the Environmental Noise Regulations (S.I. No. 140/2006 and S.I. 549 / 2018). These are published and available via the EPA geo portal for Noise Maps Round 3 (2016) (https://gis.epa.ie/EPAMaps/). The modelled noise maps include existing sources of major rail, road and aircraft noise within the Dublin Agglomeration area and form the basis of the Dublin Agglomeration NAP 2018 – 2023 (DCC; FCC; SDCC; DLRCC 2018). This information provides a useful high-level overview of noise levels in the study area. The parameters presented in terms of the noise mapping are the L_{den} and L_{night} noise parameters which are both long term noise indicators based on annual traffic and transport modes.

Lden is the 24-hour noise rating level determined by the averaging of the Lday with the Levening (plus a 5dB penalty) and the Lnight (plus a 10dB penalty). Lden is calculated using the following formula, as defined within the Environmental Noise Regulations (S.I.549 / 2018).

$$L_{\text{den}} = 10log\ \left(\frac{1}{24}\right)\left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+10}{10}}\right)\right)$$

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the day periods of a year. The 12hr daytime period is between 07:00 to 19:00hrs.

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The 4hr evening period is between 19:00 to 23:00hrs.

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The 8hr night-time period is between 23:00 to 07:00hrs.

The existing mapping available is based on noise modelled data from 2016.

The range of noise sources within the published contour mapping associated with road, rail and air traffic, are discussed in Section 13.3.

13.2.4.2 Baseline Noise Surveys

Baseline noise surveys have been conducted at locations representative of the nearest noise sensitive areas which have the potential to be impacted by the Construction Phase and/or those likely to be

impacted during the Operational Phase of the proposed Project. Baseline noise measurements were made over both long-term and short-term periods to inform the assessment.

Long-term surveys (typically one week in duration) were made at a total of 52 locations. Short-term surveys (attended day-time measurements), made at a total of 73 locations along the length of the proposed Project were used to supplement the long-term surveys.

- Within AZ1, a total of 20 long term unattended survey locations and 26 attended survey locations were surveyed. The monitoring locations in AZ1 are illustrated in Figure 13.1, Sheets 1 to 2. A description of the survey locations is included in Table 13.24. The survey results are summarised and discussed in Section 13.3.1.3.
- Within AZ2, one long term unattended survey location and one attended survey location were surveyed. The monitoring locations in AZ2 are illustrated in Figure 13.1, Sheets 2 to 3. A description of the survey locations is included in the survey results are summarised and discussed in Section 13.3.1.4.
- Within AZ3, three long term unattended survey locations and four attended survey locations were surveyed. The monitoring locations in AZ3 are illustrated in Figure 13.1, Sheets 3 to 4. A description of the survey locations is included in Table 13.27. The survey results are summarised and discussed in Section 13.3.1.5.
- Within AZ4, 28 long term unattended survey locations and 42 attended survey locations were surveyed. The monitoring locations in AZ4 are illustrated in Figure 13.1, Sheets 4 to 7. A description of the survey locations is included in Table 13.29. The survey results are summarised and discussed in Section 13.3.1.6.

Full details of the survey methodologies, acoustic terminology, survey results and discussion are included in full in Appendix A13.1 and Appendix A13.2.

13.2.4.3 Baseline Vibration Surveys

Baseline vibration surveys have been conducted at locations representative of the nearest sensitive areas which have the potential to be impacted during Construction Phase and/or those likely to be impacted during the Operational Phase which currently are exposed to sources of vibration. Sources of vibration in the existing environment are typically limited to operational rail lines and quarrying activity. Baseline surveys have been undertaken at representative survey locations in the vicinity of existing rail lines adjacent to the proposed Project.

A total of three locations have been monitored which sit within AZ4. There are no baseline vibration survey positions within AZ1, AZ2 or AZ3 due to the absence of existing vibration sources in the surrounding environment of these zones.

Additional vibration surveys at sensitive buildings along the tunnel alignment with potential for Groundborne impacts are discussed in Chapter 14.

The baseline vibration locations are described in Table 13.31 and illustrated in Figure 13.1, Sheets 5 to 7. The vibration survey results are summarised and discussed in Section 13.4. Full details of the vibration survey methodologies, parameter definitions and results of the baseline surveys are included in full in Appendix A13.3.

13.2.5 Analysis Methods

The potential noise and vibration impact on the surroundings are considered for each of two distinct stages:

- Construction Phase; and
- Operational Phase.

The analysis methods used to assess the potential noise and vibration impacts during each phase is discussed in the following sections.

13.2.5.1 Construction Phase

13.2.5.1.1 Standard Working Hours

Standard working days, as set out in Table 13.6, will range from 07:00hrs to 19:00hrs on weekdays (excluding Bank and Public Holidays) and from 07:00hrs to 13:00hrs on Saturdays. The appointed contractor(s) will require staff and sub-contractors to adhere to these standard working hours for each site, insofar as reasonably practicable, unless otherwise permitted by the relevant Local Authority.

Table 13.6: Standard Working Days

Day	Typical Working Hours
Monday to Friday:	07:00hrs to 19:00hrs (this includes a half hour to prepare site at each end, giving 11 hours working: 07:30hrs to 18:30hrs)
Saturday:	07:00hrs to 13:00hrs (this includes a half hour to prepare site at each end, giving 5 hours working: 07:30hrs to 12:30hrs)
Sunday/Bank & Public Holiday, including annual and extraordinary events	None (apart from the exceptions with those activities listed below and in Chapter 5 under additional working hours))

Proposed working hours for each site will be outlined in the final outline CEMP, in addition to procedures to extend working hours, should this be required under exceptional circumstances. Any restrictions to working hours associated with major events in the area of works will be agreed with the Local Authorities and An Garda Síochána. In addition, a Noise and Vibration Management and Control Plan (NVMCP) will be included as part of the final outline CEMP and this will include for specific working hour measures at sensitive locations. For example, works outside churches will need to take into consideration mass or funeral events. Additional special measures may be required during marches and public demonstrations.

13.2.5.1.2 Additional Working Hours

Most construction activities will be undertaken during the proposed standard working hours, as outlined in Table 13.6, with the exception of tunnelling and associated activities, track works at the Glasnevin Interchange and in exceptional circumstances as outlined below and in Chapter 5 (MetroLink Construction Phase). Occasional night-time works may be required for specific activities such as traffic management and footbridge installation. If night works are required timings/activities are to be planned in advance and agreed with the Local Authority, taking sensitive receptors into consideration, particularly local residents.

In the event that additional work is required outside of the standard hours, an approval will be sought from the relevant Local Authority for these works on a case-by-case basis, such as:

- Certain operations such as earthworks are season and weather-dependent. In these instances, the appointed contractor(s) may seek to extend the standard working hours and/or days for such operations to take advantage of daylight hours, with the consent of the relevant Local Authority; and
- Certain other specific construction activities may require extended working hours for reasons of engineering practicability. These activities include, but are not limited to utility diversions, large concrete pours and piling/diaphragm wall (D-wall) works.

Chapter 5 (MetroLink Construction Phase) includes further detail on all working hours for the proposed Project. This information has been used to inform the noise and vibration impact assessment.

13.2.5.1.3 Construction Phase Noise and Vibration Assessment Methodology

During the Construction Phase of the proposed Project, potential impacts will include those from the following areas. The specific areas per each assessment zone assessed are set out in Section 13.5.2.

Noise from surface works required to construct Metrolink stations includes:

- Works associated with TBM portals;
- Overground sections of rail and trackwork;
- Utility works;
- Overground structures and buildings including depots;
- Road works; and
- Construction traffic.

Table 13.7 summarises the approach adopted to address the sources noted above which have been assessed as part of the Construction Phase.

Table 13.7: Overview of Construction Phase Noise and Vibration Assessment Procedures

Source	Assumptions	Prediction Method	Key Considerations	Impact Assessment
Construction noise at fixed sites & linear sections of cut & cover/retained cuts/track laying	Working hours as per the Working hours (Section 13.2.5 and Chapter 5). Construction of station boxes using diaphragm wall construction No percussive piling will occur	SoftNoise Predictor Version 2021 (BS 5228-1Methodology (BSI 2009 +A1 2014a))	Model enables detailed plant and site layout information to calculate noise levels for varying work phases at multiple locations per site.	Results compared against construction noise significance thresholds (CNTs), baseline noise levels and mitigation trigger values for noise insulation (NI) or temporary rehousing (TRH) dependent on duration of impacts, magnitude and sensitivity.
Utility Diversions	Linear sections of work over temporary periods	Construction spreadsheet calculations for distances from work segments (BS 5228-1Methodology (BSI 2009 +A1 2014a))	Calculations provided per distance from activity	Results compared against CNLs to determine compliance with criteria
Construction Vibration	No percussive piling will occur	Methodology from BS 5228-2 (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	Construction traffic access site compounds during normal working hours	Methodology from CRTN (UK Department of Transport 1998)	Changes in noise level with and without Metrolink Construction Phase - Calculated relating to volume flow changes in AADT (car, LGV and HGV fleet). Sensitive analysis allows	Significance of impact dependent on change in traffic noise level

Source	Assumptions	Prediction Method	Key Considerations	Impact Assessment
	– unless otherwise noted.	Noise & acoustic principals	magnitude of change to be determined	

Construction Compounds

The potential source of above ground noise from the various construction site compounds relate to above ground construction plant and construction traffic.

It is important to note that calculation of specific construction noise levels during the Construction Phase is limited to information available at EIAR stage. Whilst the phasing of works, location of activities, plant items and work sites have been progressed to detailed stages as part of this EIAR, the nature of the source is dynamic in nature and will vary over the course of the proposed Project at any one location subject to site conditions, work scheduling, contractor proposals and potential updated technology and methodologies.

Construction noise levels will fluctuate at any one location over the full duration of the proposed Project given the variations in the items above on a week to week or month to month basis. The approach undertaken therefore is to review the likely significant effects across the proposed Project based on the extent of information that is available. This includes prediction of construction noise levels associated with the key work stages deemed representative of the likely worst-case scenarios for each work sites using expected plant types and numbers, and site layout plans provided by the design team. This approach allows the likelihood of significant effects to be identified and to address the way in which potential construction impacts will be managed, including mitigation and codes of practices that will be applied. It is important to note on the basis of the above, the construction noise calculations undertaken as part of the assessment are used to identify the likely significant effects and inform the requirement for noise mitigation and the approach for controlling and managing significant effects. Should the project be approved, prior to the commencement of any construction works, a detailed noise assessment for each work site will be undertaken based on the most up to date information for each.

Notwithstanding, a series of detailed noise predictions have been conducted in the vicinity of each of the key construction work areas using the approach discussed in Table 13.7. The assessments have been undertaken through detailed review of plant and vehicles, site compound layouts, proposed work phasing, operational on-time for plant and equipment, and operational hours provided by the design team. Calculations have been performed at the NSLs identified within each study area with potential to experience significant construction impacts for each construction work site which include:

- Proposed Stations;
- Proposed Portals;
- Proposed above ground track sections (cut and cover, retained cut, viaduct);
- Proposed intervention shaft,
- Track laying; and
- Proposed ancillary structures (i.e. Park and Ride Facility, Dardistown Depot and Viaducts).

All construction noise calculations have been performed in accordance with to BS 5228 – 1 (BSI 2009 +A1 2014a), using the plant sound power level method. The calculations have been performed using a proprietary noise calculation package (SoftNoise *Predictor* Version 2021) which implements the calculation method of BS 5228 – 1 (BSI 2009 +A1 2014a) for construction noise. The 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 model predicts noise levels taking into account a range of factors affecting the propagation of sound, including:

- The magnitude of the noise source in terms of sound power;
- The percentage on-time of a source;
- The distance between the source and receiver;
- The presence of obstacles such as buildings, screens or barriers in the propagation path taken from OS mapping, google earth imagery and site visits;
- The presence of reflecting surfaces;
- The hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity.

Input Data

The following input data was used to develop the noise model for each modelled work area:

- OS mapping;
- Construction compound layout plans. Refer to Figure 5.1 & 5.3 (Construction Compound Locations);
- Constructability reports for key working areas and compounds;
- Plant equipment list and numbers, operating on-time per period, plant noise levels provided by the design team;
- For each construction compound or working area, the plant list was broken down into the key construction stages and calculations performed for each, e.g. site establishment through to fit out works;
- Site hoarding plans. For the modelled base scenario, hoarding heights are 2.4m unless otherwise stated;
- Sound power data (third-octave) for items of plant to be used on site were sourced from BS 5228 -1 (BSI 2009 +A1 2014a), from previous measurements carried out at other sites by AWN Consulting, from source data obtained by the construction team on other large infrastructural projects of similar construction; and
- Average daily HGV movements accessing the construction site based over a typical working day.

A detailed description of the proposed surface construction works is presented in Chapter 5 (Metrolink Construction Phase). The modelled equipment and sound power data corresponding to each modelled construction compound is presented in Appendix A13.7.

Receiver Locations

For each construction compound assessed, receiver locations have been positioned at the closest NSLs to the construction work boundaries which have the potential to experience moderate to significant impacts. The study area for each site is dependent on the site orientation and layout, proximity of NSLs, and the presence of surrounding buildings and structures which fully screen a NSL from a working area. For each receiver location, a calculation height representing each floor of the building with a noise sensitive façade is inputted into the noise model. All calculations are made to the receiver external façade. A façade correction is applied to all receiver locations.

Assessment Periods

Noise levels have been assessed over daytime weekday periods (07:00 to 19:00hrs) and Saturday morning periods (07:00 to 13:00hrs) periods at all station construction compounds, Intervention Shaft construction compounds, and Portal locations in accordance with the proposed construction working hours for the project (refer to Table 13.6).

Once the TBM has been launched within the tunnel, the Northwood Portal and the DASP will operate over a 24-hour period in order to provide the required support to the TBM. These will have activities

occurring at surface level. Noise levels over day, evening and night-time periods have therefore been assessed at these sites during this phase of the works.

Track laying along the above ground section of rail north of DANP will also be undertaken over day and night-time periods and have been assessed on this basis. During track laying activity within the tunnel and at surface level concrete batching plants will be operational over 24/7 periods at Estuary, DASP, Northwood, Dardistown and Griffith Park. Noise levels at these locations have been assessed over daytime and night-time periods during these activities.

Glasnevin Possession work for Great Southern and West Railway (GSWR) & Midland Great Western Railway (MGWR) main line track alignment works will take place over possession periods ranging from standard possession of 3.5 hours, Saturday night possession 6 hrs, extended disruptive possession 55/76 hours weekend or long weekend with bank holidays respectively. Day and night-time possession works are therefore assessed for this location.

Additional specified works which will occur outside of the main standard working hours include surface compound support activities for spray concrete lining (SCL) at DASP, Albert College Park Intervention Shaft and Charlemont which will be 24/7 which are assessed at these locations.

Mechanical Electrical & Plumbing (MEP) fit out at the stations will be carried out on a 24 hour a day, seven-day week basis. This activity will be underground within the stations but may require some above ground surface support activity. Locations where this is likely to occur based on information provided by the design team are discussed in the relevant construction compound sections.

Further details relating to the assessment periods are set out in Section 13.5.2 to each construction work area.

Output Data

For each construction compound or work area assessed, a construction noise level (CNL) has been calculated at each receiver location per site model. CNLs are calculated at each floor height. For buildings with multiple calculation points at varying floor heights, the highest CNLs has been extracted for the purpose of the impact assessment.

All results are expressed as $L_{Aeq,\,T}$ and include a façade correction. For daytime weekday periods, the T (time) value is expressed over a 12hr period (07:00 to 19:00hrs) and for Saturday morning periods over a 6-hour period (07:00 to 13:00hrs). Where evening and night-time calculations are made, these are expressed over a 4-hour period (19:00 to 23:00hrs) and 8-hour period (23:00 to 07:00hrs) respectively.

Construction Traffic

In addition to the potential noise impact relating to HGV movements within each construction site and at each entrance/egress point as discussed in the methodology detailed above, an assessment has been made of the impact of construction vehicles along the surrounding road network serving each of the construction compounds.

All construction traffic will travel along the existing road network onto defined and approved haul routes (Refer to Figure 5.2 Haul Routes). Given that roads where construction traffic will travel is along the existing road network which already carry 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. The key consideration in terms of impact assessment therefore relates to the change in traffic noise levels and the related impact associated with same.

Input Data

Traffic modelling for the Construction Phase of the proposed Project has been undertaken over the full extent of the NTAs Eastern Regional Model (ERM). This includes the road network within the full Leinster Region. Outputs from the traffic model has been provided for the Do Minimum Scenario which is a

forecast of future baseline traffic across the study area for the assessment years used for the Construction Phase.

During the Construction Phase of the Proposed Project, there are two considerations relating to changes in traffic flows:

- Traffic re-routing and re-distribution along roads in the surrounding environment due to traffic management measures (i.e. road closures, one-way systems, site access/egress points); and
- Construction traffic volumes added to the network travelling to and from work sites along the designated haul routes. This will comprise a mixture of Large Good vehicles (LGVs) and Heavy Good Vehicles (HGVs) for deliveries and earthworks material haulage.

Information relation to road closures and diverted routes during the Construction Phase are outlined in the proposed Project Traffic Management Plan (STMP), included in Appendix A9.5 of this EIAR, and are discussed in Chapter 9 (Traffic & Transport) and Chapter 5 (MetroLink Construction Phase).

Traffic model outputs provided for the Construction Phase scenario (Do Something Scenario) take account of impacts due to traffic management measures and additional fleet onto the haul routes. Traffic impacts will vary across the proposed Project on a temporal and geographic basis over the lifespan of the proposed Project. To account for this variation, two construction traffic scenarios have been modelled based on a worst-case month for stations located north and south of the M50 Motorway as follows:

- November 2028 - Peak northern construction traffic for stations north of M50 Motorway. This model scenario considers the highest volume of traffic along the full extent of the ERM road network when the peak volume of construction vehicles are forecast to occur when stations are being constructed to the south of the M50 Motorway; and
- September 2028 - Peak southern construction traffic for stations south of M50 Motorway. This model scenario considers the highest volume of traffic along the along the full extent of the ERM road network when the peak volume of construction vehicles are forecast to occur when stations are being constructed to the south of the M50 Motorway.

The resultant impacts are therefore considered the worst-case conditions relating to peak traffic scenarios for either of the two scenarios. Traffic noise impacts outside of these peak periods will therefore be less than those assessed.

Detailed traffic data have been provided for each modelled road within the full extent of the Leinster region for the two peak months noted above. For each road, traffic flows are provided in terms of Annual Average Daily Traffic (AADT) with a percentage breakdown of cars, buses, LGVs and HGVs for each road.

Noise levels associated with a passing event such as road traffic may be expressed in terms of its Sound Exposure Level (L_{AX}). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period using the following formulae:

$$L_{Aeq,T} = L_{AX} + 10\log_{10}(N) - 10\log_{10}(T)\ dB$$

Where:

- $L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds)
- L_{AX} is the "A-weighted" Sound Exposure Level of the event considered (dB)
- N is the number of events over the course of time period T

The following Sound Exposure Level (L_{AX}) reference values have been used for the assessment. The specific data has been obtained from specific source measurements undertaken from AWN's in-house data base of road vehicle sound exposure levels measured under controlled conditions for other applications. The L_{AX} values relate to vehicles traveling at a low to moderate speed in an urban

environment. The reference noise values are also comparable with those within the CNOSSOS-EU (EU 2012) document for road traffic noise for light, medium and heavy vehicles at urban speeds and from HGV source data presented in BS5228-1 (BSI 2009 +A1 2014a).

Table 13.8: Reference Sound Exposure Levels for Noise Calculations

Vehicle Type	LAX at 5m from road edge, dB [Note 3]
Car	72
LGV	75
Bus	78
HGV (OGV1 & 2) [Note 1]	85
Rigid Dump Truck [Note 2]	90

Note 1 OGV 1 Rigid road vehicles with 2 or 3 axels / OGV 2: Rigid road vehicles with 4 or more axels and all articulated vehicles

Note 2 Whilst construction HGVs accessing the sites and using haul routes will for the majority fall into category OGV2, a higher emission value of 90dB LAX at 5m has been used for all construction related additional traffic volumes added to the network to provide a robust assessment.

Note 3 These values relate to vehicles at low to moderate speeds in urban settings. For higher speeds up to 100 km/hr such as along dual carriageways an additional 3dB is added.

A diurnal profile was used for two key road types, those roads within the inner-city cordon and those within the outer city cordon. This information was used to calculate traffic noise levels over the 16hr daytime period (07:00 to 23:00hrs) and the 8hr night-time (23:00 to 08:00hrs) for each road. The majority of construction traffic will access the work sites during the standard construction working periods. There will be an element of out of hours traffic will be required to facilitate construction activities such as concreting or for material delivery, however this will be restricted as far as possible to facilitate abnormal works only and to avoid residential areas. Further discussion on construction traffic delivery hours are discussed in Chapter 5 (MetroLink Construction Phase).

The approach adopted for construction noise traffic analysis involves calculation of noise emission levels associated with the Do Minimum and Do Something traffic scenarios and determining the related increase in noise level as a result of the additional traffic on the road network. The AADT for each vehicle category is used to calculate a total $L_{Aeq,24hr}$ value along each road within the study area at a reference distance of 5m. The $L_{Aeq,24hr}$ is converted to an $L_{Aeq,16hr}$, $L_{Aeq,8h}$, and where relevant, L_{den} value using the following correction values from the research paper *Conversion between noise exposure indicators L_{eq24hr}, L_{Day}, $L_{Evening}$, L_{night}, L_{dn}, and L_{den}; Principels and practical guidance.* The Inner Zone correction factors were developed based on the diurnal profile within the inner-city cordon.

Table 13.9: Reference Sound Exposure Levels for Noise Calculations

Parameter	$L_{Aeq,24hr}$ correction (Outer Zone)	$L_{Aeq,24hr}$ correction (Inner Zone)
LAeq,16hr	+1.3	+1.1
LAeq,8hr	-5.5	-3.7
Lden	3.3	+4.2

These conversion factors have been tested for a range of sample road sections in the study area using the AADT and diurnal profiles and are confirmed to provide a comparative result to those measured during baseline surveys and those calculated using the CRTN BNL output and $L_{Aeq,1hr}$ conversion methodologies from the Transport Research Laboratories (TRL) from L_{A10} to L_{Aeq} and the calculated results are all within and less than 1dB.

The approach used above has been used in Lieu of the Basic Noise Level Calculation (BNL) from the CRTN (1988) in order to calculate a direct L_{Aeq} value per period. In addition, the approach above allows for a sensitive analysis relating to different classification of vehicle where required.

In addition to calculating traffic noise impacts using the ERM model outputs in AADT, a further calculation of AM peak (1hr) construction traffic was reviewed, and noise levels calculated for roads adjacent to each main work site where highest construction volumes will pass, provided by the traffic consultants.

Output Data

For each modelled road within ERM study area, the associated daytime $L_{Aeq,16hr}$ traffic noise level was calculated for the Do Minimum and the Do Something scenario (Construction Phase) for the year 2028. For all roads, calculations are made at a reference distance of 5m from the road edge.

The difference in the base calculated noise levels between the Do Minimum and Do Something (Construction Phase) scenario was used to determine the initial screening exercise of potential traffic noise effects. The relevant appraisal methods used for assessing traffic related noise impacts are discussed in Section 13.2.6.1.5.

Where significant changes in noise levels were calculated, the specific traffic noise level was calculated to the nearest NSL along the identified road and was used to compare against baseline noise levels and range of typical traffic noise levels across the Dublin Region.

The determination of significance of changes in traffic noise levels are set out in Section 13.2.6.1.5.

Construction Phase - Vibration

During the Construction Phase of the proposed Project, the most significant sources of potential vibration relate to drilling and blasting, mechanical excavation in rock, piling and diaphragm wall construction. Vibration impacts associated with these activities in terms of building response and human response are assessed in detail in Chapter 14 (Groundborne Noise & Vibration).

The following are noted relating to vibration sources and assumptions from Chapter 14 (Groundborne Noise & Vibration):

- All assumptions and calculated vibration outputs relating to drill and blast activities are set out in Chapter 14 (Groundborne Noise & Vibration).
- Vibration sensitivity analysis undertaken for mechanical excavation in rock has determined that due to the potential for significant effects using hydraulic peckers, the use of road headers/milling machines will be used for this activity. Vibration impacts associated with this activity is assessed in Chapter 14 (Groundborne Noise & Vibration).
- Mechanical excavation is also part of the process of inserting diaphragm walls at station boxes where these extend down into the rockhead, when a hydrofraise is employed. The cutting head of a hydrofraise is similar to that of a road header, although not necessarily as large. The vibration impacts calculated for mechanical excavation may be taken as the envelope vibration levels from diaphragm wall construction as well as mechanical excavation of rock within the station boxes. Further discussion is set out in Chapter 14 (Groundborne Noise & Vibration).
- Secant piling will be used predominately within AZ1 for building foundations, cut and cover and retained cut sections, and other ancillary structures, as required. This methodology will also be used at selected work areas within AZ3 and AZ4 for shafts and other ancillary structures. Calculations undertaken for secant piling are included within Chapter 14 (Groundborne Noise & Vibration) and are referred to, where relevant, in this chapter.
- The use of percussive piling methods using vibratory piling rigs or impulsive driven piles will not be used on the proposed Project. Where sheet piling is required along U-sections of the overground rail alignment in AZ1 or along the canal at Glasnevin in AZ4, these will be by means of push in piles.

For all other construction activities at surface level, vibration sources during the construction phase will be significantly less than the sources discussed above with resultant lower vibration magnitudes.

During the initial site establishment phases where demolition of structures or buildings are required this will be undertaken using top-down construction or deconstruction methods resulting in low vibration magnitudes.

Initial ground excavation at surface level for station boxes, cut and cover sections and utility works will require the intermittent use of hydraulic breakers or breaker mounted excavators to break through made ground (road surfaces, paving and concrete). During landscaping and road works during the project completion stages, potential vibration sources relate to road roller and ground compaction activities. Potential vibration impacts associated with these activities has been obtained from reference to BS5228-2 (BSI 2009 +A1 2014b) and measurement data compiled by AWN Consulting during other construction projects with similar methodologies.

13.2.5.2 Operational Phase - Noise

During the Operational Phase of the proposed Project, potential impacts will arise from the following sources and activities:

- Airborne noise from overground rail;
- Operational activities associated with Dardistown Depot;
- Operational noise associated with ventilation plant for underground stations, shafts and tunnels;
- Operational noise associated with substations;
- Noise from public address (PA) systems in retained cut or surface stations;
- Car parking and traffic noise at Estuary Park and Ride facility; and
- Changes in road traffic noise along surrounding road network.

Table 13.10 summarises the approach adopted to address the sources noted above which have been assessed as part of the Operational Phase. The specific methodologies, input and output data sets are set out in the individual sections dealing with each in the following sections.

Table 13.10 Overview of Operational Phase Noise Assessment Procedures

Source	Prediction Method	Key Considerations	Impact Assessment
Airborne noise from above ground operational rail	SoftNoise Predictor Version 2021 (RMR 2012 Methodology)	Sections of above ground rail along viaducts and within retained cut sections with potential for airborne noise emissions i.e., sections of the Metrolink line not within the underground tunnel or within cut and cover sections north of Dublin Airport and south of M50 Motorway.	Results compared against operational noise thresholds and baseline noise levels
Dardistown Depot	Operational Rail activities: SoftNoise Predictor Version 2021 (RMR 2012 Methodology) Operational Sources: ISO 9613-2 (ISO 1996)	Rail movements, maintenance activities within and external to depot, fixed plant items.	Results compared against operational noise thresholds and baseline noise levels to determine significance magnitudes
Ventilation Plant Noise	BS 4142 (BSI 2014 +A1 2019)	Operational sources of ventilation plant at stations and shafts operating over day	Limit values determined through reference to background noise levels

Source	Prediction Method	Key Considerations	Impact Assessment
		and night-time periods	
Estuary Park and Ride	Operational Sources: ISO 9613-2 (ISO 1996)	Operational car parking and traffic movements noise sources	Results compared against operational noise thresholds and baseline noise levels to determine significance magnitudes
Operational Traffic Noise	Calculation of change in traffic noise levels between Do Minimum and Do Something scenarios.	Changes in noise level with and without Metrolink operational phase - Calculated relating to volume flow changes in AADT (car, LGV and HGV fleet). Sensitive analysis allows magnitude of change to be determined	Where significant impact is determined, the absolute noise level is considered for overall ranking of impact (discussed in Section 13.2.6.2.2.).

The appraisal methods associated with the operational phase are set out in the Section 13.2.6.2.

13.2.5.2.1 Above Ground Railway Noise

Rail Noise Model

Predictive noise calculations associated with above ground sections of the MetroLink rail line have been conducted in accordance with the RMR (Dutch Housing, Spatial Planning and the Environment 2012). The calculations have been performed using the acoustic modelling software SoftNoise *Predictor* Version 2021 which calculates rail noise levels in accordance with RMR 2012 and updated rail categories from the RMR-2 2006 publication.

The RMR rail noise calculation method is based on a prediction methodology, broadly broken into the calculation of the rail noise source and the calculation of the noise propagation.

The first step of the calculation process is to categorise the train vehicle, track and support types to determine the emission value of the train noise source. These values are based on set criteria outlined in the standard which includes the following:

- Identification of railway vehicles into appropriate categories as designated by the RMR standard;
- Identification of rail tracks and supports as designated by the RMR standard;
- Identification of track disconnections along the route;
- Identification of the source height;
- Identification of train speed; and
- Identification of train numbers.

The second step of the calculation process is to calculate the propagation of railway noise to receptor points taking into account the following factors which are built into the calculation model:

- Reflection factors from buildings and other vertical surfaces;
- Distance attenuation & air absorption;
- Ground factors (absorbent and reflecting surfaces);
- Ground height differences (cuttings/embankments);
- Screening effects (boundary treatments, buildings and retaining walls); and
- Meteorological conditions.

Input Data

The first stage is to obtain a comparative source emission data either through using the pre-defined rail categories within the RMR standard or alternatively by using source data obtained from a comparable rail system.

This assessment is based on the train design specifications set out below and from information within Chapter 6 (MetroLink Operations & Maintenance). Although the RO permits a range of train design specifications, any such design (and associated impacts) will be within the scope of what has been assessed in this EIAR.

The Metrolink vehicle comprises 3 No units each with a length of 21m. There are 2 No Bogies and 4 No. Axels per train unit. The total train length is 64m.

In the absence of a comparable operational rail system, the following source input data has been used which have been advised by the design team:

- RMR Rail Category: Category 7: Disc rammed metro and high-speed tram equipment;
- Track Type: Slab Track;
- Support Correction: Adjustable Rail Fasteners;
- Track Correction: Continuous Welded Rail (CWR);
- Bogies per unit: 2 per unit, total of 6 per Metrolink vehicle; and
- Operational Speed: 80km/hr.

The service will operate in two loops:

- A long loop will cover the full route from Charlemont to Estuary; and
- A short loop will cover Charlemont to Dublin Airport.

The proposed Project has been developed based on a scenario to operate the long loop during peak hours and alternate long and short loops during inter-peak hours. During the peak hours, the same level of service would be provided to all the stations, but during the inter-peak period half the trains will complete the long loop and half the short loop, resulting in double the number of trains between Charlemont and Dublin Airport than between Dublin Airport and Estuary. In this event, the proposed Project has been designed flexibly to allow different service patterns. The EIAR is based on the worse case, which is the single loop.

Train numbers for the operational phase per day, evening and night-time period have been calculated using operational phase data as summarised in Chapter 6 (MetroLink Operations & Maintenance).

The proposed operating hours for the proposed Project are as follows:

- Monday to Friday: 05:30 to 00:30hrs;
- Saturdays: 05:30 to 00:30hrs; and
- Sundays and Bank Holidays 05:30 to 00:30hrs.

The currently proposed operational strategy does not include for 24-hour services but late night or overnight services may run on an occasional basis to facilitate night-time travel during busy holiday periods or special events.

Based on a single loop strategy along the full extent of the rail alignment between Estuary and Charlemont, the following train numbers have been modelled over daytime and night-time periods based on the future design year of 2057 which represents the highest train number forecasts. The single loop strategy also represents a conservative assessment of potential train numbers along the line, particularly between Estuary and Dublin Airport where the inter peak demand is forecast to be lower compared to the section of rail between Dublin Airport and Charlemont. On this basis, the following train numbers are considered to represent a conservative assessment:

- Daytime (07:00 to 19:00hrs): 364 trains per direction/36 peak hour (per direction);
- Evening (19:00 to 23:00hrs): 74 trains per direction/30 peak hour (per direction); and
- Night-time (23:00 to 07:00hrs): 45 trains per direction/18 peak hour (per direction).

Receiver Locations

Receiver locations have been positioned at the closest NSLs to the overground sections of the proposed alignment which have the potential to experience perceptible changes to their noise environment. For each receiver location, a calculation height representing each floor of the building with a noise sensitive façade is inputted into the noise model. All calculations are made to the receiver external façade and are free field. Receiver locations have been positioned at the areas summarised in Table 13.11. The table notes the alignment profile, the noise sensitivity of the receptor and the potential noise impact based on the proximity to the alignment and the alignment profile (i.e. cut and cover, retained cut). The sensitivity of a receptor location is based on the receptor use and the time period it is occupied. These are categorised in Table 13.18.

Table 13.11: Overview of Airborne Noise Sensitive Areas to Rail Noise

Rail Line Section	Rail Alignment/Profile	Key Sensitive Receivers	Property Sensitivity	Potential Noise Impact
Estuary to R125	Surface – Viaduct	Residential properties at Lissenhall, Emmaus Retreat Centre	High	Medium – High
	Viaduct	Tigin Montessori	High	Medium – High
		Commercial/industrial east and west of R132	Low – Medium	Low – Medium
	Retained Cut	Castlegrange Hill residential estate, Newcourt Estate	High	Low to Medium
		Commercial/industrial east and west of R132, Sports clubs at Sluagh Hall/Lissenhall Road.	Low	Very Low
Castlegrange Road to Seatown Road	Cut & Cover	National Learning Network, Newcourt Estate	High	Very Low
	Retained Cut	Seatown Villas, Seatown West, The Crescent residential estate	High	Medium - High
	Cut & Cover	Seatown West, Comyn Manor, Estuary Court, Woodies	High	Very Low
Seatown Road to Drynam Road	Seatown Station (Retained Cut – cut & cover north and south)	Hertz (Office/Commercial)	Medium - High	Low – Medium
		Seatown Terrace Residential	High	Low – Medium
	Retained Cut	Kids Inc. Creche, Seatown Walk residential properties	High	Low – Medium
		Commercial/offices (North Dublin Corporate Park, Siemens)	Low - High	Low – Medium

Rail Line Section	Rail Alignment/Profile	Key Sensitive Receivers	Property Sensitivity	Potential Noise Impact
	Cut & Cover	Chapel Lane, Castle Park, Castle Grove, Longlands, Ashley Avenue, Ashley Grove, Foxwood residential estates	High	Very Low
Drynam Road to R125 Dublin Road	Retained Cut	Drynam Road Residential Properties	High	Low - Medium
	Swords Central Station & Cut and Cover	Lakeshore Drive Offices	Medium	Medium
	Retained Cut	Carlton Court Residential Estate	High	Low to Medium
	Cut and Cover	Travel Lodge Hotel	High	Very Low
R125 Dublin Road to Nevistown Lane	Retained Cut	Swords Veterinary Clinic/Residential Property	Medium - High	Medium
	Fosterstown Station – Cut & Cover	Boroimhe Willows & residential properties west	High	Very Low
	Retained Cut – Cut & Cover	Boroimhe Elms residential area, Premier Inn Hotel, Tara Winthrop Clinic	High	Very Low to Medium
Nevistown Lane to DANP	Retained Cut	Broimhe Hazel & Individual properties east & west	High	Low to Medium
Dardistown to Northwood	Retained Cut & Surface	Collinstown Lane Cottages, Old Airport Road Residences	High	Low to Medium
	Viaduct – Retained Cut	St Annes Residential property, Charter Hill properties, Northwood properties.	High	High

Assessment Periods and Output Data

Noise levels have been calculated and presented in terms of the daytime $L_{Aeq,16hr}$ period (07:00 to 23:00hrs), Night-time $L_{Aeq,8hr}$ periods (23:00 to 07:00hrs), L_{den} and the peak hour per day and night-time period ($L_{Aeq,1hr}$).

Rail noise levels (RNL) are calculated at each floor height for each modelled location. For buildings with multiple calculation points at varying floor heights, the highest RNLs has been extracted for the purpose of the impact assessment.

13.2.5.2.2 Dardistown Depot

The Dardistown Depot will operate on a 24/7 basis and will be used to stable, store, clean and maintain the proposed rail fleet. Stabling, storage and maintenance of fleet will be within an enclosed stabling building. An external train wash area is located along the western boundary. An electrical substation is proposed along the north-western boundary which will house the building power and traction

substation, transformers and High voltage (HV) equipment within their own structures. The depot will also include staff offices and staff car parking. To assess the noise impact of the operation of this facility, the following noise sources have been considered:

- Maintenance building activity – note this building is enclosed and noise internal to the building will be largely contained within the building;
- Substation and mechanical plant serving the Depot;
- External Automatic Train Wash (ATW);
- Stabling areas, and
- Rail movements in and out of depot.

To inform the assessment, source data previously measured by AWN at existing rail depot locations has been used. This source data has been obtained by AWN in support of other rail applications. The source measurements include activities associated with rail maintenance from several workshops at the current Irish Rail Fairview and Inchicore depots. Train wash activity was also measured at the existing Fairview rail depot. The following noise levels measured during these surveys have been used in this assessment:

- General maintenance activity – Average reverberant value of 74dB(A) within the buildings, and;
- Automatic Train Wash (ATW) – 61dB(A) at 12m for an open-air ATW.

The following are the maximum noise levels for internal equipment within Dardistown Depot:

- The noise of the wheel lathe machine shall be maximum 80dB(A) at one (1) meter distance with the engine of the machine powered. (This level was measured within the IR Fairview Depot and hence is confirmed is readily achievable from measurements undertaken);
- The noise of the swarf crusher and conveyor shall be maximum 80dB(A) at one (1) metre distance when processing the wheels of the vehicles; and
- The noise level of the Synchronized Mobile Lifting Jacks (SMLJ) during operation shall not exceed the limit established in relevant standards, in any case 70dB(A) when measured at one (1) meter from the machine.

The depot buildings housing rail maintenance and stabling activities are steel framed buildings with metallic envelope made of double skin system and sandwich panel roof with acoustic modular false ceiling. The final thickness of the façade will be determined by the insulation required (both thermal and acoustic). The model of these depot buildings includes for a lightweight insulated cladding panel as per the design. The sound insulation performance assumed for this structure is has a weighted sound reduction index (Rw) of 26dB which is readily achievable based on the base construction proposal.

An electrical high voltage (HV) substation will be constructed at Dardistown which will include two step down transformers. The noisiest components of this substation will be the 110kV transformers in the outdoor compound. An operational noise level of 40dB(A) at 5m from boundary of the substation compound has been used which is taken from the Eirgrid *Evidence Based Environmental Studies Study 8: Noise (2016)*. This noise level relates to the overall substation, encompassing the outdoor 110kV transformers and the substation structures. The substations are enclosed buildings.

In addition to activities noted above, there will be fixed plant required to service the depot buildings for ventilation, heating and cooling purposes. A natural ventilation system is proposed across the majority of the depot buildings with the additional use of direct exchange (DX) heat pumps, variable refrigerant volume (VRV) units, heat recovery units and electrical radiators. The final design, number and choice of plant for each building has not been progressed at this stage of the EIAR. For calculation purposes, four No. items of roof mounted plant per depot stabling/maintenance/workshop buildings with a sound pressure level of 80dB(A) at 1m has been used. Two No. items of plant with the same noise emission value has been modelled on the administration building. The noise levels used are highly conservative based typical plant noise emissions for HVAC systems but are used to allow for flexibility in the design.

The movement of the proposed trains entering and exiting the Depot has also been modelled. For the purposes of the assessment the peak hour movements discussed previously in Section 13.2.5.1.3 have been adopted as a worst-case along the depot rail network.

13.2.5.2.3 Changes in Traffic Flow

There is a potential for changes in traffic patterns and flows within the Greater Dublin Area (GDA) once the MetroLink becomes operational. Traffic modelling for the Operational Phase of the proposed Project has been undertaken over the same study area as the Construction Phase i.e. the full extent of the ERM.

In the Operational stage of the proposed Project, traffic modelling has been carried for the following scenarios:

- Scenario A: The Do Committed Minimum scenario includes additional transport schemes that are under construction or committed to be implemented post the base-year of the ERM base (2016). 'Committed' refers to schemes that have planning permission and also have a funding commitment.
- Scenario B: The Likely Future scenario, presents an enhanced transport network scenario which has been developed to understand how usage of the proposed Project may change if other planned infrastructure schemes are delivered during the appraisal period. A scheme bundle approach has been developed to examine the impacts of the enhanced network, with one bundle representing the schemes within the National Development Plan (2018-2027) and the other bundle representing the full build out of the infrastructure and initiatives contained within the NTA's Transport Strategy for the Greater Dublin Area (2016-2035).

Information on the transport projects included within the Scenario A and Scenario B models are set out in Chapter 9 (Traffic & Transport).

Traffic outputs for the following scenarios have been used as part of the noise assessment for the Operational Phase:

- Scenario A: Opening Year (2035) Do Minimum and Do Something Scenarios;
- Scenario A: Design Year (2050) Do Minimum and Do Something Scenarios;
- Scenario B: Opening Year (2035) Do Minimum and Do Something Scenarios; and
- Scenario B: Design Year (2050) Do Minimum and Do Something Scenarios.

The approach adopted for operational traffic noise analysis involves calculation the change in traffic noise levels between the Do Minimum and Do Something traffic scenarios as a result of increased or reduced traffic on the road network.

The same calculation methodology discussed in Section 13.2.5.1.3 has been used for calculating Operational Phase traffic noise.

The determination of significance of changes in traffic noise levels associated with the Operational Phase are set out in Section 13.2.6.2.2.

13.2.5.2.4 Fixed Airborne Noise Sources

Fixed noise sources associated with the proposed project include ventilation shafts (forced ventilation and draught relief systems), substations, station PA systems and all other line-side equipment.

The final design of fixed sources including ventilation systems, substations serving the proposed stations, the park and ride facility and the Dardistown Depot will form part of the detailed design of the proposed Project at procurement stage. In this instance, the noise impact assessment has focused on setting a range of allowable operational levels in order to ensure the impact from their operation does not lead to any significant increase in the existing noise environment. This has been undertaken using guidance taken from BS 4142 (BSI 2014 +A1 2019) and BS 8233 (BSI 2014).

For these areas of fixed plant items, it is proposed to adopted set noise emission targets relative the site boundary to ensure that offsite noise levels at NSL's are appropriate considering the guidance in BS 8233:2014 (BSI 2014c) and BS 4142. For night-time the design target for operational plant items at the nearest NSL shall be limited to no greater than 5dB above the background sound level. Depending on

the context, it may be acceptable for plant noise emissions to be greater than 5dB above the background provided guideline values for internal noise levels within residential dwellings from in BS 8233:2014 (BSI 2014c) are not exceeded.

Noise from PA systems would not normally be considered using this guidance given its nature and frequency. In this instance, best practice guidance has been set out for this source which will be implemented during detail design of the stations.

13.2.5.3 Operational Phase - Vibration

Operational Phase vibration associated with the MetroLink Rail line over the full extent of the rail alignment is assessed in Chapter 14 (Groundborne Noise & Vibration).

There are no other sources of vibration associated with the operational phase which will give rise to any perceptible human response. Operational phase vibration is therefore not considered further within this chapter.

13.2.6 Appraisal Method for the Assessment of Impacts

The significance of impacts has been assessed in accordance with the EPA Guidelines (EPA 2022). The relevant definitions relating to quality, significance and durations of impacts are defined as per the EPA Guidelines (EPA 2022) are set out in Chapter 2 (Methodology Used in Preparation of the EIAR. These have been used to define the category of impacts throughout this Chapter.

As these guidelines do not quantify the criteria for assessing impacts specifically for noise or vibration, reference has been made to relevant guidelines and standards relating to noise and vibration to further define significance ratings. These are discussed in the following sections.

13.2.6.1 Construction Phase Appraisal of Impacts

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 tolerated during a Construction Phase of a project compared to its long-term Operational Phase. As construction works will be less than seven years at any one location and are varied over the course of the proposed Project, they are defined as short term in accordance with the EPA Guidelines (EPA 2022). The following sections set out the criteria for rating construction noise significance effects.

13.2.6.1.1 British Standard BS 5228 – 1: 2009+A1:2014 – Fixed Limits

To provide context on typical fixed noise limits commonly applied for major construction projects, reference is made to Section E.2 of BS 5228-1 (BSI 2014a). This sets recommended threshold levels using a fixed limit value set depending on the setting of the noise environment rather than the prevailing baseline noise levels. For example, paragraph E.2 states:

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

Paragraph E.2 goes on to state: -

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed: -*
>
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
>
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

These limits apply to daytime working outside living rooms and offices. The document notes that where works occur outside other noise sensitive situations with daytime sensitivities, e.g. near hospitals and educational establishments or if works are occurring outside of normal daytime working hours, reduced construction noise levels may be more appropriate.

For previously approved large scale infrastructure projects in Ireland including DART Underground and Metro North, similar fixed noise limits to those in Section E.2 (BSI 2014a) were applied by An Bord Pleanála for residential and other sensitive receptors. In the context of the proposed Project these limit values applies on the basis of the following:

- Residential receptors: Upper noise limits for construction noise of 75dB ($L_{Aeq,12hr}$) during the day; 65dB ($L_{Aeq,4hr}$) during the evening; or 55dB ($L_{Aeq,8hr}$) during the night, or above the existing ambient if this is higher.
- For commercial buildings (i.e. offices, industrial facilities and sport clubs) which are less noise sensitive, the following the following fixed noise limit as per Section E.2 of BS 5228 – 1 (BSI 2014a) for urban areas near main roads in heavy industrial areas is applied i.e.:
- Commercial, offices and industrial facilities: 75dB ($L_{Aeq,T}$) daytime (12hr) & Saturday AM (6hr).

Similarly, for construction activities across the proposed Project associated with mobile working areas with temporary to short term durations, the same fixed limits are applied. These relate to utility diversion works and ESBN cable re-routing works:

- Utility diversion/EBSN cable rerouting: 75dB ($L_{Aeq,T}$) daytime (12hr) & Saturday AM (6hr).

13.2.6.1.2 Dublin City Council – Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition

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

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

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

The duration, nature and extent of construction activities associated with the Construction Phase of the proposed Project would categories 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) does not use an equivalent noise risk assessment procedure, the approach used by DCC has been applied across the full extent of the proposed Project 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), and also refers to DMRB Noise and Vibration (UKHA 2020) in order to review and set appropriate construction noise significance ratings or significance thresholds.

13.2.6.1.3 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 is associated with the construction activities, depending on context. Table 13.12 sets out the values which, when exceeded, signify a potential significant effect.

Table 13.12: BS 5228-1 Example of Thresholds of Potential Significant Effect

Assessment Category & Threshold Value Period (L_{Aeq})	Construction Noise Threshold (CNT) (dB)		
	Category A [A]	Category B [B]	Category C [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 5dB) are less than these values	Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.	Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
			If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise

The construction noise thresholds (CNTs) have been applied at the façade of residential buildings, hotels and hostels, buildings in educational use and buildings in health and/or community that are noise sensitive.

For NSLs where the existing night-time ambient noise level exceeds 55 dB $L_{Aeq,8hr,}$ the BS 5228 ABC guidance proposes a significance threshold equal to the prevailing noise environment. It is however, acknowledged that construction noise above this level during night-time periods has potential for significant effects, depending on the extent and type of works involved. The approach used for the proposed Project therefore assigns a significant effect for Category C locations where night-time CNLs are calculated above 55 dB $L_{Aeq,8hr.}$ This approach is used for the purposes of determining initial potential significance and to identify areas where control measures will be required.

The determination of significance at an individual NSL or group of NSLs will therefore depend on the calculated construction noise level, the prevailing baseline noise environment and the duration and

extent of the works. Given the extensive nature of the proposed Project and the number of construction sites and sensitive receptors, the CNT will vary across the project on a site by site and receptor by receptor basis.

Due to the nature, scale and duration of the proposed Project it is acknowledged that the CNTs discussed in Table 13.12 will be exceeded during certain Construction Phases, particularly at NSLs which form the boundary with large work sites. This is particularly true for areas with the lowest CNT (Category A), where it will not be possible to manage certain construction activities within these significance thresholds due to the factors noted above. At levels of noise exposure below Category C, internal impacts inside properties affecting people or their activities is much less intrusive. However, outside the properties the construction noise is sufficiently prominent relative to ambient levels that this would be an effect on the external acoustic character of the area. Mitigation of such effects therefore relates to mitigation at source.

In order to assist with interpretation of significance, Table 13.13 includes guidance as to the likely magnitude of noise impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of DMRB Noise and Vibration (UKHA 2020) and adapted to include the relevant significance effects from the EPA Guidelines (EPA 2022) using professional expertise and judgment.

In accordance with the DMRB Noise and Vibration (UKHA 2020), 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 night in any 15 consecutive day or nights; and
- A total number of days exceeding 40 in any six consecutive months.

Table 13.13: 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 Note 1	
Above CNT and below or equal to CNT +5dB Note 2	Moderate	Moderate to Significant	
Above CNT +5 and below or equal to CNT +15dB	Major	Significant, to Very Significant	
Above +15dB		Very Significant to Profound Note 3	

Note 1: CNLs at the upper end of this range will result in higher potential impacts, therefore this range is categorised as slight to moderate, acknowledging that values approaching the CNT are greater than slight. In accordance with DMRB, noise levels below the CNT are deemed 'Not Significant'.

Note 2: Where night-time CNLs are calculated above Category C values, a significant effect is determined. Increasing magnitudes of impact depend on the scale above 55 dB $L_{Aeq,8hr}$ in accordance with Table 13.13.

Note 3: The DMRB does not distinguish beyond a 'Major' impact. For the purposes of distinguishing between a Very Significant and Profound Impact, CNLs exceeding the CNT by +20dB are categorised as Profound.

The adapted DMRB Noise and Vibration (UKHA 2020) guidance is used to assess the overall significance of construction noise at NSLs across the proposed Project.

13.2.6.1.4 Criteria for Noise Insulation or Temporary Rehousing

Due to the nature and duration of the proposed Project, even where all reasonable measures have been taken to reduce noise levels, at some locations residual levels mean widespread community disturbance or interference with sleep is likely to occur. In such circumstances, TII will consider whether the provision of further Noise Insulation (NI) or Temporary Rehousing (TRH) will be appropriate at locations where eligibility for either has been established. The document *Transport Infrastructure Ireland (TII) Airborne and Groundborne Noise Mitigation Policy* (Appendix A14.6) sets out the further mitigation measures and supports which will be available to those who meet the eligibility criteria. Non-residential buildings likely to be particularly sensitive to noise (e.g. commercial/educational establishments, hospitals and clinics) will be subject to individual consideration in accordance with the *Transport Infrastructure Ireland (TII) Airborne and Groundborne Noise Mitigation Policy*. The identified construction noise impacts at non-residential sensitive buildings are discussed throughout Section 13.5.2 which presents the predicted construction noise impacts across the proposed Project.

13.2.6.1.5 Criteria for Rating Construction Traffic Noise Impacts.

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 Noise and Vibration document (UKHA 2020). This document provides magnitude rating tables relating to changes in road traffic noise. The document suggests that changes in traffic noise levels are assessed against the Short-Term magnitudes.

Table 13.14 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This is compiled from Table 3.17 of the DMRB Noise and Vibration (UKHA 2020) and the relevant sections of the document.

Table 13.14: Magnitude of Impact Relating to Changes in Road Traffic Noise Level - Construction Phase

Magnitude of Impact	Increase in Traffic Noise Level (dB)	Duration	Initial Significance Rating
Major	Greater than or equal to 5.0	>10 days/nights over 15 consecutive day/nights & >40 days over 6 consecutive months	Significant
Moderate	Greater than or equal to 3.0 and less than 5.0		Significant
Minor	Greater than or equal to 1.0 and less than 3.0		Not Significant
Negligible	Less than 1.0		Not Significant

The overall significance rating is determined taking account of the change in road traffic noise levels in addition to the specific absolute noise level (Refer to Section 13.2.6.2.2).

13.2.6.1.6 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 and include guidance for sensitive equipment within buildings. For vibration impacts associated with surface construction activities in terms of building and human response, in both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV). Construction vibration sources associated with the proposed Project with potential to impact sensitive equipment are assessed in Chapter 14.

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 15mm/s at 4 Hertz (Hz) increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5mm/s PPV the risk of damage tends to 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 groundborne disturbance. The vibration limit range for protected and historical buildings are 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, further stringent criteria have been applied for transient vibration. It is assumed that known buildings and structures of this kind, will be subject to condition surveys well in advance of the works, and any defects identified repaired. The results of conditions surveys will determine whether a building or structure is classed as "vulnerable". Table 13.15 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 BS5228-2 (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 13.15.

Table 13.15: 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	50mm/s	25mm/s
Unreinforced or light framed structures. Residential or light commercial-type buildings	15mm/s	7.5mm/s
Protected and Historic Buildings *Note 1	6mm/s – 15mm/s	3mm/s – 7mm/s
Identified Potentially Vulnerable Structures and Buildings with Low Vibration Threshold	3mm/s	

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

13.2.6.1.6.1 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 (BSI 2014b) notes that vibration typically becomes perceptible at around 0.15mm/s to 0.3mm/s and may become disturbing or annoying at higher magnitudes. During surface construction works associated with breaking of ground, piling, diaphragm wall construction and excavation, depending on the methodologies involved have the potential to be clearly perceptible to building occupants and have the potential to cause significant effects.

Higher levels of vibration are however typically tolerated for single events or events of temporary duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5mm/s during the daytime and the evening if those affected are aware of the time-frame and origin of the vibration, and if they have been informed about the limit values relating to the structural integrity of neighbouring properties. Table 13.16 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS 5228 – 2 (BSI 2014b) and reference to the Association of Noise Consultants (ANC) Measurement and Assessment of Groundborne Noise and Vibration (Third edition, 2020).

Table 13.16: 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	Very Low	Imperceptible to Not significant

13.2.6.1.6.2 Disturbance of Vibration Sensitive Equipment or Processes

There are no standard criteria for assessing the potential impact of vibration on sensitive equipment or processes. BS 5228 – 2 (BSI 2014b) provides a guide of vibration sensitivities of differing types of sensitive equipment from microscopes to microelectronic manufacturing equipment. However, these ranges are generic and relate to the sensitivity of the equipment as installed, not the external façade of the building. Vibration impacts associated with the Construction Phase on sensitive equipment is assessed in Chapter 14 (Groundborne Noise & Vibration).

The following maximum allowable vibration levels are set by TII with respect to preventing damage to the Luas Light rail system (TII Code of Engineering practice for works on, near, or adjacent the Luas light rail system. Appendix 3 Vibration and Settlement (2016).

Table 13.17: Maximum Vibration Levels for Prevention of Damage to Luas Light Rail System

Frequency Range	Level 1	Level 2	Level 3
Above 50Hz	10mm/s	12mm/s	15mm/s
50Hz and below	10mm/s	10mm/s	10mm/s
Actions above trigger levels	Initiate review of techniques to reduce vibration magnitudes	Cease of associated works & propose alternative techniques to reduce to below Level 1	As level 2

13.2.6.2 Operational Phase Appraisal of Impacts

13.2.6.2.1 Operational Rail Noise

There is no applicable national guidance specifying airborne noise limits from rail operations, therefore precedence from other rail projects has been used. A review of relevant criteria relating to operational train noise has been undertaken for several large-scale urban rail projects, namely Dublin Luas, Channel Tunnel Rail Link-London and Cross Rail-London in addition to guidance documents relating to environmental noise including the WHO Environmental Noise Guidelines) (WHO 2018).

Table 13.18 proposes airborne noise operational rail criteria based on a review of the most applicable Irish rail projects.

Table 13.18: Operational Rail Noise Threshold

Sensitive Locations	Receptor Sensitivity	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 and hostels	High	Daytime: 55dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs) Night-time: 45dB $L_{Aeq,8hr}$ (23:00 – 07:00hrs)
Locations that are only sensitive during daytime periods, and are sensitive to noise: ▪ Educational Establishments; ▪ Theatres ▪ Places of worship (churches & other religious buildings) ▪ Offices	High	Daytime: 55dB $L_{Aeq,16hr}$ (07:00 – 23:00hrs)
Locations that are only sensitive during day but are less sensitive to noise that the categories above: ▪ Commercial buildings ▪ Outdoor recreational areas ▪ Cinemas	Medium	Assessed on a case-by-case basis, depending on the sensitivity of the specific use, the level of sound insulation that may be afforded by the building & the prevailing noise environment
▪ Industrial Warehouses ▪ Indoor recreational areas ▪ Shopping centres/retail park	Low	

Where operational rail noise is calculated to be below the threshold values in Table 13.18, the impact is determined to be not significant. Where operational rail noise levels are above these threshold levels, the impact rating is dependent on the magnitude above the threshold value and the increase above the baseline noise environment.

Where pre-existing noise levels are already very high (well above the threshold value), a small change in noise levels may be unnoticeable, however a larger change may cause disturbance and be significant. The scale of the impact will depend on the degree of noise change. If the ambient noise is 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 impact ratings are summarised in Table 13.19.

Table 13.19: Rail Noise Impact Magnitude and Significance Rating

Calculated noise level above threshold or baseline	Impact Magnitude	Significance Rating
>10dB	Very High	Very Significant
5 – 10dB	High	Significant
3 – 5dB	Medium	Moderate
1 – 3dB	Low	Slight
Less than 1dB	Very Low	Not Significant

WHO Environmental Noise Guidelines for the European Region

The World Health Organisation (WHO) have published in October 2018 Environmental Noise Guidelines for the European Region. 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 risks.

The following recommendations are noted from the WHO guidelines relating to rail noise:

- For average noise exposure, the WHO strongly recommends reducing noise levels produced by railway traffic below 54dB L_{den}, as railway noise above this level is associated with adverse health effects.
- For night noise exposure, the WHO strongly recommends reducing noise levels produced by railway traffic during night time below 44dB L_{night}, 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 13.18.

It should be noted that 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.

13.2.6.2.2 Road Traffic on Surrounding Road Network

Changes in Road Traffic Noise Level

Impacts associated with changes in road traffic noise levels during the Operational Phase are also assessed using guidance from the DMRB Noise and Vibration document (UKHA 2020). 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 (+15 years post opening) when people become more habituated to the change.

For the proposed Project, the initial significance criteria are used to describe the magnitude of change for the short- and medium-term period, (i.e. the year of opening up to 15 years post). For this assessment year, a 1dB change between the Do Minimum and Do Something scenarios is the smallest that is considered perceptible. Table 13.20 summarises the potential impact associated with defined changes in traffic noise level during the year of opening, 2035.

Table 13.20: Significance of Change Criteria – Short-Term

Change in Noise Level, dB	Short Term Magnitude	Initial Significance Rating
Greater than or equal to 5.0	Major	Significant
3.0 to 4.9	Moderate	Significant
1.0 to 2.9	Minor	Not Significant

Change in Noise Level, dB	Short Term Magnitude	Initial Significance Rating
Less than 1.0	Negligible	Not Significant

Where changes in traffic noise levels in the short-term is less than 3dB, the impact is deemed not significant. Where changes in traffic noise levels are greater than 3dB, the impact is deemed to be potentially significant.

Further consideration of the magnitude of change in noise levels are determined for the long-term period (i.e. between the year of opening Do Minimum and the design year Do Something). For this assessment year (design year 2050), a 3dB change is the smallest that is considered to pose any notable impact when considered over the life span of the project i.e. over a long term 15-year post year of opening in accordance with the DMRB Noise and Vibration (UKHA 2020) guidance document. Table 13.21 summarises the likely impact associated with defined changes in traffic noise level between the Do Minimum and Do Something scenarios during the long-term period.

Table 13.21: Significance of Change Criteria – Long-Term

Long-Term Magnitude	Change in Noise Level, dB	Initial Significance Rating
Major	Greater than or equal to 10.0	Significant
Moderate	5 to 9.9	Significant
Minor	3.0 to 4.9	Not Significant
Negligible	Less than 3.0	Not Significant

Absolute Noise Levels

The absolute noise level is an important consideration when determining the response to noise levels along affected roads within the study area. This is particularly valid for locations where a 'moderate' or 'major' magnitude of change rating applies against comparably low absolute noise levels.

The most appropriate documentation for guidance on road traffic noise level ranges across the study area is the Dublin Agglomeration NAP 2018 – 2023 (DCC; FCC; SDCC; DLRCC 2018). This document proposes the following thresholds for defining Desirable Low and Undesirable High sound levels across the Agglomeration of Dublin:

- Desirable Low: <55dB(A) L_{day} / < 50dB(A) L_{night}; and
- Undesirable High: >70dB(A) L_{day} / >55dB(A) L_{night}.

The following thresholds are also used to define a Quiet Area:

- <55dB(A) L_{day}; and
- <45dB(A) L_{night}.

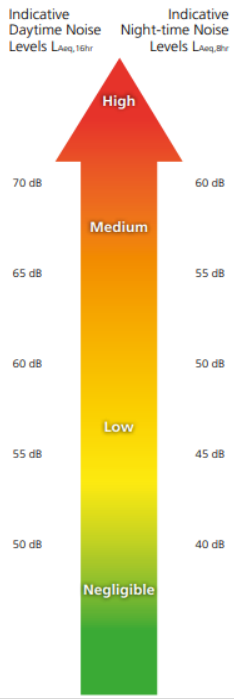
To further define noise levels between 'Desirable Low' and 'Undesirable High' reference is made to ProPG (IoA 2017). Whilst the scope of this document is used for the consideration of new residential development exposed to transport sources, the range of noise levels included provides a means of further categorising road traffic noise between the upper and lower threshold values described in the NAP with respect to noise sensitive properties. This document categorises noise level ranges from Negligible (< 50dB $L_{Aeq,16hr}$ /< 40dB $L_{Aeq,8hr}$) to High (< 70dB $L_{Aeq,16hr}$ /< 60dB $L_{Aeq,8hr}$) in steps of 5dB(A) to enable a site-specific risk assessment for an area to be undertaken depending on its noise exposure ranges.

It is noted, the daytime period within the ProPG (IoA 2017) document is described using the $L_{Aeq,16hr}$ parameter. This is the L_{Aeq} noise level between 07:00hrs and 23:00hrs which encompasses the L_{day} (07:00hrs to 19:00hrs) and $L_{evening}$ (19:00hrs to 23:00hrs) periods as defined in Section 13.2.4.1. The night-

time period is described using the $L_{Aeq,8hr}$ parameter, i.e. the L_{Aeq} noise level between 23:00 and 07:00hrs which is equivalent to the L_{night} in Section 13.2.4.1 and used in the Dublin Agglomeration NAP 2018 – 2023 (DCC; FCC; SDCC; DLRCC 2018).

Table 13.22 combines the threshold values from both documents to provide a combined range of noise level categories and their noise exposure levels. For the purposes of this assessment, the daytime period is defined as the $L_{Aeq,16hr}$ to capture both the L_{day} and $L_{evening}$ periods.

Table 13.22: Noise Level Ranges and Exposure Categorisation (ProPG (IoA 2017) and Dublin Agglomeration NAP 2018 - 2023 (DCC; FCC; SDCC; DLRCC 2018))



Daytime: dB $L_{Aeq,16hr}$	Night-time: dB $L_{Aeq,8hr}$	Pro PG - Noise Risk Assess Pro PG - Noise Risk Assessment	Dublin Agglomeration Noise Action Plan
>70dB	>60	High	Undesirable high day
65 – 70	55 - 60	Medium – High	Undesirable high night
60 – 65	50 - 55	Medium	
55 – 60	45 - 50	Low – Medium	Desirable Low night
<55	<45	Negligible – Low	Desirable low daytime/Quiet area threshold day and night
<50	<40	Negligible	

Both documents define a daytime noise level below 55dB(A) as being Low/Desirable Low, and both define daytime noise levels above 70dB(A) as High/Undesirably High. For night-time periods, noise levels below 45dB $L_{Aeq,8hr}$ are defined as being low with increasing magnitude of impact with higher noise levels. Night-time noise levels below 50dB $L_{Aeq,8h}$ are defined as desirable low within the Dublin Agglomeration NAP 2018 – 2023 (DCC; FCC; SDCC; DLRCC 2018) with night-time noise levels greater than 55dB $L_{Aeq,8h}$ as undesirable high.

As part of the noise impact assessment, therefore, consideration is given to the magnitude of change in traffic noise levels in addition to the noise level category in which a road is defined within where potential significant impacts are identified.

13.2.6.2.3 Vibration

Operational vibration significance thresholds for the MetroLink rail line are discussed in Chapter 14 (Groundborne Noise & Vibration). There are no other sources of vibration associated with the Operational Phase which would give rise to any perceptible significant impacts to building occupants, impacts to sensitive equipment, structures or buildings. No additional criteria over and above those discussed in Chapter 14 (Groundborne Noise & Vibration) are therefore included in this chapter.

13.2.6.2.4 Fixed Noise Sources

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings (BSI 2014c) provides guideline values for internal noise levels within residential dwellings. The following guideline values in Table 13.23, for indoor noise levels are presented in the standard.

Table 13.23: BS 8233:2014 Indoor Noise Levels

Activity	Location	Daytime	Night-time
Resting	Living room	35dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40dB $L_{Aeq, 16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq, 16hour}$	30dB $L_{Aeq, 8hour}$
Notes: Daytime assessment period – 07:00 to 23:00 hrs Night-time assessment period – 23:00 to 07:00 hrs			

The L_{AFmax} is the instantaneous fast time weighted maximum sound level, measured during the sample period, and the 45dB L_{AFmax} criterion applies to 'single sound events' within bedrooms at night. This guideline is generally interpreted as the value that individual noise events should not normally exceed.

Referring to the BS 8233:2014 (BSI 2014c), the following daytime and night-time internal noise thresholds have been identified for residential dwellings in the vicinity of Operational Phase plant items:

- 35dB $L_{Aeq, 16\ hr}$ within living rooms and dining rooms during daytime periods (07:00hrs to 23:00hrs);
- 30dB $L_{Aeq, 8\ hr}$ within bedrooms during the night-time period (23:00hrs to 07:00hrs); and
- A value of 45dB L_{AFmax} is not normally exceeded in bedrooms at night.

It is appropriate to derive external noise limits based on the internal guidance set out in Table 13.23. This is done by factoring in the degree of noise reduction afforded by a partially open window. Annex G in BS 8233:2014 (BSI 2014c) comments that, '*...If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB...*'. In summary, therefore the following external noise criteria are proposed for residential properties in the vicinity of the Proposed Project:

- Daytime (07:00hrs to 23:00hrs): 50dB $L_{Aeq, 16hr}$;
- Night-time (23:00hrs to 07:00hrs): 45dB $L_{Aeq, 8hr}$; and
- Night-time (23:00hrs to 07:00hrs): 60dB L_{AFmax}.

Locations where fixed plant items are sited along the proposed Project are those serving the Metrolink stations, plant items serving the Park and Ride Facility, intervention shafts, the substation to the east of DANP and fixed plant items and operational activities at Dardistown Depot. The prevailing noise environment in the vicinity of all stations is medium to high, dominated by road traffic, aircraft noise and existing rail, (where relevant) in addition to general urban and sub urban sources. In this instance, the fixed noise limits noted above are below the prevailing noise environment for the majority of NSLs located in proximity to any fixed noise source and sources operating at these noise levels will not generate a significant noise impact.

Notwithstanding, in areas where background noise levels (expressed using the L_{A90} parameter) are below the fixed noise limits above, there is potential for the operation of a new noise sources at this level to be audible and to generate potential significant effects, depending on the magnitude above the background noise level. Therefore, when considering the potential impact of the noise emissions from operational plant associated with the proposed Project consideration will also be given to the British Standard BS 4142 (BSI 2014 +A1 2019).

BS 4142 (BSI 2014 +A1 2019) is the industry standard method for analysing building services plant sound emissions to residential receptors. BS 4142 (BSI 2014 +A1 2019) describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 (BSI 2014 +A1 2019) assessment it is necessary to compare the measured external background sound level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating

level ($L_{Ar,T}$) of the various plant items, when operational. Where sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS 4142 advises that penalties be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal sound characteristics outlined in BS 4142 (BSI 2014 +A1 2019) recommends the application of a 2dB penalty for a tone which is just perceptible at the receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible. In relation to intermittency, BS 4142 (BSI 2014 +A1 2019) recommends that if the intermittency is readily distinguishable against the residual acoustic environment, a penalty of 3dB can be applied. The following definitions as discussed in BS 4142 (BSI 2014 +A1 2019) as summarised below:

- *"ambient sound level, $L_{Aeq,T}$"* equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at any given time, usually from many sources near and far, at the assessment location over a given time interval, T.
- *"residual sound level, $L_{Aeq,T}$"* equivalent continuous A-weighted sound pressure level of the residual sound (i.e. ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound) at the assessment location over a given time interval, T.
- *"specific sound level, $L_{Aeq,T}$"* equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.
- *"rating level, $L_{Ar,T}$"* specific sound level plus any adjustment for the characteristic features of the sound.
- *"background sound level, $L_{A90,T}$"* A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

In order to establish an initial estimate of impact, BS 4142 (BSI 2014 +A1 2019) states the following:

"*Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following.*

a. *Typically, the greater this difference, the greater the magnitude of the impact.*

b. *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*

c. *A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*

d. *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 impact 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.*"

Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

13.3 Baseline Environment

The following section describes the receiving noise environment within the study area. The baseline noise environment has been characterized through a desktop review of publicly available published data sources and an extensive suite of noise surveys. The following sections summarise the data sources and the results of the baseline noise surveys.

13.3.1 Baseline Noise

13.3.1.1 Desktop Noise Study

The key sources of publicly available baseline data include published noise mapping studies undertaken by CIE, TII and DAA which feed into the strategic noise mapping requirements of the Environmental Noise Regulations (S.I. 549 / 2018), based on noise modelled data from 2016. These are published and available via the EPA geo portal for Noise Maps Round 3 (2016) (https://gis.epa.ie/EPAMaps/). The modelled noise maps include existing sources of major rail, road and aircraft noise within the Dublin Agglomeration area. This information provides a useful high-level overview of noise levels in the study area. The parameters presented in terms of the noise mapping are the L_{den} and L_{night} noise parameters which are both long term noise indicators based on annual traffic and transport modes. The existing mapping available is based on noise modelled data from 2016.

The range of noise sources within the published contour mapping associated with road, rail and aircraft noise, are discussed alongside the measured baseline noise surveys in Section 13.3.1.2.

13.3.1.2 Baseline Noise Surveys

Baseline noise surveys have been conducted at locations representative of the nearest noise sensitive areas which have the potential to be impacted by construction works and/or those likely to be impacted during the operational phase. Baseline noise measurements were made over both long-term and short-term periods to inform the assessment. Long-term surveys (typically one week in duration) were made at a total of 52 locations. Short-term surveys (attended day-time measurements), made at a total of 74 locations along the length of the proposed Project were used to supplement the long-term surveys.

Full details of the survey methodologies, equipment, acoustic parameters and terminology and results of the baseline surveys are included in Appendix A13.1 and Appendix A13.2.

Figure 13.1 presents the baseline noise survey locations. Each is discussed in the relevant geographic area AZ1 to AZ4 in the following sections.

13.3.1.3 Baseline Noise Environment AZ1: Northern Section

A total of 20 long term unattended survey locations and 26 attended survey locations were surveyed within the AZ1 study area. The location reference, and description survey positions are included in Table 13.24.

Table 13.24: Noise Monitoring Locations AZ1

Location	Description of Survey Location
Unattended (Long term) Noise Survey Locations	
UT1	Green area to front of residential and farm buildings in Lissenhall Great
UT2	Green area within grounds of Emmaus Retreat Centre, Estuary
UT3	Green area to rear of Tigín Montessoi School, Estuary
UT4	Rear garden of residential building in Seatown Park, Swords
UT5	At side of residential building in Estuary Court, Swords
UT6	Rear garden of residential building in Comyn Manor, Swords
UT7	Rear garden of Kids Inc. Creche, Seatown Walk, Swords
UT8	Rear garden of residential building on Chapel Lane, Swords
UT9	Rear garden of residential building on Ashley Avenue, Swords
UT10	Rear garden of residential building in Castle Grove, Swords

Location	Description of Survey Location
UT11	Rear garden of residential building in Foxwood, Swords
UT12	Green area to rear of commercial building in Airside Business Park, Swords
UT13	Rear garden of residential building in Carlton Court, Swords
UT14	Green area to side of Hotel at Pinnock Hill Roundabout, Swords
UT15	Green area to front of residential building at Cremona, Swords
UT16	Rear garden of residential building in Boroimhe Willows, Airside
UT17	Carpark area to side of Private Clinic in Nevinstown West
UT18	Rear garden of residential building in Boroimhe Hazel, Nevinstown West
UT19 Note 1	Rear garden of residential building in Nevinstown West off R132
UT20 Note 1	Rear garden of residential building in Nevinstown West off R132
Attended Noise Survey Locations	
AT1	Green area at HSE Ambulance Depot in Lissenhall Great
AT2	Grass siding set back from R132 in Lissenhall Great
AT3	Side of road near car park of sports facility in Seatown West
AT4	Green area in Seatown Villas housing estate
AT5	Siding of access road to North Dublin Corporate park
AT6	Green area within Seatown Villas
AT7	Green area in Castle Park housing estate
AT8	Green area at end of Foxwood housing estate
AT9	Grass siding of exit from Pavilions SC at junction with R132
AT10	Carpark of commercial building within Airside Business Park
AT11	Green area at end of Carlton Court housing estate
AT12	Paved area to side of Airside Retail Park
AT13	Green area in Boroimhe Poplars housing estate
AT14	Green area in Boroimhe Hazel housing estate
AT74	Green are on verge of Ennis Lane
AT50	Cul-de-sac at end of Seatown West, bordering roundabout linking R132 and R125
AT51	Green area on Seatown Terrace
AT52	Green area at end of Estuary Court bordering the R132
AT53	Green area on Seatown Wak bordering the R132
AT54	Green area off of Ashley Ave bordering the R132
AT55	Green area at end of Castle Grove bordering the R132
AT56	Northern end of Carlton Court bordering the R132
AT57	Southern end of Carlton Court bordering the R132
AT58	Green area on the side of the R132 carriageway
AT59	North-eastern end of Boroimhe Willows bordering the R132
AT60	Green area at the merge of Nevinstown Lane and the R132

Note 1: Noise survey undertaken at UT19 & UT20 were logged for a period of 3 hours within gardens of these properties. The 3-hour survey results are summarised in Table 7 under the attended survey results.

The noise survey results recorded during at baseline surveys locations within the AZ1 study area are summarised in Table 13.25. For unattended survey locations, results are presented in terms of the 16hr daytime period (07:00 – 23:00hrs) for the L_{Aeq} and L_{A90} parameters and the eight-hour night-time period

(23:00 – 07:00hrs) in terms of the L_{Aeq} and L_{A90} parameters. The derived L_{den} for each day is also presented.

For attended surveys, the survey results are presented as the average daytime L_{Aeq} and L_{A90} parameters over the three-hour survey periods and the calculated L_{den} parameter.

Table 13.25: Noise Survey Results within AZ1 Study Area

Unattended Location	Daytime dB $L_{Aeq,16hr}$	Daytime dB $L_{A90,16hr}$	Night-time, dB $L_{Aeq,8hr}$	Night-time, dB $L_{A90,8hr}$	dB L_{den}	Attended Location	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB L_{den}
Estuary									
UT1	68	63	62	51	71	AT1	66	61	68
UT2	58	55	54	47	61	AT2	70	66	71
UT3	64	58	57	49	66	AT74	58	45	62
R132 Estuary to Seatown									
UT4	66	61	59	49	68	AT3	60	53	64
UT5	68	64	60	50	70	AT4	62	59	63
UT6	73	62	67	51	76	AT5	59	54	59
UT7	64	55	59	46	67	AT6	61	58	62
						AT50	59	61	62
						AT52	65	63	67
R132 Seatown to Swords Central									
UT8	68	61	60	48	69	AT7	53	49	57
UT9	57	53	53	47	60	AT8	65	57	69
UT10	58	55	53	47	61	AT9	69	62	71
UT11	62	57	57	49	65	AT10	63	59	65
UT12	73	62	65	45	75	AT51	58	56	61
						AT53	66	61	67
						AT54	65	61	67
						AT55	64	60	67
R132 Swords Central to Fosterstown									
UT13	65	56	57	42	67	AT11	64	57	67
UT14	63	60	57	47	65	AT12	61	56	61
UT15	62	57	57	47	65	AT13	53	45	55
UT16	57	50	54	46	61	AT56	65	60	67
UT17	59	55	56	49	63	AT57	63	56	66
						AT58	70	60	72
R132 Fosterstown to Naul Road									
UT18	58	53	56	51	63	AT14	49	46	54
						UT19	58	52	60
						UT20	59	53	61
						AT59	63	54	66
						AT60	65	60	67

The noise survey results within this assessment zone indicate that a high noise environment is experienced at sensitive locations in closest proximity to the proposed Project.

13.3.1.3.1 Estuary

Within the Estuary study area, road traffic along the M1 and R132 are the dominant noise sources at the survey positions in the vicinity of the proposed Project. During daytime periods, average ambient noise levels were recorded in range of 58 to 68dB $L_{Aeq,16hr}$ at the unattended survey positions (UT1 to UT3). At the attended survey locations (AT1, AT2 and AT74), daytime noise levels were measured in the range of 58 to 70dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 55 to 63dB $L_{A90,16hr}$ at the unattended survey positions and between 45 and 66dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels are recorded at the survey locations closest to the R132 Road (UT1 and AT2).

Night-time noise levels at the survey locations are dominated by road traffic noise. Average ambient night-time noise levels were measured in the range of 54 to 62dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 47 to 51dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 61 and 71dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 68 to 71dB L_{den}.

13.3.1.3.2 R132 - Estuary to Seatown

Between Estuary and Seatown, noise survey locations are located along the R132 at representative noise sensitive properties in the vicinity of the proposed Project. At these survey positions, road traffic along the R132 is the dominant noise source at all locations surveyed.

During daytime periods, average ambient noise levels were recorded in range of 64 to 73dB $L_{Aeq,16hr}$ at the unattended survey positions (UT4 to UT7). At the attended survey locations (AT3 to AT6, AT50 and AT52), daytime ambient noise levels were measured in the range of 59 to 65dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 55 to 64dB $L_{A90,16hr}$ at the unattended survey positions and between 53 and 63dB $L_{A90,\ 15mins}$ at the attended survey locations. Highest noise levels are recorded at the survey locations closest to the R132 Road (UT6).

Night-time noise levels at the survey locations (UT4 to UT7) are dominated by road traffic noise. Average ambient night-time noise levels were measured in the range of 59 to 67dB $_{LAeq,8hr}$. Average background noise levels during this time period were measured in the range of 46 to 51dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 68 and 76dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 59 to 67dB L_{den}.

The measured noise levels within this study area align closely with those included within the EPA noise maps in this assessment zone for road traffic noise along the R132. Mapped contour noise levels are between 70 and 75dB L_{den} at distances extending approximately 40m from the R132 road centreline, between 65 to 69dB L_{den} between 40m and 70/80m from the road centre line and between 55 and 60dB L_{den} at distances of 300m, depending on the roadside boundary treatments which align with those recorded at the survey positions at similar distances from the road edge.

13.3.1.3.3 R132 - Seatown to Swords Central

Between Seatown and Swords Central, noise survey locations are located along the R132 and adjacent residential areas off the R132 at representative noise sensitive properties in the vicinity of the proposed Project. At these survey positions, road traffic along the R132 is the dominant noise source at all locations surveyed.

During daytime periods, average ambient noise levels were recorded in range of 57 to 73dB $L_{Aeq,16hr}$ at the unattended survey positions (UT8 to UT12). At the attended survey locations (AT7 to AT10, and AT51

to AT 55), daytime ambient noise levels were measured in the range of 53 to 69dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 53 to 62dB $L_{A90,16hr}$ at the unattended survey positions and between 49 and 62dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels are recorded at the survey locations closest to the R132 Road (UT12 and AT9).

Night-time noise levels at the survey locations (UT8 to UT12) are dominated by road traffic noise. Average ambient night-time noise levels were measured in the range of 53 to 65dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 45 to 49dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 60 and 75dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 57 to 71dB L_{den}.

The measured noise levels within this study area align closely with those included within the EPA noise maps in this assessment zone for road traffic noise along the R132. Mapped contour noise levels are between 70 and 75dB L_{den} at distances extending approximately 40m from the R132 road centreline, between 65 to 69dB L_{den} between 40m and 70/80m from the road centre line and between 55 and 60dB L_{den} at distances of 300m, depending on the roadside boundary treatments which align with those recorded at the survey positions at similar distances from the road edge.

13.3.1.3.4 R132 - Swords Central to Fosterstown

Between Swords Central and Fosterstown, noise survey locations are located along the R132 and adjacent residential areas off the R132 at representative noise sensitive properties in the vicinity of the proposed Project. At these survey positions, road traffic along the R132 is the dominant noise source at all locations surveyed in addition to overhead aircraft movements to and from Dublin Airport.

During daytime periods, average ambient noise levels were recorded in range of 57 to 65dB L_{Aeq},16hr at the unattended survey positions (UT13 to UT17). At the attended survey locations (AT11 to AT13 and AT56 to AT58), daytime ambient noise levels were measured in the range of 53 to 70dB L_{Aeq}, 15mins. Background noise levels were measured in the range of 50 to 60dB LA90,16hr at the unattended survey positions and between 45 and 60dB L_{A90}, 15mins at the attended survey locations. Highest noise levels are recorded at the survey locations closest to the R132 Road (UT13 and AT58). The lowest values were recorded within a residential area set back some 100 to 140m from the R132 road edge (UT16 & AT13).

Night-time noise levels at the survey locations (UT13 to UT17) are dominated by road traffic noise. Average ambient night-time noise levels were measured in the range of 54 to 57dB L_{Aeq},8hr. Average background noise levels during this time period were measured in the range of 55 to 67dB L_{A90},8hr.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 61 and 67dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 57 to 72dB L_{den}.

The measured noise levels within this study area align closely with those included within the EPA noise maps in this assessment zone for road traffic noise along the R132. Mapped contour noise levels are between 70 and 75dB L_{den} at distances extending approximately 40m from the R132 road centreline, between 65 to 69dB L_{den} between 40m and 70/80m from the road centre line and between 55 and 60dB L_{den} at distances of 300m, depending on the roadside boundary treatments which align with those recorded at the survey positions at similar distances from the road edge.

13.3.1.3.5 Fosterstown to Naul Road

Within the study area between Fosterstown and the Naul Road, road traffic along the R132 is also the dominant noise source in addition to overhead aircraft noise. Noise survey positions in this area are typically located further from the R132 road edge as the alignment of the proposed project moves south-west towards Dublin Airport.

During daytime periods, average ambient noise levels measured 58dB $L_{Aeq,16hr}$ at the unattended survey position (UT18). At the attended survey locations (AT14, UT19, UT20, AT59 and AT60), daytime noise levels were measured in the range of 49 to 65dB $L_{Aeq,15mins}$. Background noise levels measured 53dB $L_{A90,16hr}$ at the unattended survey position and measured between 46 and 60dB $L_{A90,15mins}$ at the attended survey locations.

Night-time noise levels are dominated by road traffic noise and aircraft movements. Average ambient night-time noise levels measured 56dB $L_{Aeq,8hr}$ at UT18. Average background noise levels at this survey location during night-time periods measured 51dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the unattended survey location (UT18) measured 63dB L_{den}. At the attended survey locations, calculated L_{den} values are in the range of 54 to 67dB L_{den}.

At survey location UT18, mapped road traffic noise levels in the vicinity of survey position are within the 55 to 59dB L_{den} contour which align closely with those measured. At survey location UT19 and UT20 mapped road traffic noise levels in the vicinity of survey position are within the 60 to 64dB L_{den} contour which also align with those measured.

13.3.1.4 Baseline Noise Environment AZ2: Airport Section

One long term unattended survey location was surveyed within the AZ2 study area. This location was measured within the rear garden of Our Lady Queen of Heaven Church at Dublin Airport. One attended survey position was surveyed within AZ2 at Location AT15 along a green area near a former entrance to creche off Naul Road. The measured results recorded at this survey location are summarised in Table 13.26. For unattended survey locations, results are presented in terms of the 16hr daytime period (07:00 – 23:00hrs) for the LAeq and LA90 parameters and the eight-hour night-time period (23:00 – 07:00hrs) in terms of the LAeq and LA90 parameters and the Lden. For attended survey, the results are presented as the average daytime LAeq and LA90 parameters over the three-hour survey period and the calculated Lden parameter.

Table 13.26: Noise Monitoring Location AZ2

Unattended Location	Daytime dB $L_{Aeq,16hr}$	Daytime dB $L_{A90,16hr}$	Night-time, dB $L_{Aeq,8hr}$	Night-time, dB $L_{A90,8hr}$	dB L_{den}	Attended Location	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB L_{den}
UT21	61	57	58	52	65	AT15	60	55	62

The noise survey results within this assessment zone are dominated by aircraft overhead noise and airport ground activities including traffic localised traffic movements. Average ambient daytime noise levels measured 61dB $L_{Aeq,16hr}$ and average ambient night-time noise levels measured 58dB $L_{Aeq,8hr}$. The L_{den} at this location measured 65dB.

At the attended survey location, road traffic was the dominant noise source in addition to ground activities from the operation of Dublin Airport. Average ambient daytime noise levels were measured as 60dB $L_{Aeq,15mins}$, average background noise levels measured 55dB $L_{A90,15mins}$ and the calculated L_{den} is 62dB.

Our Lady Queen of Heaven Church sits within the 60 to 64dB L_{den} and 50 to 54dB L_{night} aircraft noise contours published by the EPA. The L_{den} survey results align closely with the published data. Measured night-time noise levels at this location are higher than the published maps indicating sources other than overhead aircraft movements influence the noise environment at this location, i.e. airport ground activities, which align with observations made on site.

13.3.1.5 Baseline Noise Environment AZ3: Dardistown to Northwood

A total of three long term unattended survey locations and four attended survey locations were surveyed within the AZ3 study area. The location reference, and description survey locations are included in Table 13.27.

Table 13.27: Noise Monitoring Locations AZ3

Location	Description of Survey Location
Unattended (Long term) Noise Survey Locations	
UT22	Rear garden of residential building off Old Airport Road
UT23	Green area within grounds of residential building in Charter School Hill, Ballymun Cross
UT24	Garden to rear of residential apartment building at junction of Ballymun Road and Santry Avenue
Attended Noise Survey Locations	
AT16	Road-side at derelict residence near commercial buildings in Ballymun, north of the M50 Motorway
AT17	Side road at entrance to Gulliver's Retail Park
AT61	Side of road on Charter School Hill
AT62	Green area on the carriageway edge of the R108

The noise survey results recorded during the baseline surveys within the AZ3 study area are summarised in Table 13.28. For unattended survey locations, results are presented in terms of the 16hr daytime period (07:00 – 23:00hrs) for the L_{Aeq} and L_{A90} parameters and the eight-hour night-time period (23:00 – 07:00hrs) in terms of the L_{Aeq} and L_{A90} parameters. The derived L_{den} for each day is also presented.

For attended surveys, the survey results are presented as the average daytime L_{Aeq} and L_{A90} parameters over the three-hour survey periods and the calculated L_{den} parameter.

Table 13.28: Noise Survey Results within AZ3 study area

Unattended Location	Daytime dB $L_{Aeq,16hr}$	Daytime dB $L_{A90,16hr}$	Night-time, dB $L_{Aeq,8hr}$	Night-time, dB $L_{A90,8hr}$	dB L_{den}	Attended Location	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB L_{den}
Dardistown/Ballymun Cross									
UT22	65	54	60	49	68	AT16	65	58	64
UT23	59	57	55	52	63	AT17	68	62	69
UT24	66	60	61	50	69	AT61	59	57	61
						AT62	72	65	74

The results of the noise survey within this assessment zone indicate a moderate to high noise environment is experienced at the noise sensitive locations at closest proximity to the proposed Project. The noise environment at Location UT22 is largely dominated by aircraft noise from Dublin Airport in addition to traffic along the R108. The noise environment at Location UT23 is dominated by road traffic along the M50 Motorway, the Ballymun Road and aircraft noise from Dublin Airport. Location UT24 was measured in a garden area of apartment building at the junction of Ballymun Road and Santry Avenue and was dominated by road traffic along these two adjacent roads.

During daytime periods, average ambient noise levels were recorded in range of 59 to 66dB $L_{Aeq,16hr}$ at the unattended survey positions, averaged over a seven-day period. At the attended survey locations, daytime noise levels were measured in the range of 65 to 72dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 54 to 60dB $L_{A90,16hr}$ at the unattended survey positions and between 58 and 65dB $L_{A90,15mins}$ at the attended survey locations.

Night-time noise levels at the survey locations are also heavily influenced by road traffic noise and overhead aircraft at locations in proximity to Dublin Airport. Average ambient night-time noise levels were measured in the range of 55 to 61dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 49 to 52dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 63 and 69dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 61 to 74dB L_{den}.

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. Mapped aircraft noise levels in the vicinity of survey position UT22 are in the 65 to 69dB L_{den} contour which align closely with those measured.

Road traffic noise along the M50 Motorway and Naul Road in vicinity of Location UT23 are mapped between 65 to 69dB $L_{den.}$ Measured noise levels at Location UT23 are marginally lower than those presented in the EPA noise maps for road traffic. This is likely due to the lower ground level in which this survey position is located relative to the M50 Motorway ground levels.

Mapped road traffic noise levels in the vicinity of survey position UT24 are in the 65 to 69dB L_{den} contour which also aligns with the measured noise levels at this position.

13.3.1.6 Baseline Noise Environment AZ4: Northwood to Charlemont

A total of 28 long term unattended survey locations and 42 attended survey locations were surveyed within the AZ4 study area. The location reference, and description survey positions are included in Table 13.29.

Table 13.29: Noise Monitoring Locations AZ4

Location	Description of Survey Location
Unattended (Long term) Noise Survey Locations	
UT25	Garden to rear of Primary Education building in Ballymun
UT26	On roof of Civic Centre building in Ballymun
UT27	Garden to side of Secondary Education building off Ballymun Road
UT28	Paved area to side of CDETB Building off Ballymun Road
UT29	Carpark area to front of Primary Education building off Ballymun Road
UT30	Carpark area to side of Church in Whitehall
UT31	Paved area to front of residential building off R108 in Whitehall
UT32	Green area within grounds of Special Education building off Ballymun Road in Ballygall
UT33	Green area to side of Scoil Chaitríona Secondary School building off St Mobhi Road in Glasnevin
UT34	Paved area to front of residential building off St Mobhi Road in Glasnevin
UT35	Green area to side of Scoil mobhí Primary Education building off St Mobhi Road in Glasnevin
UT36	Garden to rear of residential building in Claremont Crescent
UT37	Garden to rear of house on St Teresa's Rd
UT38	Garden to rear of residential building in Claremont Lawns
UT39	Garden to rear of residential building in Coke Oven Cottages
UT40	Garden to rear of residential building in Dalcassian Downs
UT41	Garden to rear of residential building off Whitworth Road
UT42	Green area to front of Mater Hospital on Eccles St
UT43	Green area to front of Mater Hospital on Eccles St
UT44	Green area to side of St Joseph's Church, Berkeley Road
UT45	To front of construction site off O'Connell Street Upper
UT46	To rear of construction site off O'Connell Street Upper
UT47	To front of construction site/commercial carpark off O'Connell Street Upper

Location	Description of Survey Location
UT48	On roof of Fire Station building on Townsend Street
UT49	On roof of residential apartment building at Tara and Townsend Street junction
UT50	Green area within St Stephen's Green maintenance compound
UT51	Paved area within compound of disused commercial building off Grand Parade in Charlemont
UT52	Paved area within compound of disused commercial building off Grand Parade in Charlemont
Attended Noise Survey Locations	
AT18	In public park off R104 in Ballymun
AT19	In carpark off R108 in Ballymun
AT20	Grass area outside HSE Carpark in Ballymun
AT21	On footpath in car park of terraced housing off R108 in Ballymun
AT22	Green area at side of R108 in Ballymun
AT23	Green area at side of R108 at entrance to primary school in Ballymun
AT24	Grass siding to R108 at pedestrian entrance to housing estate on Albert College Grove
AT25	Grass siding of R108 beside pedestrian entrance to DCU
AT26	Side road footpath at entrance to sports and education buildings in Ballygall
AT27	Carpark of sports facility adjacent to housing estate in Ballygall
AT28	On footpath at junction of 2 lanes of R108 in Ballygall
AT29	Grass verge at side of driveway entrance to Secondary Education building off St Mobhi Road in Glasnevin
AT30	Grass area inside entrance gate to Secondary Education building off St Mobhi Road in Glasnevin
AT31	Carpark of Bon Secours Hospital in Glasnevin Hill
AT32	Side of driveway entrance to sports facility off St Mobhi Road in Glasnevin
AT33	Carpark of sports facility, Primary Education building adjacent off St Mobhi Road in Glasnevin
AT34	Green area in Dalcassian Downs housing estate
AT35	On footpath on north side of Royal Canal Way off Whitworth Road
AT36	On footpath at side of R108 at junction with Whitworth Road
AT37	On footpath on south side of Royal Canal Way off Whitworth Road
AT38	On footpath at corner of North Circular Road and Berkeley Road
AT39	On footpath at side of Berkely Road
AT40	On footpath at side of Eccles Street Rd
AT41	At entrance to Mater Staff car park, at side of Eccles Street
AT42	On footpath at side of Berkely Rd
AT43	On footpath at side of Poolbeg St
AT44	On footpath at gated entrance to 1 George's Quay complex, under DART bridge.
AT45	On footpath at side of Townsend St
AT46	On footpath at entrance of St Stephen's Green
AT47	On footpath at junction of R138 and Hume St
AT48	On footpath at side of R138
AT49	On footpath at entrance St Stephen's Green, junction of R138 and R110
AT64	Footpath at the merge of Hampstead Avenue and Ballymun Road
AT65	Green area on Dalcassian Downs at the edge of the R108
AT66	Walkway on the canal edge of Phibsborough Road

Location	Description of Survey Location
AT67	Footpath on Eglinton Terrace bordering the R108
AT68	Footpath on the edge of Eccles Street
AT69	Side of the carriageway on Berkeley Road
AT70	Footpath at the merge of O'Rahilly Parade and Moore Lane
AT71	Position on the road edge of Henry Place
AT72	Position on the road edge of Dartmouth Road
AT73	Carpark on the edge of Dartmouth Place

The measured results recorded during the noise survey within the AZ4 study area are summarised in Table 13.30. For unattended survey locations, results are presented in terms of the 16hr daytime period (07:00 – 23:00hrs) for the L_{Aeq} and L_{A90} parameters and the eight-hour night-time period (23:00 – 07:00hrs) in terms of the L_{Aeq} and L_{A90} parameters. The derived L_{den} for each day is also presented.

For attended surveys, the survey results are presented as the average daytime L_{Aeq} and L_{A90} parameters over the three-hour survey periods and the calculated L_{den} parameter.

Table 13.30: Noise Survey Results within AZ4 Study Area

Unattended Location	Daytime dB $L_{Aeq,16hr}$	Daytime dB $L_{A90,16hr}$	Night-time, dB $L_{Aeq,8hr}$	Night-time, dB $L_{A90,8hr}$	dB L_{den}	Attended Location	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB L_{den}
Ballymun									
UT25	57	47	50	40	59	AT18	56	53	59
UT26	68	62	63	50	71	AT19	52	43	55
UT27	60	53	55	44	63	AT20	67	55	68
UT28	62	54	56	44	65	AT21	69	60	72
						AT22	68	60	70
Collins Avenue									
UT29	51	46	43	39	53	AT23	66	54	69
UT30	55	47	48	41	57	AT24	69	59	72
						AT25	65	56	68
						AT63	68	58	70
Albert College Park									
UT31	68	56	64	44	72	AT26	60	50	63
UT32	60	53	55	44	63	AT27	48	46	52
						AT28	69	62	71
						AT64	66	56	69
Griffith Park									
UT33	55	48	49	42	58	AT29	62	52	65
UT34	70	54	65	41	73	AT30	53	47	54
UT35	55	49	49	43	59	AT31	56	45	56
						AT32	57	48	61
						AT33	51	47	54
Glasnevin/Whitworth									
UT36	57	41	51	37	60	AT34	46	40	50

Unattended Location	Daytime dB $L_{Aeq,16hr}$	Daytime dB $L_{A90,16hr}$	Night-time, dB $L_{Aeq,8hr}$	Night-time, dB $L_{A90,8hr}$	dB L_{den}	Attended Location	dB $L_{Aeq,15min}$	dB $L_{A90,15min}$	dB L_{den}
UT37	49	44	45	40	53	AT35	58	57	59
UT38	54	44	45	39	56	AT36	71	62	71
UT39	57	42	52	38	60	AT37	52	47	55
UT40	51	41	46	40	54	AT65	66	57	67
UT41	51	47	47	42	55	AT66	54	49	57
						AT67	62	54	66
Mater Hospital/Eccles Street/Berkeley Road									
UT42	63	49	61	44	68	AT38	69	61	71
UT43	60	49	57	47	65	AT39	64	54	64
UT44	58	49	54	42	62	AT40	64	54	67
						AT41	58	53	59
						AT42	64	51	68
						AT68	63	51	67
						AT69	63	51	66
O'Connell Street									
UT45	58	54	56	49	63	AT70	64	55	65
UT46	60	54	58	50	65				
UT47	67	61	63	54	71	AT71	59	56	61
Tara Street									
UT48	64	59	61	56	68	AT43	69	57	68
UT49	63	57	58	51	66	AT44	67	57	71
						AT45	70	62	72
St Stephen's Green									
UT50	62	54	59	50	66	AT46	66	60	68
						AT47	68	60	70
						AT48	68	59	70
						AT49	71	60	71
Charlemont									
UT51	61	41	54	38	63	AT72	64	55	67
UT52	57	44	50	39	59	AT73	63	52	65

The results of the noise survey within this assessment zone indicate a range of noise environments are experienced, depending on the proximity to roads or urban activities.

13.3.1.6.1 Ballymun to Griffith Park

Between Ballymun and Griffith Park, road traffic along the Ballymun Road, St Mobhi Road and adjacent surrounding roads is the dominant noise source in addition to localised suburban activities within schools, parks and local commercial areas.

During daytime periods, average ambient noise levels were recorded in range of 51 to 70dB $L_{Aeq,16hr}$ at the unattended survey positions (UT25 to UT35). At the attended survey locations (AT18 to AT33 and

AT63 to AT69), daytime noise levels were measured in the range of 48 to 69dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 46 to 62dB $L_{A90,16hr}$ at the unattended survey positions and between 43 and 62dB $L_{A90,15mins}$ at the attended survey locations.

Night-time noise levels at the survey locations are influenced by road traffic noise. Average ambient night-time noise levels were measured in the range of 43 to 63dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 39 to 50dB $L_{A90,8hr}$.

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. These are summarised as follows:

- Mapped road traffic noise levels in the vicinity of survey positions UT26 and UT28 off the Ballymun Road are in the 65 to 69dB L_{den} contour which align with those measured;
- Mapped road traffic noise levels in the vicinity of survey positions UT30 off the Ballymun Road are in the 55 to 59dB L_{den} contour which align with those measured;
- Mapped road traffic noise levels in the vicinity of survey positions UT31 off the Ballymun Road are in the 65 to 69dB L_{den} contour which align with those measured;
- Mapped road traffic noise levels in the vicinity of survey positions UT32 off the Ballymun Road are on the cusp of the 59 to 59dB L_{den} and 60 to 64dB L_{den} contours. The measured noise levels at this location fall within the higher contour range (63dB L_{den});
- Mapped road traffic noise levels in the vicinity of survey positions UT34 off St Mobhi Road are in the 60 to 64dB L_{den} contour. Measured noise levels at this survey position was higher than those mapped, recording 73dB $L_{den.}$ Additional sources at this location included localised school traffic and sports ground activities; and
- Mapped road traffic noise levels in the vicinity of survey positions UT35 off St Mobhi Road are in the 55 to 59dB L_{den} contour. Measured noise levels at this survey position was higher than those mapped, recording 63dB $L_{den.}$ Additional sources at this location included school and sports ground activities.

13.3.1.6.2 Glasnevin/Whitworth

At Glasnevin/Whitworth survey locations UT36, UT39, UT40 and AT35 are influenced by rail noise from the Dublin to Maynooth railway line in addition to local residential activities set back from road traffic. UT37 and UT38 are set back from road and rail traffic in a residential area. Attended location AT37 was measured along the edge of Botanic Road, adjacent to the rail overbridge and is dominated by road traffic and passing rail. UT41 is influenced by road traffic and to a lower degree from rail traffic.

During daytime periods, average ambient noise levels were recorded in range of 49 to 57dB $L_{Aeq,16hr}$ at the unattended survey positions (UT36 to UT41). At the attended survey locations (AT34 to AT37 and AT65 to AT67), daytime noise levels were measured in the range of 46 to 71dB $L_{Aeq,15mins,}$ the higher value being recorded at AT36 which was located at a busy junction of R180 and Whitworth Road close to the road edge. Background noise levels were measured in the range of 41 to 47dB $L_{A90,16hr}$ at the unattended survey positions and between 40 and 62dB $L_{A90,15mins}$ at the attended survey locations.

Night-time noise levels at the survey locations are influenced by road traffic and passing rail. At unattended survey positions, average ambient night-time noise levels were measured in the range of 45 to 52dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 37 to 42dB $L_{A90,8hr}$.

The measured L_{den} values in this study area at the long-term unattended survey locations ranged between 53 and 60dB $L_{den.}$ At attended survey locations, calculated L_{den} values are in the range of 50 to 71dB L_{den}.

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. Mapped road traffic noise levels in the vicinity of survey position UT41 are in the 55 to 59dB L_{den} contour which align with those measured.

At survey locations UT39 and UT40, mapped rail noise levels in the vicinity of survey positions are in the 55 to 59dB L_{den} contour which align with those measured.

13.3.1.6.3 Mater Hospital/Eccles Street/Berkeley Road

Noise survey locations at the survey locations in this study area are influenced predominately by road traffic along Berkley Road, Eccles Street, the North Circular Road and the surrounding road network. Local sources from within the Mater Hospital campus in addition to local suburban sources (e.g. pedestrian movements or local commercial activities) also contribute to the noise environment in this study area.

During daytime periods, average ambient noise levels were recorded in range of 58 to 63dB $L_{Aeq,16hr}$ at the unattended survey positions (UT42 to UT44), averaged over a seven-day period. At the attended survey locations (AT38 to AT42 and AT68 and AT69), daytime noise levels were measured in the range of 58 to 69dB $L_{Aeq,15mins.}$ Background noise levels measured 49dB $L_{A90,16hr}$ at the unattended survey positions and between 51 and 61dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels were recorded at locations immediately fronting the road edge (UT42, AT38 and AT42) representative of residential properties in this area which directly front the local road network.

Night-time noise levels at the survey locations are also heavily influenced by road traffic. Average ambient night-time noise levels were measured in the range of 54 to 61dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 42 to 47dB $L_{A90,8hr.}$

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 62 and 68dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 59 to 71dB $L_{den.}$

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. At survey locations UT42 and UT43, mapped road traffic noise levels are in the 65 to 69dB L_{den} contour which align with those measured. At survey locations UT44, mapped road traffic noise levels are in the 55 to 59dB L_{den} contour which are slightly lower than those measured at this survey location (62dB L_{den}).

13.3.1.6.4 O'Connell Street

Noise survey locations at the O'Connell Street area are influenced predominately by road traffic along O'Connell Street, Parnell Street, the Luas Green Line in addition to traffic along the surrounding road network. Local sources from retail and commercial units in addition to local urban sources (e.g. pedestrian movements and plant noise) also contribute to the noise environment in this study area.

During daytime periods, average ambient noise levels were recorded in range of 58 to 67dB $L_{Aeq,16hr}$, averaged over a seven-day period at the unattended survey locations (UT45 to UT47). At the attended survey locations (AT70 and AT71, daytime noise levels were measured in the range of 59 to 64dB $L_{Aeq,15mins.}$ Background noise levels were measured between 54 and 61dB $L_{A90,16hr}$ at the unattended survey positions and between 55 and 56dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels were recorded at UT47 which was recorded directly along the O'Connell Street façade representative of buildings in this area which directly front this street.

Night-time noise levels at the survey locations are also heavily influenced by road traffic. Average ambient night-time noise levels were measured in the range of 56 to 63dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 49 to 54dB $L_{A90,8hr}$.

The measured L_{den} values in this study area ranged between 63 and 71dB L_{den} at the unattended survey locations and between 61 and 65dB L_{den} at the attended survey locations.

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. At survey locations UT45 and UT47, mapped road traffic noise levels are in

the 70 to 74dB L_{den} contour which align with those measured at location UT47. Monitoring location UT45 was partially screened by site hoarding which reduced measured noise levels at this location.

At survey location UT46, mapped road traffic noise levels are in the 60 to 64dB L_{den} contour which align with those measured at this survey location. Rail noise levels are not mapped for the Luas line in this study area as the Luas line was not operational for the period the noise maps relate to (2016).

13.3.1.6.5 Tara Street

Noise survey locations at Tara Street are influenced predominately by road traffic along Tara Street, Townsend Street, Parnell Street, the DART rail line in addition to traffic along the surrounding road network. Local sources from retail and commercial units in addition to local urban sources (e.g. pedestrian movements and plant noise) also contribute to the noise environment in this study area.

During daytime periods, average ambient noise levels measured between 63 and 64dB $L_{Aeq,16hr}$, at the unattended survey locations (UT48 and UT49) averaged over a seven-day period. At the attended survey locations (AT43 to AT45), daytime noise levels were measured in the range of 67 to 70dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 57 to 59dB $L_{A90,16hr}$ at the unattended survey positions and between 57 and 62dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels were recorded at the attended survey locations which were located along the footpath edge.

Night-time noise levels at the survey locations are also heavily influenced by road traffic in addition to surrounding urban sources. Average ambient night-time noise levels were measured in the range of 58 to 61dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 51 to 56dB $L_{A90,8hr}$.

The measured L_{den} values in this study area from the long-term unattended survey locations ranged between 66 and 68dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 68 to 72dB L_{den}.

The measured noise levels across the study area align closely with those included within the EPA noise maps in this assessment zone. At survey location UT48, mapped road traffic noise levels are in the 65 to 69dB L_{den} contour which align with those measured at the survey location. At survey location UT49, mapped road traffic noise levels are in the 70 to 74dB L_{den} contour. Measured noise levels at this location area marginally lower than mapped noise levels, this is due to the height of the survey location which was on the roof of an apartment building at the Tara Street and Townsend Street Junction.

13.3.1.6.6 St Stephen's Green

Noise survey locations within the St Stephens Green study area are influenced predominately by road traffic along the surrounding road network, in addition to traffic along the surrounding road network with a small contribution from Luas Green Line tram movements. Local sources from retail and commercial units in addition to local urban sources (e.g. pedestrian movements and plant noise) also contribute to the noise environment in this study area.

During daytime periods, average ambient noise levels measured 62dB $L_{Aeq,16hr}$ within St Stephens Green Park, at the unattended survey location (UT50) averaged over a seven-day period. At the attended survey locations (AT46 to AT49) located along the footpath edge adjacent to commercial buildings along St Stephens Green North and East, daytime noise levels were measured in the range of 66 to 71dB $L_{Aeq,15mins}$. Background noise levels measured 54dB $L_{A90,16hr}$ at the unattended survey position within St Stephens Green Park and between 59 and 60dB $L_{A90,15mins}$ at the attended survey locations. Highest noise levels were recorded at the attended survey locations immediately fronting the road edge.

Night-time noise levels at the unattended survey location are influenced by road traffic in addition to surrounding urban sources. Average ambient night-time noise levels measured 59dB $L_{Aeq,8hr}$. Background noise levels during this time period measured 50dB $L_{A90,8hr}$.

The L_{den} in this study area at the unattended survey location measured 66dB L_{den}. At attended survey locations, calculated L_{den} values are in the range of 68 to 71dB L_{den}.

The measured noise levels in the study area align closely with those included within the EPA noise maps in this assessment zone. At survey location UT50, mapped road traffic noise levels are in the 60 to 64dB L_{den} noise contour which broadly align with those measured at the survey location.

13.3.1.6.7 Charlemont

Noise survey locations at Charlemont are influenced predominately by road traffic along the surrounding road network, the Luas rail line in addition local sources from residential and commercial units.

During daytime periods, average ambient noise levels were measured in the range of 57 to 61dB $L_{Aeq,16hr}$, at the unattended survey locations (UT51 and UT52) averaged over a seven-day period. At the attended survey locations (AT72 to AT73), daytime noise levels were measured in the range of 63 to 64dB $L_{Aeq,15mins}$. Background noise levels were measured in the range of 41 to 44dB $L_{A90,16hr}$ at the unattended survey positions and between 52 and 55dB $L_{A90,15mins}$ at the attended survey locations.

Highest noise levels were recorded at the survey location which bounds the Luas Green Line (UT51) and at the attended survey locations which were influenced by passing traffic.

Night-time noise levels at the survey locations are influenced by surrounding road traffic, passing Luas rail movements in addition to surrounding urban sources. Average ambient night-time noise levels were measured in the range of 50 to 54dB $L_{Aeq,8hr}$. Average background noise levels during this time period were measured in the range of 38 to 39dB $L_{A90,8hr}$.

The measured L_{den} values in this study area ranged between 59 and 63dB L_{den} at the attended survey locations and between 65 and 67dB L_{den} at the attended survey locations.

The measured noise levels in this study area broadly align with those included within the EPA noise maps in this assessment zone. At survey location UT51, mapped rail traffic noise levels are in the 70 to 74dB L_{den} contour. Measured noise levels at this survey locations are lower than those mapped, likely as a result of the height of the survey position compared to those mapped. At survey location UT52, mapped rail traffic noise levels are in the 60 to 64dB L_{den} contour. Measured noise levels at this survey locations are broadly in line with those mapped for this area.

13.4 Baseline Vibration Environment

The baseline vibration environment has been characterised through vibration surveys at areas where existing vibration sources potentially form part of the baseline environment. This has been limited to representative survey locations in the vicinity of existing rail lines adjacent to the proposed Project. As discussed in Section 13.2.4.3 additional vibration surveys at sensitive buildings along the tunnel alignment with potential for Groundborne impacts are discussed in Chapter 14 (Groundborne Noise & Vibration).

13.4.1 Baseline Vibration Surveys

Baseline vibration surveys have been conducted at locations representative of the nearest sensitive areas which have the potential to be impacted by construction works and/or those likely to be impacted during the Operational Phase which currently are exposed to sources of vibration. As noted above, this has been limited to representative survey locations in the vicinity of existing rail lines adjacent to the proposed Project.

Baseline vibration measurements were installed for a period of five to seven days at each location using logging survey equipment. A total of three locations have been monitored which sit within AZ4. There are no baseline vibration survey positions within AZ1, AZ2 or AZ3 due to the absence of any significant baseline vibration levels in the surrounding environment of these zones.

Full details of vibration survey methodologies, equipment, parameter and terminology definitions and results of the baseline surveys are included in Appendix A13.3.

Figure 13.1 presents the baseline vibration survey locations.

The location reference, and description survey positions are included in Table 13.31.

Table 13.31: Vibration Monitoring Locations

Location	Description of Survey Location
Vibration Survey Locations	
VM01	Coke Oven Cottages, Glasnevin. South of Dublin to Maynooth Railway Line, approximately 20m from nearside rail line
VM02	O Connell Street, to rear of Dr. Quirkey's façade to west of Luas Green Line. Measurement position was approximately 25m from nearside rail line
VM03	Charlemont, within development site to east of Luas Green Line embankment. Measurement position was approximately 2m from base of rail embankment and approximately 4m below rail line.

13.4.1.1 Coke Oven Cottages – VM01

The vibration survey results recorded during the baseline surveys for VM01 are summarised in the following section. Appendix A13.3.

Table 13.32 presents the vibration results in terms of the PPV parameter in mm/s. For this parameter, the range of vibration magnitudes measured over each day and night-time period are presented for the vertical axis. Full survey results and discussion on the range of measured data is included in Appendix A13.3.

Table 13.32: VM01 Vibration Survey Results – PPV

Location	Daytime (07:00-23:00Hhrs)				Night-time (23:00 – 07:00hrs)			
	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)
Coke Oven Cottages								
VM01	0.8 – 1.5	0.02	0.03	0.11 – 0.2	0.14 – 0.58	0.02	0.03	0.11 – 0.2

At survey location VM01, PPV values for the majority of daytime survey periods measured 0.03mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV value associated with passing rail is between 0.11mm/s and 0.2mm/s. A low number of PPV events were recorded in the range of 0.2mm/s to 0.9mm/s over daytime periods which are also potentially attributed to rail pass bys. The maximum events recorded are expected to be as a result of activities within the garden, specifically resident's dogs. A number of significant outlier values associated with the accelerometer being moved, potentially due to dogs within the garden, have been removed from the analysed data set.

PPV values for the majority of night-time survey periods measured 0.03mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV values associated with passing rail is between 0.11mm/s and 0.2mm/s. A minor number of PPV events were recorded in the range of 0.2mm/s to 0.6mm/s over night-time periods which are also potentially attributed to rail pass bys, although the higher values may also be attributed to activities within the garden. A number of significant

outlier values associated with the accelerometer being potentially moved due to dogs have been removed from the analysed data set.

Table 13.33 presents the vibration results in terms of the Vibration Dose Value (VDV) parameter for the vertical axis in $m \cdot s^{-1.75}$. For this parameter, daytime VDV and night-time VDV values are presented in addition to a typical VDV associated with train pass by events and the typical baseline VDV value. Full survey results and discussion on the range of measured data is included in the survey report in Appendix A13.3.

Table 13.33: VM01 Vibration Survey Results – VDV

Location	Daytime (07:00-23:00Hhrs)			Night-time (23:00 – 07:00hrs)		
	$VDV_{,b,\ day}$ ($m/s^{-1.75}$)	Typical train pass by VDV_b ($m/s^{-1.75}$)	Baseline, VDV_b ($m/s^{-1.75}$)	$VDV_{,b,\ night}$ ($m/s^{-1.75}$)	Typical train pass by VDV_b ($m/s^{-1.75}$)	Baseline VDV_b ($m/s^{-1.75}$)
Coke Oven Cottages						
VM01	0.03 – 0.05	0.002 – 0.01	0.0003	0.011 – 0.015	0.002 – 0.01	0.0003

At survey location VM01, the calculated daytime VDV values are between 0.03 to $0.05 m \cdot s^{-1.75}$ over the six-day survey period. Analysis of the data indicates the typical VDV associated with passing rail is of the order of 0.002 to $0.01 m \cdot s^{-1.75}$. Similar to the PPV values discussed above, a number of significant outlier values associated with the accelerometer being potentially moved due to dogs have been removed from the analysed data set.

The calculated night-time VDV value at this location is between 0.011 and 0.015 $m \cdot s^{-1.75}$ over the six-day survey period. Analysis of the data indicates the typical VDV associated with passing rail is of the order of 0.002 to $0.01 m \cdot s^{-1.75}$. Similar to the PPV values discussed above, a small number of outlier values associated with the accelerometer being potentially moved due to dogs have been removed from the analysed data set.

13.4.1.2 O'Connell Street – VM02

The vibration survey results recorded during the baseline surveys for VM02 are summarised in the following section. Table 13.34 presents the vibration results in terms of the PPV parameter in mm/s. For this parameter, the range of vibration magnitudes measured over each day and night-time period are presented for the vertical axis. Full survey results and discussion on the range of measured data is included in the survey report in Appendix A13.3.

Table 13.34: VM02 Vibration Survey Results – PPV

Location	Daytime (07:00-23:00Hhrs)				Night-time (23:00 – 07:00hrs)			
	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)
O'Connell Street								
VM02	0.15 – 0.4	0.03	0.04	0.05 – 0.08	0.07 – 0.13	0.03	0.04	0.05 – 0.08

At survey location VM02, PPV values for the majority of daytime survey periods measured 0.04mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV value associated

with passing rail is between 0.05 and 0.08mm/s. Maximum PPV events ≥0.2mm/s were recorded over an insignificant number of intervals and are expected to be as a result of activities within the area immediately adjacent to the accelerometer and not from passing trams.

PPV values for the majority of night-time survey periods measured 0.04mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV value associated with passing rail is of the order of 0.05 – 0.08mm/s. An insignificant number of PPV events were recorded in the range of 0.9 to 0.13mm/s over night-time periods which are likely associated with non-rail events in proximity to the accelerometer.

Table 13.35 presents the vibration results in terms of the VDV parameter for the vertical axis in $m \cdot s^{-1.75}$. For this parameter, daytime VDV and night-time VDV values are presented in addition to a typical VDV associated with train pass by event and the typical baseline VDV value. Full survey results and discussion on the range of measured data is included in the survey report in Appendix A13.3.

Table 13.35: VM02 Vibration Survey Results – VDV

Location	Daytime (07:00-23:00Hhrs)			Night-time (23:00 – 07:00hrs)		
	$VDV_{,b,\ day}$ $(m/s^{-1.75})$	Typical train pass by VDV_b $(m/s^{-1.75})$	Baseline, VDV_b $(m/s^{-1.75})$	$VDV_{,b,\ night}$ $(m/s^{-1.75})$	Typical train pass by VDV_b $(m/s^{-1.75})$	Baseline VDV_b $(m/s^{-1.75})$
O'Connell Street						
VM02	0.006 – 0.03	0.001 – 0.0015	0.0001	0.004 – 0.005	0.001 – 0.0015	0.0001

At survey location VM02, the calculated daytime VDV values are between 0.006 to $0.03 m.s^{-1.75}$ over the seven-day survey period. Analysis of the data indicates the typical VDV associated with passing trams is of the order of 0.001 to $0.002 m \cdot s^{-1.75}$.

The calculated night-time VDV value at this location is between 0.004 and $0.005 m \cdot s^{-1.75}$ over the seven-day survey period. Analysis of the data indicates the typical VDV associated with passing rail is of the order of 0.001 to $0.0015 m \cdot s^{-1.75}$.

13.4.1.3 Charlemont – VM03

The vibration survey results recorded during the baseline surveys for VM03 are summarised in the following section. Table 13.36 presents the vibration results in terms of the PPV parameter in mm/s. For this parameter, the range of vibration magnitudes measured over each day and night-time period are presented for the vertical axis. Full survey results and discussion on the range of measured data is included in the survey report in Appendix A13.3.

Table 13.36: VM03 Vibration Survey Results – PPV

Location	Daytime (07:00-23:00Hhrs)				Night-time (23:00 – 07:00hrs)			
	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)	Maximum PPV mm/s	Minimum PPV mm/s	Median PPV (mm/s)	Typical train pass by PPV (mm/s)
Charlemont								
VM03	0.13 – 1.15	0.02	0.04	0.05 – 0.15	0.1 – 1.09	0.03	0.04	0.05 – 0.15

At survey location VM03, PPV values for the majority of daytime survey periods measured 0.04mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV value associated with passing rail is between 0.05mm/s and 0.15mm/s. Maximum PPV events ≥1mm/s were recorded over an insignificant number of intervals and are expected to be as a result of activities within the area immediately adjacent to the accelerometer and not from passing rail.

PPV values for the majority of night-time survey periods measured 0.04mm/s indicating a low vibration environment. Analysis of the data indicates the typical PPV value associated with passing rail is of the order of 0.05mm/s to 0.15mm/s. Maximum PPV events ≥1mm/s were recorded over an insignificant number of intervals and are expected to be as a result of activities within the area immediately adjacent to the accelerometer and not from passing rail.

Table 13.37 presents the vibration results in terms of the VDV parameter for the vertical axis in $m \cdot s^{-1.75}$. For this parameter, daytime VDV and night-time VDV values are presented in addition to a typical VDV associated with train pass by event and the typical baseline VDV value. Full survey results and discussion on the range of measured data is included in the survey report in Appendix A13.3.

Table 13.37: VM03 Vibration Survey Results – VDV

Location	Daytime (07:00-23:00Hhrs)			Night-time (23:00 – 07:00hrs)		
	$VDV_{,b,\ day}$ ($m/s^{-1.75}$)	Typical train pass by VDV_b ($m/s^{-1.75}$)	Baseline, VDV_b ($m/s^{-1.75}$)	$VDV_{,b,\ night}$ ($m/s^{-1.75}$)	Typical train pass by VDV_b ($m/s^{-1.75}$)	Baseline VDV_b ($m/s^{-1.75}$)
Charlemont						
VM03	0.01 – 0.03	0.003 – 0.006	0.0003	0.005 – 0.028	0.003 – 0.006	0.0003

At survey location VM03, the calculated daytime VDV values are between 001 to $0.03m \cdot s^{-1.75}$ over the five-day survey period. Analysis of the data indicates the typical VDV associated with passing trams is of the order of 0.003 to $0.006m \cdot s^{-1.75}$.

The calculated night-time VDV value at this location is between 0.005 and $0.028m \cdot s^{-1.75}$ over the five-day survey period. Analysis of the data indicates the typical VDV associated with passing trams is of the order of 0.003 to $0.006m \cdot s^{-1.75}$.

13.5 Predicted Impacts

13.5.1 Do Nothing

In the event that the proposed project does not proceed there will be no change in the noise and vibration environment associated with either the construction of the operational phase.

13.5.2 Construction Phase

Construction noise calculations for each of the key work sites are set out in the following sections using the methodology described in Section 13.2.5.1.3. The results for all scenarios discussed in this section assume the base design scenario which includes for standard site hoarding of 2.4m high around the site boundaries at the locations noted in the site hoarding layout drawings (Illustrated in Figure 5.1 Construction Compounds and Works Sites).

The majority of station and the shaft construction sites across the proposed Project will be constructed using top-down methods. This will involve initial reinforcement of the construction box with concrete D-walls and construction of a roof slab. After a roof slab has been constructed, excavation of the construction box will take place beneath the roof slab leaving necessary openings to facilitate top-down construction. This methodology significantly reduces the level of construction activity at surface level

and associated noise to the surrounding environment. Excavation to station level below the slab will be undertaken using excavators for soft ground and drill and blast methods for rock extraction. Noise and vibration impacts associated with blasting in is included in Chapter 14 (Groundborne Noise & Vibration).

The airborne noise assessment for the excavation beneath roof slab includes plant and equipment at surface and below ground level. The equipment includes the use of rock drills, excavators, loaders and drum cutters. Once the rock has been extracted through blasting there will be a requirement to further break the rock into smaller grades prior to removal from the excavation pit. For the airborne noise assessment the use of breakers/peckers mounted on excavators have been included for this activity below the slab. It is noted, however, that due to the potential for significant groundborne noise from this activity, the use of road headers/milling machines will be used for this activity to control impacts. For a conservative assessment, however, the use of breakers is included in all airborne noise models. Hydraulic breakers will be used as required during the initial stage excavation at ground level. This equipment is modelled at surface level for this phase of works within the airborne noise models.

For all other construction activities such as cut and cover/retained cut, viaducts, portal activities, track lowering, track laying, utility diversions and road works, the methodologies employed will involve a range of construction plant at surface level over varying durations.

Detailed information relating to the proposed construction methodologies are included in Chapter 5 (Metrolink Construction Phase) and the relevant supporting appendices. This information in addition to plant lists per site have been provided by the design team in order to inform the noise impact assessment. The plant lists used for the airborne noise models are included in Appendix A13.7.

As noted in Section 13.2.5.10 the calculation of construction noise levels during the Construction Phase is limited to information available at EIAR stage. Whilst the phasing of works, location of activities, plant items and work sites have been progressed to detailed stages as part of this EIAR, the nature of the source is dynamic in nature and will vary over the course of the proposed Project at any one location subject to site conditions, work scheduling, contractor proposals and potential updated technology and methodologies.

This section sets out the calculated noise levels for the activities and work sites listed in Table 13.40. Reference to other less intrusive activities or those with much shorter durations are discussed on a case-by-case basis within each of the assessment zones set out in the following sections.

The construction work areas and the key work phases as advised by the design team as summarised in Table 13.38.

Table 13.38: Construction Phase Key Activities Assessed for Airborne Noise

Construction Type	Assessment Zones	Key Phases Assessed
Estuary Compound Park and Ride & Compound	AZ1	▪ Site establishment/clearance/demolition ▪ Compound operations ▪ Enabling works & batching plant ▪ Piling works ▪ Park & Ride building construction ▪ Station Piling works ▪ Station excavation & capping beams ▪ Concreting works ▪ Finishing & reinstatement works ▪ Rail head & batching plant
Retained Cut Stations	AZ1 (Seatown Station, Swords Central Station, Fosterstown Station)	▪ Site establishment/clearance/demolition ▪ Guide walls and piling mat ▪ Secant piling works ▪ Excavation/capping beams and propping ▪ Concrete works ▪ Fit out, reinstatement and landscape works

Construction Type	Assessment Zones	Key Phases Assessed
Viaduct/Bridge Construction	AZ1 (Broadmeadow Viaduct) AZ3 (M50 Viaduct/Northwood Viaduct)	▪ Site establishment/clearance/demolition ▪ Site operation ▪ Piling works ▪ Abutment construction ▪ Pier construction ▪ Deck construction ▪ Finishing Works
Cut and Cover/Retained Cut Sections	AZ1 (Metrolink Rail line alignment)	▪ Site establishment/clearance ▪ Install guide walls and piling mat ▪ Secant piled walls ▪ Excavation, capping beams & propping ▪ Concrete works ▪ Site reinstatement and landscaping works
Track Laying Works	AZ1 (Above ground retained cut rail sections) AZ3 (M50 Motorway /Northwood overground)	▪ Surface concreting and tracklaying at track level ▪ Railhead at Estuary
TBM launch & receiver portals	AZ2 (DANP/DASP) AZ3 (Northwood Portal)	▪ Enabling works ▪ Demolition (where relevant) ▪ Diaphragm wall (D-wall) construction ▪ Excavation ▪ TBM support activities ▪ Portal decommissioning and finishing works
Dardistown Compound	AZ3 (Compound, OCC construction, station construction)	▪ Station Advanced enabling & utility works, site preparation Works ▪ Station Piling, excavation, propping, slabs, platforms, lift shafts, roof slabs ▪ Fit out & Reinstatement ▪ Depot site prep works, demolition & guide walls ▪ Concrete batching plant operation ▪ Railhead ▪ Piling & main building works ▪ Road works, landscaping
Mined Stations/Shafts/Intervention Tunnels	AZ2 (Dublin Airport Station) AZ3 (Northwood Station) AZ4 (Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater Hospital, O'Connell Street, Tara Street, St Stephens Green & Charlemont Stations & Albert College Park Shaft)	▪ Advanced enabling & utility works, site preparation works ▪ Demolition (where relevant) ▪ Piling works (D-wall/secant piles) ▪ Excavation works & roof slab construction ▪ Excavation (including blasting) below roof slab ▪ Fit out & finishing works ▪ Batching plant operations at specific sites (discussed where relevant per site) ▪ Spray concrete lining surface compound works (discussed where relevant per site)
Compounds	AZ1 – AZ3	▪ Compound activities
Utility Diversion Works including MetroLink grid connection works– outside above work areas	AZ1 – AZ4	▪ Site preparation & breaking ▪ Excavation & utility diversion ▪ Finishing works

For each modelled construction compound, a CNT has been established for each modelled receiver location based on the baseline noise environment established (Section 13.3). The CNL at each receiver location has been compared against the CNT to determine the potential for significant impacts. All of the work sites and activities included in Table 13.38 will occur over durations exceeding ten or more

days or night in any 15 consecutive day or nights, or a total number of days exceeding 40 in any six consecutive months and hence, where construction noise levels are calculated above the CNT, a potential significant effect is determined. The exception to this is for track laying works along the above ground section of the alignment along the R132, whereby the progression rate of the linear works will not exceed these durations at individual properties.

Where CNLs are calculated below the baseline noise level or the relevant CNT, the impact is determined to be Not Significant to Slight to Moderate in accordance with the significance ratings set out in Table 13.13. The exception of this is at NSLs with high night-time ambient noise levels. As discussed in Section 13.2.6.1, a significant effect is assigned to CNLs exceeding 55 dB $L_{Aeq,T}$ to recognise the potential for significant effects above this level, depending on context.

Where the CNL is calculated to exceed the CNT, the relevant significance ratings are discussed in the following sections. The CNL is also commented on with respect to the upper fixed noise limits used for large infrastructure projects discussed in Section 13.5.2.2. The calculated results for all modelled receiver locations per construction compounds are included in full in Appendix A13.7.

13.5.2.1 Compound Lighting, Water Pumps and Ventilation

At the main site compounds, there will be site lighting which will operate on a 24/7 basis which may require generators for power. The use of water pumps may also be required to operate on a 24/7 basis depending on the requirement for de-watering within excavations. Any fixed item of plant for these compounds such as generators or pumps requiring night-time operation will be fully attenuated and/or enclosed to control noise emissions beyond the site boundaries to below the significance thresholds. These will be established at each site prior to commencement of the works.

Similarly, ventilation fans may require operation outside of normal hours at mined stations, TBM and SCL tunnel portals and the intervention shaft. These items will be fully enclosed within soundproofed housing with attenuators to control noise emissions beyond the site boundaries to below the significance thresholds. Detailed modelling has therefore not been undertaken for night-time periods for these compounds to account for these items of plant which will be controlled through strict mitigation measures. Further details on mitigation measures are included in Section 13.6.1.2.

13.5.2.2 Mechanical Electrical Plumbing (MEP)

MEP fit out works will take place 24/7 within the underground stations within AZ3 and AZ4 once the main fit out works are complete. For underground stations noise breakout during these works will be suitably limited by the roof slab and mitigation measures. There may be additional support plant located on the development site surface level during these periods. These items of plant will typical be vans, pick-up trucks and trolleys. A mobile crane or similar will be required for lifting equipment and materials down the access hatches/voids to the concourse, mezzanine and platform levels. Most items will be delivered on a just in time basis, but it may be necessary to arrange deliveries at night, due to local traffic restrictions. If these activities occur at night, depending on the time periods over which they occur and the activities involved, there are potential for moderate to significant noise impacts during night-time periods where the cranes and HIABS are used.

Given the limited number of times these will be used over a night-time period, it is not predicted that they will exceed the temporal criteria required to trigger a significant impact or any external mitigation such as noise insulation provision. Staff will be briefed to ensure they are aware of the potential for noise impacts and how to mitigate them appropriately. Specifically, the scheduling of works to co-ordinate activities with potential for high noise emissions to be restricted during night-time periods, as far as practicable. Where residual night-time CNLs are determined to exceed the relevant CNTs for the temporal criteria required to trigger a significant, further on-site noise control measures will be put in place. Further discussion on noise mitigation measures is included in Section 13.6.1.

13.5.2.3 AZ1 Northern Section: Estuary Station to Dublin Airport North Portal

Construction noise impacts are presented for the following sections in AZ1:

- Estuary to Seatown;
- Seatown Station to Malahide Roundabout;
- Malahide Roundabout to Pinnock Hill; and
- Pinnock Hill to DANP.

Within each of the above sections, a number of construction elements will take place over different sequences. The sequencing of work within these sections are detailed in Chapter 5 (Metrolink Construction Phase).

As noted above, the results discussed in the following sections are associated with the base scenario which are unmitigated with the exception of the standard hoarding around each site discussed in the previous sections.

Where potential significant effects are calculated, they are presented in the impact tables per construction site. Modelled receivers which are calculated below the relevant identified significance thresholds are not presented in this section but are included in full in Appendix A13.7.

13.5.2.3.1 Estuary to Seatown

This section of the proposed alignment is between Estuary Station and Park and Ride Facility and Seatown Station. The works along this section will require one main construction compound at Estuary and five satellite compounds in addition to the working areas along the Metrolink alignment section. A variety of construction activities will occur within this section which are discussed under the relevant headings below.

Estuary Compound

A total of 17 construction phases have been modelled within the Estuary compound which relate to site establishment works, compound works, batching plant works, excavation, piling, station & park and ride construction and reinstatement. The construction working hours at this site are, for the majority during the standard daytime working hours. Night-time works will be required during batching plant operations and when the rail head is in operation to support track laying activities. These scenario and construction periods have been assessed at this compound.

Nine NSLs have been modelled in the vicinity of this working area, the closest being the Emmaus Centre west of the site boundary and residential dwelling within farm holding along the south-east boundary. The construction noise receiver location for this section are displayed in Figure 13.2 (Sheet 1 and 2) Due to the distance between the construction working areas, the numbers and type of plant on-site and the distance to the nearest NSL, there are no NSLs where calculated CNLs exceed the daytime CNTs (65 to 75dB $L_{Aeq,T}$) or night-time CNTs (55dB $L_{Aeq,T}$) during the key works phases identified. Full calculated results for this work area are included in Appendix A13.7.

Broadmeadow and Ward River Viaduct

A total of seven scenarios have been modelled relating to works associated with constructing the Broadmeadow and Ward River Viaduct from site establishment works, piling, abutment works, batching plant works, excavation, piling, pier, deck and finishing works.

Seventeen NSLs have been modelled in the vicinity of this working area, the closest being the Montessori facility west of the viaduct some 75m from the structure. The construction noise receiver location for this section is displayed in Figure 13.2 (Sheets 1 to 3). There are no NSLs calculated to exceed the daytime CNTs (65 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. Calculated CNLs are below 65dB $L_{Aeq,T}$ at all locations. Full calculated results for this work area are included in Appendix A13.7.

Cut and Cover and Retained Cut

The proposed alignment between Seatown West and Seatown Station in AZ1 is within a mixture of cut and cover and retained cut sections. The construction of this section will involve a linear work area which will progress in a north to south direction. The nature of construction activities for this section will result in different phases of works taking place on a sequential basis as it moves along the length of the proposed Project. The key phases involve site clearance and top ground level removal, installation of guide walls and piling mats, secant piling works, excavation, propping, concreting and close out works. A series of satellite construction compounds are located in this section at Fingallian Footbridge site, Seatown West, Estuary Court and Woodies which will act as a base for enabling works and the cut and cover and retained cut sections. These will be used for welfare, materials and equipment storage. For purpose of calculation, a 300m linear working area has been modelled which incorporates all the above phases operating simultaneously within sequential work areas. All activities are modelled at ground level, representing a worst-case scenario. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheets 1 to 3).

The results have been used to identify the horizontal distance from the works at which construction noise thresholds will be exceeded. This activity will take place during the standard daytime working hours for the proposed Project.

The following locations are calculated to exceed the relevant CNTs in this area The relevant significance of impacts at these locations are summarised in Table 13.39.

Table 13.39: Cut and Cover and Retained Cut Sections – Estuary to Seatown

Activity	Receptor		CNT		Predicted Significance of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Cut and Cover/Retained Cut Construction – Linear sequential works and compounds	16	Seatown West	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
	18	77-78 Seatown Villas	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
	20 - 21	79 – 84 Seatown Villas	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	24	26-28 Comyn Manor	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
	25	16 - 17 Comyn Manor	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	32	2-3 Estuary Court	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	33	1 Estuary Court	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
	34	10 Estuary Court	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	44	Woodies	75	75	76 - 80	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a moderate to significant to significant to very significant, short-term effect is identified

in the absence of noise mitigation. Further mitigation will therefore be required to reduce noise impacts at these locations.

Tracklaying Activities for Overground Rail

Tracklaying activities within AZ1 will take place once the rail alignment has been excavated and lined. Tracklaying activities will progress in a linear manner from Estuary in a southerly direction towards the DANP and involve laying sleepers, track laying and welding using a mixture of mobile gantry equipment, locomotives and concreting equipment. A railhead and batching plant will operate at Estuary which will provide ancillary support for the track laying activities along the rail line.

Airborne noise impacts will occur along sections of retained cut, surface and elevated viaduct level. Tracklaying activities within cut and cover sections will be enclosed with minimal noise emissions at either end of the section opening. For purpose of calculation, sections of surface, elevated and retained cut have been modelled to incorporate the above activities operating simultaneously within these work areas. This activity will take place over day, evening and night-time working hours which has been assessed as part of the noise modelling.

The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheets 1 to 3). There are no NSLs in this section where calculated CNLs exceed the relevant CNTs during daytime or evening construction periods. During night-time periods the NSLs calculated to exceed the CNTs and relevant significance of impacts at these NSLs for night-time works are presented in Table 13.40.

Table 13.40: Above Ground Track Laying – Estuary to Seatown

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 -07:00)	CNL	Night-time (23:00 - 07:00)
Above Ground Track Laying and Railhead	2	Emmaus Retreat	55	61 - 65	Significant to Very Significant
	3	R132 Farm Residence	55	55 - 60	Significant
	16	5 Seatown West	55	61 - 65	Significant to Very Significant
	18	77-78 Seatown Villas	55	61 - 65	Significant to Very Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a potential significant to very significant, effect is identified. The progression of tracklaying is projected at a rate of approximately 100m per day or night. The impacts identified in Table 13.40 will occur for a period of typically one-night duration at any one location which relate to the physical track laying works in proximity to the NSL resulting in a brief to temporary duration of effect. Whilst there will be railway traffic to/from railheads along this section, the noise contribution of this activity will be less than those associated with the track works themselves, particularly along sections of the rail alignment within retained cut sections.

Section Summary

Referring to the calculated construction noise levels discussed for the activities and work areas discussed above, highest potential impacts will be experienced during cut and cover and retained cut works with associated compound activity during standard daytime working hours over and during track laying works at night. Construction traffic and construction vibration impacts within AZ1 are discussed in Sections 13.5.2.1.5 and 13.5.2.1.6.

13.5.2.3.2 Seatown Station to Malahide Roundabout

This section of the proposed alignment will be located east of the R132 Swords Bypass and is bound by Seatown and Malahide Roundabouts. The works along this section will require one main construction compound at Seatown Station and five satellite compounds, in addition to working areas along the track section.

Seatown Station Compound

Six scenarios have been modelled relating to works associated with constructing this retained cut station from site establishment works, piling, excavation, capping, concrete works and finishing works.

Nineteen NSLs have been modelled in the vicinity of this working area. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 3). The closest buildings are the Hertz service centre building immediately east and the North Dublin Corporate Park to the south-east. Construction noise level at these two buildings are calculated to exceed the relevant CNT of 75dB $L_{Aeq,T}$ during different phases of work. Highest noise impacts are calculated along the western façade of the Hertz Service Centre. The identified locations and construction activities with potential for significant construction noise impacts are identified in Table 13.41. At all other NSLs modelled in the vicinity of this compound, the CNTs which range between 65 and 75dB $L_{Aeq,T}$ are not exceeded.

Full calculated results for all modelled receptors in the vicinity of this work area are included in Appendix A13.7.

Table 13.41: Seatown Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Remove and store topsoil	56	North Dublin Corporate Park	75	75	76 - 80	Moderate to Significant	Moderate to Significant
Install guide walls & piling mat	5	Hertz Service Centre	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
Secant Piling Works	45	Hertz Service Centre	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
Excavation/Capping beams & propping	45	Hertz Service Centre	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
Concrete works	45	Hertz Service Centre	75	75	80 - 85	Significant to Very Significant	Significant to Very Significant
Site reinstatement & landscaping works	45	Hertz Service Centre	75	75	76 - 80	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façade of the Hertz service centre are calculated to exceed the CNT by greater than 5dB and hence a significant to very significant, short-term effect is identified in the absence of noise mitigation. The calculated CNL is also above the typical fixed upper noise limit of 75dB $L_{Aeq,T}$ at the most exposed facades of this building. At the building facades further east of the compound works, construction noise levels are reduced. Further mitigation will therefore be required at this construction compound to reduce noise impacts at this location.

Cut and Cover and Retained Cut

The proposed Metrolink alignment between Seatown Station and Malahide Roundabout in AZ1 is within a mixture of cut and cover and retained cut sections. A series of satellite construction compounds are located in this section at Woodies Mantua Park, North Dublin Corporate Park (NDC), Chapel Lane and Pavilions Shopping Centre which will act as a base for enabling works and the cut and cover and retained cut sections. These will be used for welfare, materials and equipment storage. The same approach for calculating construction noise levels from this activity as discussed for Estuary to Seatown been used for this section.

The results have been used to identify the horizontal distance from the works at which construction noise thresholds will be exceeded. This activity will take place during the standard daytime working hours for the proposed Project. The following locations are calculated to exceed the relevant CNTs in this area The relevant significance of impacts at these locations are summarised in Table 13.42. The construction noise receiver location assessed for this element of work are displayed in Figure 13.2 (Sheets 3 to 4).

Table 13.42: Cut and Cover and Retained Cut Sections – Seatown to Malahide Roundabout

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Cut and Cover/Retained Cut Construction – Linear sequential works and compounds	84	21-25 Chapel Lane	70	70	76 - 84	Significant to Very Significant	Significant to Very Significant
	87	47-51 Ashley Avenue	70	70	76 - 84	Significant to Very Significant	Significant to Very Significant
	91	28-38 Ashley Avenue	70	70	76 - 84	Significant to Very Significant	Significant to Very Significant
	92	40-50 Ashley Avenue	70	70	76 - 84	Significant to Very Significant	Significant to Very Significant
	93	52-58 Ashley Avenue	70	70	76 - 84	Significant to Very Significant	Significant to Very Significant
	99 – 105	1 to 13 Foxwood	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a significant to very significant, short-term effect is identified in the absence of noise mitigation. Further mitigation will therefore be required to reduce noise impacts at these locations.

Tracklaying Activities for Overground Rail

Tracklaying activities within this section of AZ1 will be within a covered tunnel for the major of sections in proximity to NSLs. For purpose of calculation, sections of retained cut have been modelled to incorporate the track laying activities operating simultaneously within these work areas. This activity will take place over day, evening and night-time working hours which has been assessed as part of the noise modelling.

The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 3 to 4). There are no NSLs in this section where calculated CNLs exceed the relevant CNTs during daytime or evening construction periods. During night-time periods one group of properties are calculated to potentially exceed the night-time CNTs. The relevant significance of impacts at these NSLs for night-time works are summarised in Table 13.43. Calculated results for all assessed locations are included in Appendix A13.7.

Table 13.43: Above Ground Track Laying –Seatown to Malahide Roundabout

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 -07:00)	CNL	Night-time (23:00 - 07:00)
Above Ground Track Laying and Railhead	84	21-25 Chapel Lane/Ashley Grove	55	56 -60	Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a significant effect is identified in the absence of noise mitigation. The progression of tracklaying is projected at a rate of approximately 100m per day or night. The impacts identified in Table 13.43 will occur for a period of typically one-night duration at any one location which relate to the physical track laying works in proximity to the NSL resulting in a brief to temporary duration of effect. Whilst there will be railway traffic to/from railheads along this section, the noise contribution of this activity will be less than those associated with the track works themselves, particularly along sections of the rail alignment within retained cut sections.

Section Summary

Referring to the calculated construction noise levels discussed for the activities and work areas discussed above, highest potential impacts will be experienced during cut and cover and retained cut works with associated compound activity during standard daytime working hours over, during station construction works at one commercial building and during track laying works at night at one location.

13.5.2.3.3 Malahide Roundabout to Pinnock Hill

This section of the proposed alignment will be located east of the R132 Swords Bypass between Swords Central Station and Pinnock Hill Roundabout. The works along this section will require one main construction compound at Swords Central, one satellite compound and one holding/logistics area, with a working area along the proposed alignment.

Swords Central Station Compound

Six scenarios have been modelled relating to works associated with constructing the retained cut station from site establishment works, piling, excavation, capping, concrete works and finishing works.

One Hundred and Seven NSLs have been modelled in the vicinity of this working area. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 5 and 6). The closest buildings to this compound are south-west at Lakeshore Drive commercial/office units (Fujitsu, Ryanair), Carlton Court north-west and at Barrys Park/Commons east to the south-east. Highest calculated noise levels are at Lakeshore Drive units (Fujuitu) associated with the civil works associated with construction of the retained station however all calculated noise levels along the most exposed (eastern facades) of these buildings are all below 70dB $L_{Aeq,T.}$

There are no NSLs where calculated CNLs exceed the CNTs of 70 to 75dB $L_{Aeq,T}$ at the closest NSL during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Cut and Cover and Retained Cut

The proposed Metrolink alignment between Malahide Roundabout to Pinnock Hill in AZ1 is within a mixture of cut and cover and retained cut sections. The works will be supported via the Swords Central compound and the Pinnock Hill Roundabout Construction and Logistic site. The same approach for calculating construction noise levels from this activity as discussed in 13.5.2.3.2 has been used for this section.

The results have been used to identify NSLs which have the potential to exceed their CNTs. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 5 to 6). This activity will take place during the standard daytime working hours for the proposed Project. The following locations are calculated to exceed the relevant CNTs in this area The relevant significance of impacts at these locations are summarised in Table 13.44.

Table 13.44: Cut and Cover and Retained Cut Sections –Malahide Roundabout to Pinnock Hill

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Cut and Cover/Retained Cut Construction – Linear sequential works and compounds/holding areas	111	11 Drynam Road	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	132-166	Carlton Court	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	181	Airside Business Park (Lakeshore Drive)	75	75	>80	Significant to Very Significant	Significant to Very Significant
	182	Travelodge	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	183	Swords Veterinary Hospital	70	65	76 - 85	Significant to Very Significant	Significant to Very Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a moderate to significant to significant to very significant, short-term effect is identified in the absence of noise mitigation. Calculated noise levels at the locations in Table 13.44 all have the potential to exceed the upper construction noise limit of 75dB $L_{Aeq,T}$. Further mitigation will therefore be required to reduce noise impacts at these locations.

Tracklaying Activities for Overground Rail

Tracklaying activities within this section of AZ1 will be within a retained cut section for major of sections in proximity to NSLs with small sections of cut and cover. For the purpose of calculation, sections of retained cut have been modelled to incorporate the track laying activities operating simultaneously within these work areas. This activity will take place over day, evening and night-time working hours which has been assessed as part of the noise modelling.

There are no NSLs in this section where calculated CNLs exceed the relevant CNTs during daytime or evening construction periods. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 5 to 6). During night-time periods the NSLs calculated to exceed the CNTs and relevant significance of impacts at these NSLs for night-time works are presented in Table 13.45.

Table 13.45: Above Ground Track Laying –Malahide Roundabout to Pinnock Hill

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 -07:00)	CNL	Night-time (23:00 - 07:00)
Above Ground Track Laying and Railhead	111	11 Drynam Road	55	56 -60	Significant
	157 - 162	142 – 168 Carlton Ct	55	51 - 55	Moderate to Significant
	166	180-182 Carlton Ct	55	51 - 55	Moderate to Significant
	183	Swords Veterinary Hospital	55	56 - 60	Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a moderate to significant effect is identified. The progression of tracklaying is projected at a rate of approximately 100m per day or night. The impacts identified in Table 13.45 will occur for a period of typically one-night duration at any one location which relate to the physical track laying works in proximity to the NSL resulting in a brief to temporary duration of effect. Whilst there will be railway traffic to/from railheads along this section, the noise contribution of this activity will be less than those associated with the track works themselves, particularly along sections of the rail alignment within retained cut sections.

Section Summary

Referring to the calculated construction noise levels discussed for the activities and work areas discussed above, highest potential impacts will be experienced during cut and cover and retained cut works with associated compound activity during standard daytime working hours over, and during track laying works at night.

13.5.2.3.4 Pinnock Hill Roundabout to DANP

From Pinnock Hill the alignment continues to run in the eastern verge of the R132 Swords Bypass between Pinnock Hill Roundabout and just south of Nevinstown Lane. It the then crosses to the east under the R132 Swords Bypass to connect with the DANP, located just north of Naul Road. The works along this section will require one main construction compound at Fosterstown Station and three satellite compounds (Nevinstown Lane, Boland and the North Portal), in addition with a working area along the track section.

Fosterstown Station

Seven scenarios have been modelled relating to works associated with constructing the retained cut station from site establishment works, demolition of the Smyths store at airside shopping centre, piling works, excavation, capping, concrete works and finishing works.

Seventeen NSLs have been modelled in the vicinity of this working area. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 6 and 7). The closest NSLs are residential properties at Boroimhe Willows east of the station, further south at Boroimhe Elms residential dwellings and the Premier Inn Hotel. The closest commercial buildings are at Airside Shopping Centre.

There are three NSLs where calculated CNLs exceed the CNTs identified. These relate to residential properties within Boroimhe Willows estate and the Premier Inn Hotel. The relevant significance of impacts at these locations where the CNT are exceeded are summarised in Table 13.46. At all other assessed locations, the construction noise levels are below the significance thresholds of 65 to 75dB $L_{Aeq,T}$ during the key works phases identified with highest potential for construction noise.

Full calculated results for this work area are included in Appendix A13.7.

Table 13.46: Fosterstown Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Demolition	186	24 Boroimhe Willows	70	70	71- 75	Moderate to Significant	Moderate to Significant
	187	20-22 Boroimhe Willows	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
	188 – 192, 194	Boroimhe Willows	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	196	Premier Inn Hotel Airside	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Install guide walls & piling mat	186	24 Boroimhe Willows	70	70	71 – 75	Moderate to Significant	Moderate to Significant
	187	20-22 Boroimhe Willows	65	65	66 – 70	Moderate to Significant	Moderate to Significant
Concrete works	187	20-22 Boroimhe Willows	65	65	66 – 70	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of the identified properties in Table 13.46 are up to 5dB above the CNT resulting in a potential moderate to significant to very significant impacts in the absence of noise mitigation. At all locations, the calculated construction noise level is below the typical fixed upper noise limit of 75dB L_{Aeq}, Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

Cut and Cover and Retained Cut Works

The proposed alignment between Pinnock Hill to DANP in AZ1 is predominately retained cut and surface level railway with a small section of cut and cover. The works will be supported via the Fosterstown main compound and three satellite compounds at Nevinstown Lane, Boland and the North Portal. The same approach for calculating construction noise levels from this activity as discussed in Section 13.5.2.3.2 has been used for this section.

The results have been used to identify NSLs which have the potential to exceed their CNTs. The construction noise receiver location for this element of work are displayed in Figure 13.2 (sheets 6 to 8). This activity will take place during the standard daytime working hours for the proposed Project. The following locations are calculated to exceed the relevant CNTs in this area. The relevant significance of impacts at these locations are summarised in Table 13.47.

Table 13.47: Cut and Cover and Retained Cut Sections –Pinnock Hill to DANP

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Cut and Cover/Retained Cut Construction – Linear sequential works and compounds	197	Residential dwelling R132	70	70	71 -75	Moderate to Significant	Moderate to Significant
	198	Tara Winthrop Clinic	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	207	Residential Fosterstown south	70	70	71 -75	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a moderate to significant, short-term effect is identified in the absence of noise mitigation. Calculated noise levels at the locations in Table 13.47 all below the upper construction noise limit of 75Db $L_{Aeq,T.}$

Track Laying Activities for Overground Rail

Tracklaying activities within this section of AZ1 will be within a retained cut section and at surface level for majority of the alignment with small sections of cut and cover. For purpose of calculation, sections of retained cut and rail at surface level have been modelled to incorporate the track laying activities operating simultaneously within these work areas. This activity will take place over day, evening and night-time working hours which has been assessed as part of the noise modelling.

There are no NSLs in this section where calculated CNLs exceed the relevant CNTs during daytime or evening construction periods. The construction noise receiver location for this element of work are displayed in Figure 13.2 (sheets 6 to 8). During night-time periods the NSLs calculated to exceed the CNTs and relevant significance of impacts at these NSLs for night-time works are presented in Table 13.48.

Table 13.48: Above Ground Track Laying –Malahide Roundabout to Pinnock Hill

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 -07:00)	CNL	Night-time (23:00 - 07:00)
Above Ground Track Laying and Railhead	199	58 Broimhe Hazel	55	56 -60	Significant
	207	residential Fosterstown south	55	61 – 65	Significant to Very Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the CNT by up to or greater than 5dB and hence a significant to very significant effect is identified. The progression of tracklaying is projected at a rate of approximately 100m per day or night. The impacts identified in Table 13.48 will occur for a period of typically one-night duration at any one location which relate to the physical track laying works in proximity to the NSL resulting in a brief to temporary duration of effect Whilst there will be railway traffic to/from railheads along this section, the noise contribution of this activity will be less than those associated with the track works themselves, particularly along sections of the rail alignment within retained cut sections.

Section Summary

Referring to the calculated construction noise levels discussed for the activities and work areas discussed above, highest potential impacts will be experienced during cut and cover and retained cut works with associated compound activity during standard daytime working hours over, and during track laying works at night.

13.5.2.3.5 AZ1 Construction Vibration

The construction of this element of the proposed Project will be by way of mechanical excavation, that includes secant piling, where one of the closest buildings to this activity would be the Woodies homeware store just north of Seatown roundabout on the R132.

Calculations of vibration from secant piling are included in Section 14.4 of Chapter 14 (Groundborne Noise & Vibration). The closest building is the Woodies commercial building located at a horizontal distance of 2.7m from where secant piling will take place. Calculated vibration levels at this building during this activity are approximately 1.2mm/s, reducing by about half into the building. Chapter 14 presents the calculated vibration dose value over a 16hr day within the building and concludes the values are well below the threshold level for significant effects on "occupants of residential buildings". Given that residential buildings within this zone are at greater distances that this building, vibration impacts are below the threshold level for significant impact for all such receptors in this zone. The calculated level of vibration is well below the threshold level for building damage (Table 13.15).

During breaking of made ground using breakers mounted on excavators, magnitudes of vibration are no higher than those discussed above and hence vibration impacts are below the threshold of significance for building occupants and building damage.

13.5.2.3.6 AZ1 Construction Traffic

Using the methodology discussed in Section 13.2.5.1.3, the assessment of potential construction traffic noise impacts has been undertaken using the following approach:

- Traffic noise levels have been calculated along all modelled roads over the full extent of the ERM associated with the Do Minimum and Do Something scenarios for the northern peak year, 2028 using the AADT data per fleet type for each road.
- The calculated difference between the two scenarios along all roads are below 3dB with the exception of a small number of individual roads. Roads with changes in traffic noise levels below 3dB are determined to experience a neutral, imperceptible, and short-term impact to negative, not significant, and short-term impact due to the relatively low volume of additional traffic along the road network during the Construction Phase scenario when added to existing flows.
- Along all roads with a calculated change in noise level of 3dB and above, the closest NSLs to the road edge have been identified and the daytime traffic noise level has been calculated. The magnitude of change rating and the absolute traffic noise level have been used to categorise the significance of the impact at the closest properties with reference to Table 13.14 and Table 13.22.

Table 13.49 presents the calculated change in noise level along all road sections within AZ1 where a change in noise level of 3dB or above has been calculated.

Table 13.49: Construction Phase Traffic Noise Impacts – AZ1

Road	Closest NSL	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at Closest NSL,. LAeq,16hr	Noise Level Category	Overall Significance Rating
Ennis Lane (between R132 and Estuary Site access)	Emmaus retreat centre	+4.4	Moderate	47	Negligible	Not significant - Slight
Lakeshore Drive, Airside Retail Park	Premier Inn Hotel, Airside	+4	Moderate	57	Low to Medium	Slight to Moderate
Feltrim Road	Drinan Road - properties	+3.1	Moderate	65	Medium - High	Moderate – Significant

During the assessed peak construction year (2028) the highest potential noise impacts are calculated along Feltrim Road as a result of traffic management measures and related redistributed traffic temporarily onto this road. There are no construction vehicles along these roads. The change in traffic noise is defined as moderate with traffic noise level calculated at the closest NSLs along these roads categorised as medium to high. The overall impact is determined to be negative, moderate to significant and temporary.

Along Ennis Lane, along the section of road between the R132 to the Estuary site entrance, the change in traffic noise is defined as moderate with traffic noise level calculated at the closest NSLs along this road categorised as negligible due to the distance of the closest building to this section of road. The increase in traffic noise is due to construction vehicles accessing the Estuary site compound along this road which is accounted for in the calculated noise level. Overall, a negative, not significant to slight, temporary impact is calculated at the closest NSL at Emmaus Retreat centre which is set back some 140m from the site access. Noise levels at this location will therefore be dominated by construction activities within the compound itself which includes HGV movements and other items of mobile plant.

Along Lakeshore Drive, within Airside retail park, the change in traffic noise is defined as moderate with traffic noise level calculated at the closest NSL along this road categorised as low to medium. The increase in traffic noise is due to diversion of traffic in this area due to traffic management measures. Overall, a negative, slight to moderate, temporary impact is calculated at the closest NSL.

As noted above, the construction traffic volumes used in the assessment is based on the reasonable worst case peak scenario which reflects a 'worst case month' under which the construction of multiple work sections are taking place concurrently within AZ1 with the related traffic management measures in place. Along all other roads north of the M50 Motorway within the ERM study area, construction traffic noise impacts are neutral to not significant.

A further sensitivity assessment was undertaken for each of the main site compounds in AZ1 during the AM peak period using data for the most impacted traffic road section in the immediate vicinity of the compound access an egress as advised by the traffic team. The results are summarised in Table 13.50. The calculated traffic noise is made at 5m from the road edge, unless otherwise indicated in the table.

Table 13.50: AM peak Construction Phase Traffic Impacts surrounding site compounds – AZ1

Compound	Road	Maximum AM Peak Construction HGV	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at road edge/NSL, dB $L_{Aeq,1hr}$	Noise Level Category	Overall Significance Rating
Estuary	Ennis Lane	10 HGVs (20 movements)	+9	Major	50 (NSL)	Negligible - Low	Slight
	R132 North of site access	4 HGVs (8 movements)	+0.5	Negligible	70	High	Not Significant
	R132 South of site access	6 HGVs (12 movements)	+0.2	Negligible	72	High	Not Significant
Seatown Compound	Seatown Road (site access swords business park)	2 HGVs (4 movements)	+0.6	Negligible	65	Medium	Not Significant
Swords Central Compound	R132 North of site access	4 HGVs (8 movements)	+0.5	Negligible	68	Medium - High	Not Significant
	R132 South of site access	4 HGVs (8 movements)	+0.3	Negligible	70	High	Not Significant
Fosterstown Station Compound	R132 North of site access	4 HGVs (8 movements)	+0.7	Negligible	67	Medium - High	Not Significant
	R132 South of site access	4 HGVs (8 movements)	+0.5	Negligible	68	Medium - High	Not Significant

During the assessed AM peak hour for each construction site compound within AZ1, the highest change in noise levels are calculated along Ennis Lane accessing the Estuary site compound from the R132. The change in traffic noise is defined as major, however the traffic noise level calculated at the Emmaus Retreat centre is categorised as low. The overall impact is determined as slight due to the traffic noise level experienced at the NSL. As noted above, noise levels at this location will be dominated by construction activities within the compound itself which includes HGV movements and other items of mobile plant.

For all other main site compounds in AZ1, the change in traffic noise level is negligible (<1dB). The calculated noise level along the road edge, whilst categorised as medium to high will not be altered to any perceptible level as a result of construction traffic flows and hence the overall impact is not significant.

13.5.2.4 AZ2 Airport Section: DANP to DASP

Works proposed in Area AZ2 will include the construction of the DANP, a 110KV substation at Naul Road, the DASP, underground tunnelling under Dublin Airport between both portals, evacuation and ventilation tunnels parallel to the main tunnel and the construction of Dublin Airport Station. Enabling Works will include road and utility diversion works.

Construction noise impacts are presented for the following key work areas in AZ2.

- DANP;
- Dublin Airport Station; and
- DASP.

As noted above, the results discussed in the following sections are unmitigated and are those which are calculated to result in potential significant effects. Modelled receivers which are calculated below the relevant identified significance thresholds are not presented in this section but are included in full in Appendix A13.7.

13.5.2.4.1 Dublin Airport North Portal – Construction Noise

Two scenarios have been modelled relating to works associated with constructing the DANP receiver compound prior to the TBM breakthrough which relate to standard daytime working hours. During TBM breakthrough and removal activities at this compound, construction working hours will be on a 24/7 basis which has been assessed as part of the noise modelling. Once the TBM has been removed from this compound the portal finishing out works and substation construction will be undertaken during standard working hours.

Six NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 8 and 9). The closest NSLs are a halting site to the south-west of the DANP compound and a creche to the south-west of the substation compound. There are no NSLs where calculated CNLs exceed the relevant CNTs of 70dB $L_{Aeq,T}$ during daytime or evening construction periods during the key works phases identified with highest potential for construction noise.

During the TBM breakthrough works, one modelled location, representing a halting site to the north-east of Dublin Airport, is calculated to experience a moderate to significant noise impact during night-time periods in the absence of noise mitigation. As part of the grant of permission relating to the Dublin Airport Northern Runway, this halting site is to be relocated from its current location. This modelled receiver is therefore unlikely to be an occupied NSL at the time of construction. For the purpose of this EIAR, however, it is assessed as being an occupied NSL location. The relevant significance of impacts at this NSL for night-time works are summarised in Table 13.51. Full calculated results for this work area are included in Appendix A13.7.

Table 13.51: DANP - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 – 07:00)	CNL	Night-time (23:00 – 07:00)
TBM breakthrough works	DANP 1	Halting site (NE Dublin Airport)	55	56 - 60	Significant

The range of CNLs at the most exposed NSL are calculated to exceed the CNT by up to 5dB and hence a potential significant, short-term effect is identified in the absence of noise mitigation.

13.5.2.4.2 Dublin Airport Station – Construction Noise

The main Dublin Airport Station construction site will be on the west side of the Terminal 2 departure road. This station will be constructed using a top-down construction methodology. Five scenarios have been modelled relating to works associated with site set up, piling, excavation above roof slab, excavation and blasting below roof slab and fit out which relate to standard daytime working hours.

Four NSLs have been modelled in the vicinity of this working area. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheet 10). The closest NSL is Our Lady Queen of Heaven Church located west of the station compound. During the main work phases of this station box, the CNL at the most exposed façade of Our Lady Queen of Heaven Church at Dublin Airport is calculated to exceed the CNT of 70dB $L_{Aeq, T}$. The relevant significance of impacts at this location are summarised in Table 13.52. At all other assessed locations, the construction noise levels are below the significance thresholds. Full calculated results for this work area are included in Appendix A13.7.

Table 13.52: Dublin Airport Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Site set up	2	Our Lady Queen of Heaven Church – east facade	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Piling/Diaphragm wall construction	2	Our Lady Queen of Heaven Church - east facade	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Excavation above roof slab	2	Our Lady Queen of Heaven Church - east facade	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
Excavation and blasting below roof slab	2	Our Lady Queen of Heaven Church - east facade	70	70	71 - 75	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façade (east facade) of Our Lady Queen of Heaven Church are up to 5dB above the CNT resulting in a potential moderate to significant impact in the absence of noise mitigation for the main construction phases. During the excavation above the roof slab level, construction noise levels have the potential to exceed the NCT by over 5 dB, hence a significant to very significant impact is calculated during this phase. At this façade of the church (representing the upper sections where windows are located), the calculated construction noise level is below the upper fixed upper noise limit of 75dB L_{Aeq}. Further mitigation will be required at this construction compound to reduce noise impacts at this NSL.

13.5.2.4.3 Dublin Airport South Portal - Construction Noise

The DASP Main Construction Compound is located immediately south of the Old Airport Road. The majority of the proposed land is currently greenfield locations. The compound will support the

construction of the portal and launching shaft, the open cut to the south; the TBM tunnelling under Dublin Airport and the construction of excavation and ventilation tunnels.

Six scenarios have been modelled relating to works associated with site set up and establishment, portal construction and tunnel construction, TBM support works, spray concrete lining for the intervention tunnel, batching plant works to support the track laying process and portal finishing works. Construction works are proposed over a 24/7 basis during construction of the evacuation and ventilation tunnels, TBM support works at surface level, Spray Concrete Lining (SCL) surface works and batching plant works during track laying activities. All other phases are during the normal daytime standard working hours.

Six NSLs have been modelled in the vicinity of this working area. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheet 14). The closest NSLs are residential properties along the Old Airport Road and along Collinstown Lane to the south-west of the portal at distances in excess of 300m. For each of the phases assessed, the daytime weekday CNT of 75dB $L_{Aeq,12hr}$, the Saturday daytime CNT of 70dB $L_{Aeq,6hr}$ or the night-time CNT of 55dB $L_{Aeq,8hr}$ is not exceeded at any of the modelled NSLs during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

13.5.2.4.4 AZ2 Construction Vibration

Potential vibration sources within this assessment zone include the cutting head of a hydrofraise for D-wall construction, mechanical excavation, drill and blast methods and breaking ground at surface level. As discussed in Section 13.2.5.1.2, these vibration sources are addressed in Chapter 14 (Groundborne Noise & Vibration). The assessment has concluded all activities can operate within the vibration thresholds for human response and building damage with the exception of blasting where a potential significant impact at Our Lady Queen of Heaven Church is calculated.

During breaking of made ground using breakers mounted on excavators at surface level, magnitudes of vibration are orders of magnitude below those associated with blasting at this location. Vibration magnitudes associated with intermittent hydraulic breaking at surface level will be lower than or comparable to those assessed for mechanical excavation and D-wall construction and hence vibration impacts are below the threshold of significance for building occupants and building damage.

13.5.2.4.5 AZ2 Construction Traffic

Using the methodology discussed in Section 13.2.5.1.3, the assessment of potential construction traffic noise impacts has been undertaken using the following approach:

- Traffic noise levels have been calculated along all modelled roads over the full extent of the ERM associated with the Do Minimum and Do Something scenarios for the northern peak month in 2028 using the AADT data per fleet type for each road.
- The calculated difference between the two scenarios along all roads are below 3dB along all roads with the exception of a small number of individual roads. Roads with changes in traffic noise levels below 3dB are determined to experience a neutral, imperceptible, and short-term impact to negative, not significant, and short-term impact due to the relatively low volume of additional traffic along the road network during the Construction Phase scenario when added to existing flows.
- There are no roads within AZ2 with a calculated change in noise level of 3dB or above.

Along all other roads north of the M50 Motorway within the ERM study area, construction traffic noise impacts are neutral to not significant. As noted above, the construction traffic volumes used in the assessment is based on the reasonable worst case peak scenario which reflects a 'worst case month' under which the construction of multiple work sections are taking place concurrently as part of the proposed Project.

A further sensitivity assessment was undertaken for each of the main site compounds in AZ2 during the AM peak period using data for the most impacted traffic road section in the immediate vicinity of the

compound access an egress as advised by the traffic team. The results are summarised in Table 13.53. The calculated traffic noise is made at 5m from the road edge, unless otherwise indicated in the table.

Table 13.53: AM peak Construction Phase Traffic Impacts surrounding site compounds – AZ2

Compound	Road	Maximum AM Peak Construction HGV	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at road edge/NSL, dB $L_{Aeq,1hr}$	Noise Level Category	Overall Significance Rating
DANP	Naul Road (East of site access to R132)	3 HGVs (6 movements)	+0.3	Negligible	69	High	Not Significant
Dublin Airport	Site entrance	3 HGVs (3 movements – 1 way system)	+0.5	Negligible	68	High	Not Significant
DASP/Dardistown	R108 Naul Road (South of site access to M50 Motorway)	20 (40 movements)	+2.6	Minor	69	High	Slight-Moderate

During the assessed AM peak hour for each construction site compound within AZ2, the highest change in noise levels are calculated along the R108 Naul Road to the west of Dardistown Compound. Construction traffic will access the compound along this road between the M50 Motorway and the site entrance. The closest sensitive area along this road is the Silloge Golf Course. The change in traffic noise is defined as minor along this road when added to existing traffic in this peak hour period.

For all other main site compounds in AZ2, the change in traffic noise level is negligible (<1dB). The calculated noise level along the road edge, whilst categorised as medium to high will not be altered to any perceptible level as a result of construction traffic flows and hence the overall impact is not significant.

13.5.2.5 AZ3: Dardistown to Northwood

Construction works proposed in Area AZ3 will include the construction of the proposed maintenance depot at Dardistown, Dardistown Station, the M50 Viaduct, Northwood Station and the Northwood Portal.

Construction noise impacts are presented for the following key work areas in AZ3.

- Dardistown Depot;
- M50 Viaduct and Rail Embankment Construction;
- Northwood Station; and
- Northwood Portal.

The results discussed in the following sections are unmitigated and are those which are calculated to result in potential significant effects. Modelled receivers which are calculated below the relevant identified significance thresholds are not presented in this section but are included in full in Appendix A13.7.

13.5.2.5.1 Dardistown Depot

Eight phases of work have been modelled relating to works associated with site set up and utility diversion, piling, excavation, station construction, depot construction, concrete batching plant operations, piling and depot building works, road works, rail head and track laying and site reinstatement and landscaping works. Construction of retained cut station, concrete batching plant operations, the railhead during tracklaying works and Mechanical Electrical & Plumbing fit out (MEP) are proposed over a 24/7 basis. All other phases are during the normal daytime standard working hours.

Twelve NSLs have been modelled in the vicinity of this working area. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 14 and 15). The closest NSLs are residential properties along the Old Airport Road, along Collinstown Lane and the Silloge Golf club to the west. Due to the extensive compound size at Dardistown, the position of construction working areas and plant and equipment will vary over the duration of the Construction Phase within the overall compound site. For each phase of works, construction noise sources are modelled within the relevant working areas of the site closest to the nearest NSL, as far as practicable.
For each of the phases assessed, the daytime weekday CNT of 70 to 75dB $L_{Aeq,12hr}$, the Saturday daytime CNT of 70dB $L_{Aeq,6hr}$ and the night-time CNT of 55dB $L_{Aeq,8hr}$ is not exceeded at any of the modelled NSLs during the key works phases identified with highest potential for construction noise. In all instances therefore calculated construction noise levels are below the CNTs above. Full calculated results for this work area are included in Appendix A13.7.

13.5.2.5.2 M50 Viaduct and Rail Embankment Construction

Seven scenarios have been modelled relating to works associated with constructing the M50 Viaduct and overground rail line south of the M50 Motorway towards Northwood Station. The scenarios include site establishment works, piling, abutment works, piling, pier, deck and finishing works for both work areas simultaneously.

Three NSLs have been modelled in the vicinity of this working area which are in proximity to the rail embankment south of the M50 Motorway within Northwood. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheet 15). The calculated CNLs are calculated above the daytime and weekend CNTs of 70dB $L_{Aeq,T}$ at the closest NSLs to the embankment works south of the M50 Motorway, specifically during piling and foundation works for this structure. The assessment summary for this compound is summarised in Table 13.54. Full calculated results for this work area are included in Appendix A13.7.

Table 13.54: M50 Viaduct and Rail Embankment - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Pier, Abutment & deck construction (embankment south)	220	Santry Lodge	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	216	St Annes	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Finishing works (embankment south)	216	St Annes	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	220	Santry Lodge	70	70	71 - 75	Moderate to Significant	Moderate to Significant

The calculated CNLs at the closest NSLs are up to 5dB above the CNT resulting in a potential moderate to significant impact in the absence of noise mitigation. The calculated construction noise level is below

the upper fixed upper noise limit of 75dB L_{Aeq}. Further mitigation will be required at this construction compound to reduce noise impacts at this NSL.

As part of the M50 Viaduct construction works, temporary traffic management will be required to provide access for the construction of the north and south piers. The installation of the steel beams and decking over the M50 Motorway will be undertaken in a series of phased temporary weekend night-time road closures. This process will commence with closures on the north slip road followed by the south slip road, and finally the M50 Motorway. During the M50 Motorway closure the slip roads will remain open for diversion. It is anticipated that between six and eight temporary weekend night-time road closures will be required to complete the phased installation of the bridge beams and decking. The closest activities to NSLs during this phase of work are residential locations south of the M50 Motorway when the south slip is closed and beams and decking are being lifted into place over the M50 Motorway. Whilst these activities will occur at night, the process predominately involves lifting equipment and cranes, the loudest part (crane engines) will be screened by the ground topography.

Given the restricted number of times these will be used over individual night-time periods and the distance and screening from the sources, it is not predicted that they will exceed the night-time CNT at these locations (55dB $L_{Aeq,8hr}$) or the temporal criteria required to trigger a significant impact. Staff will be briefed to ensure they are aware of the potential for noise impacts and how to mitigate them appropriately. Specifically, the scheduling of works to co-ordinate activities with potential for high noise emissions to be restricted during night-time periods, as far as practicable. Further discussion on noise mitigation measures are included in Section 13.6.1.

13.5.2.5.3 Above Ground Track Laying

Above ground tracklaying activities within this section of AZ3 will be within Dardistown Depot, along the M50 Viaduct and rail embankment north of Northwood. This activity will take place over day, evening and night-time working hours which has been assessed as part of the noise modelling.

The closest NSLs are residential dwellings north of Dardistown Depot and residential dwellings to the east and west of the rail embankment south of the M50 Motorway. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 15). During day and evening periods, calculated noise levels are within the CNT at these locations (70 to 75dB $L_{Aeq,T}$During night-time periods three properties are calculated to potentially exceed the night-time CNTs. The relevant significance of impacts at these NSLs for night-time works are summarised in Table 13.55.

Table 13.55: Above Ground Track Laying – AZ3

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 -07:00)	CNL	Night-time (23:00 - 07:00)
Above Ground Track Laying and Railhead	216	St Annes Northwood (residential)	55	61 - 65	Significant to Very Significant
	220	Santry Lodge	55	61 - 65	Significant to Very Significant
	219	1-3 Old Ballymun Road	55	61 - 65	Significant to Very Significant

The range of CNLs at the most exposed NSLs are calculated to exceed the night-time significance threshold by up to or greater than 5dB and hence a significant to very significant effect is identified. The progression of tracklaying is projected at a rate of approximately 100m per day or night. The impacts identified in Table 13.55 will occur for a period of typically one-night duration at any one location which relate to the physical track laying works in proximity to the NSL resulting in a brief to temporary duration of effect. Whilst there will be railway traffic to/from railheads along this section, the noise contribution of this activity will be less than those associated with the track works themselves.

13.5.2.5.4 Northwood Station

Six scenarios have been modelled relating to works associated with constructing Northwood station from site establishment works, piling, excavation above and below the slab including blasting and finishing works and batching plant operations. Construction of this station box will be undertaken during standard daytime working hours. Station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Eight NSLs have been modelled in the vicinity of this compound. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 16). The closest NSL is an apartment building along the R108 Old Ballymun Road to the east of the site. During excavation works above the roof slab, construction noise levels are calculated to potentially exceed the CNT identified at upper floors of this building. The relevant significance of impacts at this building are summarised in Table 13.56 during this phase. At all other assessed locations, the construction noise levels are below the significance threshold of 70dB $L_{Aeq,T}$ during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.56: Northwood Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Ground Level Excavation (Above Slab)	8	Apartments – Old Ballymun Road	70	70	71 – 75	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of this apartment building (upper floor levels) in Table 13.56 are up to 5dB above the daytime CNT resulting in a potential moderate to significant impact in the absence of noise mitigation. At these facades, the calculated construction noise level is below the typical fixed upper noise limit of 75dB $L_{Aeq,T}$ Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

13.5.2.5.5 Northwood Portal

Two scenarios have been modelled relating to works associated with constructing the Northwood Portal prior to the TBM works which relate to enabling works and pre TBM surface activity. These activities will be undertaken during the standard daytime working hours for the proposed Project. Once the TBM is launched and commences excavation of the Metrolink tunnel, the surface works at this compound will operate on a 24/7 basis which has been assessed as part of the noise modelling. These activities include the ancillary surface works relating to spoil removal via conveyors from the portal to the storage area, tunnel lining materials, batching plant and other ongoing activities within the compound. Once the TBM has been removed from this compound the portal finishing works will be undertaken during standard daytime working hours.

Eight NSLs have been modelled in the vicinity of this compound. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 16). The closest NSLs are residential dwellings at Northwood Green along the R108 Ballymun road, apartment buildings along the R108 Old Ballymun Road to the east of the site and apartment buildings along the R108 Old Ballymun Road further east. There are no NSLs where calculated CNLs exceed the relevant daytime and Saturday CNT (70dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise.

During the TBM activity and associated surface works, six of the modelled locations are calculated to exceed the night-time CNT (55dB $L_{Aeq,8hr}$) in the absence of noise mitigation. The relevant significance of impacts at these NSLs for night-time works are summarised in Table 13.57. Full calculated results for this work area are included in Appendix A13.7.

Table 13.57: Northwood Portal - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 – 07:00)	CNL	Night-time (23:00 – 07:00)
TBM works	1	11 Northwood Green	55	61 - 65	Significant to Very Significant
	2	32 Northwood Green	55	56 - 60	Significant
	3	37 Northwood Green	55	56 – 60	Significant
	4	Northwood Nursing Home	55	56 – 60	Significant
	7	Hampton Apartments	55	56 – 60	Significant
	8	Apartments - Old Ballymun Road	55	61 - 70	Significant to Very Significant

The range of CNLs are up to or above 5dB above the CNT at four modelled locations resulting in a potential significant effect in the absence of noise mitigation. At two modelled locations (Northwood Green and apartments along Old Ballymun Road) a potential significant to very significant effect is calculated in the absence of mitigation. Further mitigation will be required at this construction compound to reduce noise impacts at this NSL during night-time periods.

Both the Northwood Portal and the Northwood station will be constructed during simultaneous periods and hence there are potential cumulative effects in this area during daytime periods. Noise mitigation is required to reduce impacts at the most impacted NSLs adjacent to each compound which will reduce cumulative impacts at these are adjacent properties.

13.5.2.5.6 AZ3 Construction Vibration

At Dardistown Depot, the closet buildings to any surface works is the NCT facility to the south-east of the depot at a distance of approximately 50m from a retained cut section of the MetroLink alignment. Highest potential vibration sources at this location involve secant piling during construction of the retained cut. Vibration magnitudes at this distance from this activity will be orders of magnitude below the threshold level for human disturbance (Table 13.16) and well below the threshold levels for building damage (Table 13.15) based on the calculations undertaken in Chapter 14 (Groundborne Noise & Vibration) for this activity at the closest building (2.7m from secant piling works).

Construction of the M50 Viaduct will require piled foundations for the abutment walls and viaduct support piers. The closest buildings to bridge pier piling works is St Annes residential dwelling in Northwood, some 80m south. Similar to above, vibrations magnitudes at this building will be orders of magnitude below the threshold level for human disturbance (Table 13.16) and well below the threshold levels for building damage (Table 13.15) taking account of the distance to this activity.

Construction of Northwood Portal and Northwood station box will involve D-wall construction, mechanical excavation, drill and blast methods and breaking ground at surface level. Vibration from these activities in AZ3 are discussed in Chapter 14 (Groundborne Noise & Vibration) and concludes there are no exceedance of the vibration thresholds for human disturbance or building damage.

13.5.2.5.7 AZ3: Construction Traffic

Using the methodology discussed in Section 13.2.5.1.3, the assessment of potential construction traffic noise impacts has been undertaken using the following approach:

- Traffic noise levels have been calculated along all modelled roads over the full extent of the ERM associated with the Do Minimum and Do Something scenarios for the northern peak year, 2028 using the AADT data per fleet type for each road.

- The calculated difference between the two scenarios along all roads are below 3dB along all roads with the exception of a small number of individual roads discussed below. Roads with changes in traffic noise levels below 3dB are determined to experience a neutral, imperceptible, and short-term impact to negative, not significant, and short-term impact due to the relatively low volume of additional traffic along the road network during the Construction Phase scenario when added to existing flows.
- Along all roads with a calculated change in noise level of 3dB and above, the closest NSLs to the road edge have been identified and the daytime traffic noise level has been calculated. The magnitude of change rating and the absolute traffic noise level have been used to categorise the significance of the impact at the closest properties with reference to Table 13.14 and Table 13.22.

This section of the proposed Project will involve the greatest volume of excavated material to be removed while the city tunnel is under construction. Excavated material for the proposed Project will be loaded directly into site vehicles and transported to Huntstown Quarry. All construction traffic will use the designated haul routes only along the R108 and directly onto the M50 Motorway and N2. During night-time periods, spoil will be stockpiled such that night-time spoil removal movements are not required at this compound.

Due to this site being required for the City Tunnel launch site, the site is of sufficient size to receive delivery vehicles within its boundary to minimise the impact of vehicles idling and causing congestion on the local roads during offloading. However, a small holding bay under 0.5km from site will still be required for storage for excavated material and an area for loading this into road vehicles, manage gate access and check delivery credentials ahead of accessing site. The vehicle holding areas will be actively managed with a booking system that allows the logistics team to prepare for deliveries and ensure smooth operation of site.

Highest changes in traffic noise levels are calculated at the N2 and R135 Naul Road Junction due to lower baseline traffic volumes along the junction. Along the N2 road and R135 Naul Road, changes in traffic volumes are below 3dB due to the existing volume of traffic (including HGVs) along these roads. Closest NSLs to the junction are some 140m north and are located along the R135 Naul Road, hence noise levels are dominated by road traffic along this road. The cumulative traffic noise impact is not significant.

As noted above, the construction traffic volumes used in the assessment is based on the reasonable worst case peak scenario which reflects a 'worst case month' under which the construction of multiple work sections are taking place concurrently south of the M50 Motorway with the related traffic management measures in place. Along all other roads north of the M50 Motorway within the ERM study area, construction traffic noise impacts are neutral to not significant.

A further sensitivity assessment was undertaken for each of the main site compounds in AZ3 during the AM peak period using data for the most impacted traffic road section in the immediate vicinity of the compound access an egress as advised by the traffic team. The results are summarised in Table 13.58 The calculated traffic noise is made at 5m from the road edge, unless otherwise indicated in the table.

Table 13.58: AM peak Construction Phase Traffic Impacts surrounding site compounds – AZ3

Compound	Road	Maximum AM Peak Construction HGVs	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at road edge/NSL, dB $L_{Aeq,1hr}$	Noise Level Category	Overall Significance Rating
Northwood	R108 (North of site access)	10 HGVs (20 movements)	+0.2	Negligible	74	High	Not Significant
	R108 (South of site access)	0 HGVs	0	Negligible	75	High	Not Significant

Compound	Road	Maximum AM Peak Construction HGVs	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at road edge/NSL, dB $L_{Aeq,1hr}$	Noise Level Category	Overall Significance Rating
	St Margaret's Road (R108 – site entrance)	10 HGVs (20 movements)	+1	Negligible	69	High	Not Significant

During the assessed AM peak hour for the main compound within AZ3, the highest change in noise levels are calculated along St Margaret's Road between the R108 and the site access along this road (Logistics and holding area compound).

The change in traffic noise is defined as negligible. The calculated noise level along the road edge, whilst categorised as high will not be altered to any perceptible level as a result of construction traffic flows. In addition there are no NSL along this section of road. The overall impact is not significant.

Along the R108, construction traffic from the Northwood compounds will travel northbound only to the M50 Motorway. Changes in traffic noise along this section of road are defined as not significant.

Traffic from all other compounds in AZ4 along the R108 will travel along this road towards the M50 Motorway. These traffic volumes are modelled within the overall ERM model for the full study area and as confirmed above do not result in traffic noise levels above 3dB.

13.5.2.6 AZ4: Northwood to Charlemont

Works proposed in Area AZ4 will include the underground tunnelling from Northwood to Charlemont, the construction of nine underground stations, one interchange station at Glasnevin, an intervention shaft at Albert College Park and intervention tunnel at Charlemont.

Construction noise impacts are presented for the following key work areas in AZ4:

- Ballymun Station Main Compound;
- Collins Avenue Station Main Compound;
- Griffith Park Station Main Compound;
- Albert College Park Intervention Shaft;
- Glasnevin Station and Interchange Main Compound;
- Mater Station Main Compound;
- O'Connell Street Station Main Compound;
- Tara Station Main Compound;
- St Stephens Green Station Main Compound; and
- Charlemont Station Main Compound.

The results discussed in the following sections are unmitigated but include the standard 2.4m site hoarding around the main site compounds. Modelled receiver locations during this scenario which are calculated to exceed the relevant CNTs and result in potential significant effects are presented for each work site. Modelled receivers which are calculated below the relevant identified significance thresholds are not presented in this section but are included in full in Appendix A13.7.

13.5.2.6.1 Ballymun Station

Five scenarios have been modelled relating to works associated with constructing this station from site establishment works, piling & D-wall construction, excavation above and below the slab including blasting and finishing works. All station surface works will be undertaken during daytime standard

working hours at this compound. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Seventeen NSLs have been modelled in the vicinity of this compound. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 17). The closest NSLs are apartment buildings to the north and a hotel to the east. There are no NSLs with calculated CNL above the relevant daytime or Saturday CNTs (65 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

13.5.2.6.2 Collins Avenue Station

Six scenarios have been modelled relating to works associated with constructing this station from site establishment works, piling & D-wall construction, vent shaft construction, excavation above and below the slab including blasting and finishing works. All surface works will be undertaken during daytime standard working hours at this compound. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Eighty NSLs have been modelled in the vicinity of this compound. The construction noise receiver locations for this compound are displayed in Figure 13.2 (Sheet 18). The closest NSLs to this compound are Our Lady of Victories Church to the east and residential units at Albert College Court to the south. There are four NSLs where calculated CNLs exceed the CNTs identified during different phases of work. The relevant significance of impacts at these locations are summarised in Table 13.59. At all other modelled locations, the construction noise levels are below the daytime or Saturday AM CNTs (65 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.59: Collins Avenue Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNT	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced Enabling & Utility Works, Site Preparation Works	1	158 Ballymun Road	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	30	Church	65	65	71 -75	Significant to Very Significant	Significant to Very Significant
	39	Albert College Court	75	75	81 - 90	Significant to Very Significant	Significant to Very Significant
Piling & D-wall	30	Church	65	65	71 -80	Significant to Very Significant	Significant to Very Significant
	39	Albert College Court	75	75	81 - 90	Significant to Very Significant	Significant to Very Significant
Excavation – Ground Level	1	158 Ballymun Road	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	30	Church	65	65	71 -80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNT	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	39	Albert College Court	75	75	81 - 90	Significant to Very Significant	Significant to Very Significant
	69	Our Lady of Victories National School	65	65	66 - 70	Moderate to Significant	Moderate to Significant
Excavation – Below Slab	30	Church	65	65	71 -75	Significant to Very Significant	Significant to Very Significant
	39	Albert College Court	75	75	76 - 80	Moderate to Significant	Moderate to Significant
Fit-out	30	Church	65	65	71 -75	Moderate to Significant	Moderate to Significant
	39	Albert College Court	75	75	76 - 80	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.59 are up to or above 5dB above the CNT resulting in a potential moderate to significant or significant to very significant impact in the absence of noise mitigation. Highest noise levels are calculated at Albert College Court along the southern boundary of the compound where CNL exceed the CNT of 75dB $L_{Aeq,T}$ during multiple phases in the absence of mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

13.5.2.6.3 Albert College Park Intervention Shaft

Six scenarios have been modelled relating to works associated with constructing this intervention shaft from site establishment works, piling and D-wall construction, excavation above and below the slab including blasting and finishing works. These works will be undertaken during daytime standard working hours.

This compound will also be used as a compound for SCL which will require 24/7 works. Activities above ground will include the use of a concrete pump, site loader, ventilation fans and site power and lighting. Deliveries will be limited to daytime hours only, however there will be a requirement for concrete delivery to occur at night.

Thirty-five NSLs have been modelled in the vicinity of these working areas. The construction noise receiver locations for this element of work are displayed in Figure 13.2 (Sheet 19). The closest NSLs to this compound are residential dwellings along Hampstead Avenue to the south and residential properties across the R108 Ballymun Road to the west. There are two NSLs where calculated CNLs exceed the CNTs identified during the above ground excavation works in the absence of mitigation during daytime periods. The relevant significance of impacts at these locations are summarised in Table 13.60. At all other assessed locations, the CNLs are below the relevant CNTs for daytime and Saturday AM period (65 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. During night-time works associated with the SCL activities, exceedance of the night-time CNT is calculated at properties to the south and west of the compound.

Full calculated results for this work area are included in Appendix A13.7.

Table 13.60: Albert College Park Intervention Shaft - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Excavation – Ground Level	12	15 – 18 Hampstead Avenue	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	13	114 Ballymun Road	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Activity	**ID**	**Description**	**Night-time (23:00 – 07:00)**		**CNL**	**Night-time (23:00 – 07:00)**	
SCL	10 – 11	Hampstead Avenue	55		51 – 55	Moderate to Significant	
	12	15 – 18 Hampstead Avenue	55		55 - 60	Significant	
	13 -21	Ballymun Road (west)	55		55 - 60	Significant	
	22 - 35	Ballymun Road (North west)	55		51 – 55	Moderate to Significant	

The range of CNLs at the most exposed façades of the identified buildings in Table 13.60 are up to 5dB above the CNT resulting in a potential moderate to significant impact in the absence of noise mitigation during daytime periods. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

As discussed above, there will be additional support plant located on the development site works for SCL within the tunnel which will take place 24/7 below ground. Calculated noise levels associated with this activity has the potential for significant effects at night, unmitigated. Night-time activities will be strictly controlled through on-site mitigation measures that are detailed in Section 13.6.1 and specifically for night-time works will require all fixed items of plant to be enclosed. There may be some brief noise impact during nights where the concrete delivery take place, however this will be scheduled to occur over limited delivery periods to minimise impacts on surrounding properties. Further discussion on mitigation measures is included in Section 13.6.1.

13.5.2.6.4 Griffith Park Station

Six scenarios have been modelled relating to works associated with constructing this station from site establishment works, piling & D-wall construction, excavation above and below the slab including blasting, batching plant works and finishing works. These works will be undertaken during daytime standard working hours within the exception of batching plant which be used to support the TMB first stage concrete support which will necessitate 24/7 operation and hence will involve night-time works. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2. There may also be occasional surface activities at night during the tunnel strip and clean activities at this compound.

Thirty-two NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work is displayed in Figure 13.2 (Sheets 20 and 21). The closest NSLs to this compound are residential dwellings along St Mobhi Road to the west and Whitehall College to the east. There are two NSLs where calculated CNLs exceed the CNTs identified during the above ground excavation works in the absence of mitigation. The relevant significance of impacts at these locations are summarised in Table 13.61. At all other assessed locations, the CNLs are below the relevant CNTs for daytime and Saturday AM period (65 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest

potential for construction noise. Night-time impacts associated with the Bathing plant works are also included for residential or night-time sensitive NSLs where the CNT is exceeded. Full calculated results for this work area are included in Appendix A13.7.

Table 13.61: Griffith Park Station - Potential Daytime Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced Enabling & Utility Works, Site Preparation Works	1	Whitehall College	65	65	75 - 80	Significant to Very Significant	Significant to Very Significant
	2	Scoil Mobhi National School	65	65	66 - 70	Moderate to Significant	Moderate to Significant
Piling and D-wall	1	Whitehall College	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
	2	Scoil Mobhi National School	65	65	66 - 70	Moderate to Significant	Moderate to Significant
Excavation – Ground Level	1	Whitehall College	65	65	75 - 80	Significant to Very Significant	Significant to Very Significant
	2	Scoil Mobhi National School	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
	8	9 St Ita's Road	65	65	66 - 70	Moderate to Significant	Moderate to Significant
Excavation Underground	1	Whitehall College	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
Fit-out	1	Whitehall College	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
Batching Plant	1	Whitehall College	65	65	71 - 75	Significant to Very Significant	Significant to Very Significant
	2	Scoil Mobhi National School	65	65	66 - 70	Moderate to Significant	Moderate to Significant
Activity	**ID**	**Description**	**Night-time (23:00 – 07:00)**		**CNL**	**Night-time (23:00 – 07:00)**	
Batching Plant	7	66 R108	55		51 – 60	Significant	
	8	9 St Ita's Road	55		55 - 60	Significant	
	17 – 27	St Mohbi Rd (east)	55		51 - 62	Significant to Very Significant	

The range of CNLs at the most exposed façades of the identified buildings in Table 13.61 are up to and above 5dB above the CNT resulting in a potential moderate to significant to significant to very

significant noise impact in the absence of noise mitigation during daytime periods. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

Impacts during night-time periods range between significant to very significant in the absence of noise mitigation. As discussed above, there will be additional support plant located on the development site for the first stage concrete support within the tunnel which will take place 24/7 below ground. There may also be occasional surface activities at night during the tunnel strip and clean activities. Night-time activities will be strictly controlled through on-site mitigation measures that are detailed in Section 13.6.1 and specifically for night-time works will require all fixed items of plant to be enclosed. Further discussion on mitigation measures is included in Section 13.6.1.

13.5.2.6.5 Glasnevin Station and Rail Interchange

Construction of the Glasnevin Station and rail interchange involves a range of complex overlapping phases occurring within the overall project boundary to the north and south of the existing rail lines and to the west of the proposed station. A total of ten scenarios have been modelled which each include a number of simultaneous activities occurring within the overall site compound as advised by the design team. The base modelled scenario includes for a 3m high site hoarding along the northern and southern site boundaries. A detailed description of the construction methodology and phasing for this compound is included in Appendix A5.5.

The main site compounds required to construction the station and interchange will be undertaken during the standard daytime working hours. Possession work for GSWR & MGWR main line track alignment works will take place over various periods ranging from 3.5 hrs, Saturday night possession 6 hrs, extended disruptive possession 55/76 hrs weekend or long weekend with bank holidays respectively.

Thirty NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work is displayed in Figure 13.2 (Sheets 22 and 23). The closest NSLs to the main station compound are residential properties which bound the northern site compound at Dalcassian Downs. To the south, residential apartments along Cross Gun quay are the closest sensitive locations. There are multiple NSLs where calculated CNLs exceed the daytime and Saturday AM CNTs identified during different phases of works in the absence of mitigation. The relevant significance of impacts at these locations are summarised in Table 13.62 for standard working periods. At all other assessed locations, the construction noise levels are below the significance thresholds during the key works phases identified with highest potential for construction noise.

Full calculated results for this work area are included in Appendix A13.7.

Table 13.62: Glasnevin Station - Potential Significant Construction Noise Impacts – Daytime

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced enabling & utility works, site preparation works	2 - 11	47-64 Dalcassian Downs	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	12	65-66 Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	13 - 16	The Court Apartments, Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	22 - 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	27	3 Shandon Mill	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
North and South Station Piling Works	7 – 11	56-64 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	12	65-66 Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	13 - 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	19	15 - Prospect Road	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
South Station Piling & North – South excavation works- below ground level	11 - 12	63-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 - 16	The Court Apartments, Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant
North and South subway piling works - below ground level	8 -12	58 – 66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	16	19-36 The Court Apartments, Dalcassian	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant
South Station Piling & North – South excavation works- below ground level	11 – 12	63-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 - 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant
North and South subway piling works - below ground level	8 - 12	58 – 66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant
South Station Excavation, ramp construction and concrete works – below ground level	11 – 12	63-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
North and South subway piling works - below ground level	8 – 12	58 - 66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	66 – 70	Moderate to Significant	Moderate to Significant
South Station Excavation, ramp construction and concrete works – below ground level	2 – 12	47-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 – 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 - 23	Cross Gun Quay Apartments	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	24 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	27	3 Shandon Mill	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
South Station excavation/concrete works, MGWR west tunnel demolition & OHLE piling works	2 – 12	47-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 - 16	The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 – 23	Cross Gun Quay Apartments	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	24 - 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	27	3 Shandon Mill	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
South Station excavation/concrete works, MGWR west tunnel demolition & OHLE piling works	2 - 12	47-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	13 - 16	1-18 The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 - 23	Cross Gun Quay Apartments	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	24 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	27	3 Shandon Mill	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
North Station Excavation works, bridge slide, retaining walls, GSWR lowering/OHLE piling	6 - 8	55 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	7	56-58 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	9 - 12	59-66 Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	13 - 16	1-18 The Court Apartments, Dalcassian D	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	15	19-36 The Court Apartments, Dalcassian	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	22 – 24	Cross Gun Quay Apartments	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	25 – 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
North/South station excavation, concrete works, removal of	7 - 12	56-66 Dalcassian Downs	65	65	66 – 70	Moderate to Significant	Moderate to Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
south ramp, canal sheet piles	13	The Court Apartments, Dalcassian Downs	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	22 - 23	Cross Gun Quay Apartments	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	24 - 26	Cross Gun Quay Apartments	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	27	3 Shandon Mill	65	65	66 – 70	Moderate to Significant	Moderate to Significant
	30	Prospect Lodge	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.62 are up to or over 5dB above the CNT resulting in a potential moderate to significant or significant to very significant impacts in the absence of noise mitigation during daytime and Saturday AM periods. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

Track lowering and alignment works along the GSWR & MGWR will take place over a number of possessions which include weekend and night-time periods. Activities during night-time periods are calculated based on the typical plant items required for this phase. It should be noted, due to the complexity of this activity, the calculated noise levels are based on the available information at EIAR stage and are used to determine the likely significant effects and required noise mitigation measures through on-site control measures and further intervention measures including NI and or TRH. Additional NSLs are modelled for this scenario to the east and west of the station compound. The construction noise receiver location for this element of work is displayed in Figure 13.2 (Sheets 22 and 23).

In general, works that occur within 200m of a property that is located along the track have the potential to cause a temporary, significant impact, however, as the works progress the impacts will become less significant at that property and the impacts will follow the work progress linearly along the track.

Table 13.63: Glasnevin – Track Possession works - Potential Night-time Significant Construction Noise Impacts

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 – 07:00)	CNL	Night-time (23:00 – 07:00)
Track Alignment and Track Lowering	1 – 12	46 – 66 Dalcassian Downs	55	64 - >65	Significant to Very Significant
	13 – 16	The Court Apartments, Dalcassian Downs	55	63 - > 65	Significant to Very Significant
	21 - 26	Cross Gun Quay Apartments	55	65 - 75	Very Significant to Profound
	27 – 32	Shandon Mills	55	66 – 75	Very Significant to Profound

Activity	Receptor		CNT	Predicted Magnitude of Impact	
	ID	Description	Night-time (23:00 – 07:00)	CNL	Night-time (23:00 – 07:00)
	33 - 37	Shandon Park & Shanonn Gardens	55	60 - 65	Significant to Very Significant
	38	Coke Oven Cottages	55	65 - 70	Very Significant to Profound
	39 - 52	Claremont Crescent & Clareville Grove	55	50 - 65	Significant to Very Significant
	53 - 59	Claremont Lawns	55	65 - 75	Very Significant to Profound
	60 - 62	Claremont Lawns	55	55 - 60	Significant
	63 - 82	Dalcassian Downs (North) – Lindsay Road	55	60 - 65	Significant to Very Significant
	83 - 86	David Park	55	65 - 70	Significant to Very Significant
	89 - 91	Glengarrif Parade/Whitworth Road	55	65 - 72	Very Significant to Profound

The range of CNLs at the most exposed façades of the identified buildings indicate potential significant to profound noise impacts at impacted properties based on the CNL in isolation in the absence of noise mitigation during. The overall impact is dependent on the duration over which the CNL will occur for. Where the CNL at the above locations are exceeded for a period of ten or more days of working in any 15 consecutive days or for a total of days exceeding 40 in any six-month period then eligibility for NI or TRH will be determined in accordance with the *Transport Infrastructure Ireland (TII) Airborne and Groundborne Noise Mitigation Policy* (Appendix A14.6).

13.5.2.6.6 Mater Station

Seven scenarios have been modelled relating to works associated with constructing this mined station from advanced enabling and site establishment works, piling & D-wall construction, vent shaft construction, excavation above and below the slab including blasting and finishing works. Construction works at this compound will be undertaken during the standard daytime working hours. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Twenty-two NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work is displayed in Figure 13.2 (Sheets 24 and 25). The closest NSLs to the compound are the Mater Hospital to the north, St Joseph's Church to the south/east, and residential properties along Berkeley Road. There are 11 NSLs where calculated CNLs exceed the CNTs identified during different phases of work. The relevant significance of impacts at these locations are summarised in Table 13.64. At all other assessed locations, the construction noise levels are below the significance thresholds during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.64: Mater Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced enabling, utility works & site preparation works	1	Mater Hospital	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	2	Mater Hospital (38 Eccles St)	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	4	Mater Hospital (39 Eccles St – side gable non-sensitive)	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	5	Mater Hospital (39 - 51 Eccles St)	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	66 - 70	Significant to Very Significant	Significant to Very Significant
	7	Mater Hospital (Catherine McCauley)	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	11	St Joseph's Church	65	65	76 - 80	Significant to Very Significant	Significant to Very Significant
	18	5 - 11 Berkeley Rd	70	70	76 - 80	Moderate to Significant	Moderate to Significant
	19	12 - 17 Berkeley Rd	70	70	76 - 80	Moderate to Significant	Moderate to Significant
Mater Station Piling (South)	1	Mater Hospital	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	2	Mater Hospital (38 Eccles St)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	4	Mater Hospital (39 Eccles St – side gable non-sensitive)	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	5	Mater Hospital (39 - 51 Eccles St)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	7	Mater Hospital (Catherine McCauley)	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	11	St Joseph's Church	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	16	14 Berkeley St	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	18	5 - 11 Berkeley Rd	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
	19	12 - 17 Berkeley Rd	70	70	75 - 80	Moderate to Significant	Moderate to Significant
Mater Station Piling Works (North)	1	Mater Hospital	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
	2	Mater Hospital (38 Eccles St)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	4	Mater Hospital (39 Eccles St – side gable non-sensitive)	75	75	75 - 80	Moderate to Significant	Moderate to Significant
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	11	St Joseph's Church	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	16	14 Berkeley St	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	18	5 - 11 Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	19	12 - 17 Berkeley Rd	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
	20	19 - 22 Berkeley Rd	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
Vent Shaft Piling	1	Mater Hospital	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	19	12 - 17 Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	20	19 - 22 Berkeley Rd	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
Mater Station Excavation Works – Ground Level	1	Mater Hospital	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
	2	Mater Hospital (38 Eccles St)	70	70	75 - 80	Significant to Very Significant	Significant to Very Significant
	4	Mater Hospital (39 Eccles St –	75	75	76 - 80	Moderate to Significant	Moderate to Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
		side gable non-sensitive)					
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	7	Mater Hospital (Catherine McCauley)	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	11	St Joseph's Church	65	65	80 – 85	Very Significant to Profound	Very Significant to Profound
	16	14 Berkeley St	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	18	5 - 11 Berkeley Rd	70	70	71 - 80	Significant to Very Significant	Significant to Very Significant
	19	12 - 17 Berkeley Rd	70	70	71 - 80	Significant to Very Significant	Significant to Very Significant
	20	19 - 22 Berkeley Rd	70	70	71 - 80	Significant to Very Significant	Significant to Very Significant
	21	22a Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Mater Station Excavation – below slab	1	Mater Hospital	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	2	Mater Hospital (38 Eccles St)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	11	St Joseph's Church	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	18	5 - 11 Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	19	12 - 17 Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	20	19 - 22 Berkeley Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Finishing and Fit out works	1	Mater Hospital	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	2	Mater Hospital (38 Eccles St)	70	70	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	4	Mater Hospital (39 Eccles St – side gable non-sensitive)	75	75	71 - 80	Significant to Very Significant	Significant to Very Significant
	5	Mater Hospital (39 - 51 Eccles St)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	11	St Joseph's Church	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.64 are up to or above 5dB above the CNT resulting in a potential moderate to significant to profound impact in the absence of noise mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

O'Connell Street Station

There are two potential scenarios at O'Connell Street associated with the Construction Phase:

- Scenario A: No oversite development in place; and
- Scenario B: Dublin Central oversite development under construction.

13.5.2.6.6.1.0 Scenario A – No Oversite Development

Under this scenario, the proposed station is constructed by the proposed Project construction contractors using the same methodologies for the underground stations (i.e. using top-down construction).

Six scenarios have been modelled relating to works associated with constructing this station from site establishment works, demolition of existing structures, piling & D-wall construction, excavation above and below the roof slab including blasting and finishing works. This construction scenario assumes that the proposed Dublin Central oversite development comprising a mixture of apartments, hotels and commercial/office buildings are not constructed prior to the O'Connell Street Station. In this instance all NSLs assessed are existing building surrounding the site.

The construction works at this compound will be undertaken during the standard daytime working hours. The exception to this During the station fit out (MEP works) which will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night. A mobile gantry type crane or similar will be required for lifting equipment and materials down the access hatches/voids to the concourse, mezzanine and platform levels. Most items will be delivered on a just in time basis, but it may be necessary to arrange deliveries at night, due to local traffic restrictions.

At this location, an additional site compound is proposed along O'Rahilly Parade where the site access will also be from.

Thirty-four NSLs have been modelled in the vicinity of the O'Connell Street compound. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheet 26). There are three NSLs where calculated CNLs exceed the CNTs identified during different phases of work. The relevant significance of impacts at these locations are summarised in Table 13.65. At all other assessed locations, the construction noise levels are below the significance thresholds during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.65: O'Connell Street Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced enabling, utility works & site preparation works	27	Jurys Inn (East)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Demolition	1	Rotunda Hospital (South)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	7	Holiday Inn	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	8	Hotel Rui	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	9	19 O'Connell St	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	10	Savoy Cinema	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	11	14 O'Connell St	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	12	9 - 12 O'Connell St	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	13	1 - 8 O'Connell St	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	17	34 - 41 Henry St (rear)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	18	1 - 9 Moore St (rear)	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	20	Henry Pl (Rear)	70	70	71 - 75	Moderate to Significant	Moderate to Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	27	Jurys Inn (S)	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	29	72 Purnell St	65	65	76 - 80	Significant to Very Significant	Significant to Very Significant
Piling & D-wall	26	Jurys Inn (South)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	27	Jurys Inn (East)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
Excavation – ground level	25	Greeg Court (residential)	70	65	76 - 80	Slight to Moderate	Moderate to Significant
	26	Jurys Inn (S)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	27	Jurys Inn (E)	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
Excavation – below roof slab	27	Jurys Inn (East)	70	70	71 - 75	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.65 are up to or above 5dB above the CNT resulting in a potential moderate to significant or significant to very significant impact in the absence of noise mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

13.5.2.6.6.1.1 Scenario B – Oversite Development in Place

Under this scenario, the proposed station box will be constructed by the Dublin Central construction contractor as part of the excavation and basement phases of this development using a bottom-up construction methodology. For this scenario, additional phases of the proposed Dublin Central oversite development will be under construction at the same time as the mined station box. During the construction of the MetroLink station box, none of the oversite buildings would be occupied and hence are not assessed as NSLs. The specific noise impacts associated with this construction scenario has been assessed within the noise chapter of the EIAR prepared for the Dublin Central planning application for Site 2 (Two multi-use office and retail buildings).

The assessment had identified similar noise impacts calculated for Scenario B compared to Scenario A associated within the station box element of construction. Given construction of the MetroLink station box will be undertaken concurrent with other ground works and superstructure works associated with the proposed oversite development, the cumulative effects results in above ground works dominating the CNL. The EIAR for this proposed development includes a range of noise control measures which align with those included for the proposed Project under consideration here. The results of the assessment have confirmed the requirement for enhanced noise mitigation to reduce noise impacts. These are discussed in Section 13.6.1.2.

Tara Station

Six scenarios have been modelled relating to works associated with constructing this station from site establishment works, demolition, piling & D-wall construction, excavation above and below the slab including blasting and finishing works. The construction works at this compound will be undertaken during the standard daytime working hours. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Twenty-five NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work is displayed in Figure 13.2 (Sheet 27). The closest NSLs are residential apartments along Townsend Street to the south and the Times office building to the west. There are six NSLs where calculated CNLs exceed the CNTs identified during different phases of work. The relevant significance of impacts at these locations are summarised in Table 13.66. At all other assessed locations, the construction noise levels are below the daytime and Saturday AM CNTs (70 to 75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.66: Tara Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advanced enabling, utility works & site preparation works	15	164 Townsend St	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	16	Tara St Fire Station	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	17	Trinity Plaza Apartments	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	23	10 - 15 Tara St	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	24	Irish Times Building	75	75	81 - 85	Significant to Very Significant	Significant to Very Significant
Demolition	17	Trinity Plaza Apartments (residential)	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	24	Irish Times Building (commercial)	75	75	81 - 85	Significant to Very Significant	Significant to Very Significant
Piling & D-wall	15	164 Townsend St (commercial)	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	16	Tara St Fire Station	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	17	Trinity Plaza Apartments (residential)	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	23	10 - 15 Tara St (residential)	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	24	Irish Times Building (commercial)	75	75	76 - 80	Moderate to Significant	Moderate to Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Excavation – ground level	12	One Georges Quay	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	15	164 Townsend St	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	16	Tara St Fire Station	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	17	Trinity Plaza Apartments	75	70	76 - 80	Moderate to Significant	Significant to Very Significant
	23	10 - 15 Tara St	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	24	Irish Times Building	75	75	76 - 80	Moderate to Significant	Moderate to Significant
Excavation – below roof slab	17	Trinity Plaza Apartments	75	70	71 - 75	Slight to Moderate	Moderate to Significant
	24	Irish Times Building	75	75	76 - 80	Moderate to Significant	Moderate to Significant
Fitout	24	Irish Times Building	75	75	76 - 80	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.66 are up to or above 5dB above the CNT resulting in a potential moderate to significant or significant to very significant impact in the absence of noise mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

St Stephens Green Station

Five scenarios have been modelled relating to works associated with constructing this mined station from site establishment works, piling & D-wall construction, excavation above and below the slab including blasting and finishing works.

The construction works at this compound will be undertaken during the standard daytime working hours. The station fit out (MEP works) will be undertaken on a 27/4 basis within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Fifty-eight NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheet 28). The closest NSLs a mixture of office and commercial buildings along St Stephens Green, hotels and residential properties set back further on adjacent roads. There are five NSLs where calculated CNLs exceed the CNTs identified during different phases of work. The relevant significance of impacts at these locations are summarised in Table 13.67. At all other assessed locations, the calculated CNLs are below the daytime and Saturday AM CNTs (75dB $L_{Aeq,T}$) during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.67: St Stephens Green Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Piling & D-wall	3	44 - 45 St Stephens Green	75	75	76 - 80	Moderate to Significant	Moderate to Significant
	10	46 St Stephens Green	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	11	47 - 49 St Stephens Green	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	12	Royal Hibernian Academy	75	75	76 – 80	Moderate to Significant	Moderate to Significant
Excavation – ground level	3	44 - 45 St Stephens Green	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	10	46 St Stephens Green	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	11	47 - 49 St Stephens Green	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	12	Royal Hibernian Academy	75	75	76 – 80	Moderate to Significant	Moderate to Significant
	13	Royal Hibernian Academy	75	75	76 - 80	Moderate to Significant	Moderate to Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.67 are up to 5dB above the CNT resulting in a potential moderate to significant impacts in the absence of noise mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

Charlemont Station

Construction of the Charlemont Station involves a range of overlapping phases occurring within the overall project boundary. This construction compound is immediately adjacent to an oversite development (commercial) which is currently under construction. The oversite development will be completed and occupied during the Construction Phase of the proposed station box at Charlemont.

Six scenarios have been modelled relating to works associated with constructing this mined station from advanced enabling, utility and site preparation works, piling & D-wall construction, excavation above and below the slab including blasting and finishing works. These works will be undertaken during daytime standard working hours. This compound will also be used as a compound for the intervention tunnel to be constructed between Charlemont Station, 320m southwards, and will connect to the end of the main City Tunnel. Whilst the works in the tunnel will be fully underground (assessed in Chapter 14), a support compound will be located within the Charlemont main site compound for concreting and materials handling. This compound will be in operation on a 24/7 basis for the duration of this construction phase. During the station fit out (MEP works) which will be undertaken on a 27/4 basis

within the station. This will necessitate an element of surface activity to support these works at this location which will occur at night as discussed in Section 13.5.2.2.

Sixty-four NSLs have been modelled in the vicinity of this compound. The construction noise receiver location for this element of work are displayed in Figure 13.2 (Sheets 29 and 30). The closest NSLs are the development buildings (offices) in the oversite development immediately south, to the north the closest NSLs are residential dwellings along Dartmouth Square to the east and residential dwellings to the south along Dartmouth Road. There are multiple NSLs where calculated CNLs exceed the CNTs identified during different phases of works in the absence of mitigation. The relevant significance of impacts at these locations are summarised in Table 13.68. At all other assessed locations, the construction noise levels are below the significance thresholds during the key works phases identified with highest potential for construction noise. Full calculated results for this work area are included in Appendix A13.7.

Table 13.68: Charlemont Station - Potential Significant Construction Noise Impacts

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
Advance enabling, utility and site preparation works	21 -29	1 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	68 Dartmouth Sq	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	34 - 35	11 & 10 Cambridge Sq	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	36	7 Cambridge Sq	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	39 - 40	32 - 34 Dartmouth Rd	70	70	76 - 80	Significant to Very Significant	Significant to Very Significant
	41 - 46	26 – 31 Dartmouth Rd	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	60	2 Grand Parade	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	61	Hines Building (South - residential)	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	62	Hines Building (East residential)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
Station Piling& D-wall north	1	11 Harcourt Terrace	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	21 -29	1 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	34 - 36	11, 10 & 7 Cambridge Sq	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	60	2 Grand Parade (office)	75	75	76 - 85	Significant to Very Significant	Significant to Very Significant
	62	Hines Building (East - residential)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
Station Piling Works - South	21 – 29	1 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	68 Dartmouth Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	31	66 Dartmouth Square	65	65	71 - 75	Moderate to Significant	Moderate to Significant
	34 - 36	11, 10 & 7 Cambridge Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	37	5 Cambridge Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	39 - 46	26 - 34 Dartmouth Rd	70	70	71 - 80	Significant to Very Significant	Significant to Very Significant
	56	Dartmouth House	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	61	Hines Building (South)	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	62	Hines Building (East)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
South Station works – excavation-ground level & batching plant	1	11 Harcourt Terrace	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	21 – 29	1 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	68 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	31 - 32	66 & 64 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	34 - 37	11, 10, 7 & 5 Cambridge Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	38	3 Cambridge Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	39 - 46	26 - 34 Dartmouth Rd	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	56	Dartmouth House	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	60	2 Grand Parade	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	61	Hines Building (South)	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	62	Hines Building (East)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
South Station Works – below slab	21 – 29	1 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	30	68 Dartmouth Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	34 - 35	11 & 10 Cambridge Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	36	7 Cambridge Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	39 - 46	26 – 34 Dartmouth Road	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	60	2 Grand Parade	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	61	Hines Building (South)	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	62	Hines Building (East)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
Finishing & Fit out	21	1 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

Activity	Receptor		CNT		Predicted Magnitude of Impact		
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)	CNL	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)
	22 - 24	3 - 7 Dartmouth Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	25 - 29	9 – 17 Dartmouth Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	34	11 Cambridge Square	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant
	35	10. Cambridge Square	65	65	66 - 70	Moderate to Significant	Moderate to Significant
	39 - 45	26 – 34 Dartmouth Road	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	60	2 Grand Parade	70	70	76 - 85	Significant to Very Significant	Significant to Very Significant
	61	Hines Building (South)	70	70	71 - 75	Moderate to Significant	Moderate to Significant
	62	Hines Building (East)	65	65	71 - 80	Significant to Very Significant	Significant to Very Significant

The range of CNLs at the most exposed façades of the identified buildings in Table 13.68 are up to or above 5dB above the CNT resulting in a potential moderate to significant or significant to very significant impact in the absence of noise mitigation. Further mitigation will therefore be required at this construction compound to reduce noise impacts at these NSLs.

As discussed above, there will be additional support plant located on the development site works for SCL within the intervention tunnel which will take place 24/7 below ground. Activities above ground will include the use of a concrete pump, site loader, ventilation fans and site power and lighting. Deliveries will be limited to daytime hours only, however there will be a requirement for concrete delivery to occur at night. Night-time activities will be strictly controlled through on-site mitigation measures that are detailed in Section 13.6.1. The SCL compound at this site will housed within an acoustic enclosure and as such, night-time noise levels will be controlled through the structure design and sound insulation. There may be some brief noise impact during nights where the concrete delivery take place, however this will be scheduled to occur over limited delivery periods to minimise impacts on surrounding properties. Further discussion on mitigation measures is included in Section 13.6.1.

13.5.2.6.7 Utility Diversions and MetroLink Grid Connection Routing

Diversion works for existing utilities within individual site compounds are calculated as part of the advance enabling and utility work phases discussed in the sections above. Given the project is located in an urban environment, there are a large number of utilities required and services outside of compound boundaries located in the public road, adjacent to carriageways and in footpaths along the alignment, particularly along the R132 Swords Bypass and in Dublin City Centre that will require diversions.

Utility diversions will require excavation of the trench, loading of excavated material, trench support, utility laying and bedding, backfilling and surface reinstatement. Construction plant typically associated with utility diversion works include breakers, excavators, loaders, road pavers, and rollers, which will operate as required depending on the specific activity taking place at any one time. Noise levels associated with these activities are typically in the range of 64 to 82dB $L_{Aeq,T}$ at 10m taking account of their typical 'on-time' in a working area. Allowing for a liner working area of 50m in length for any one utility diversion activity, a total noise level of 6 items of plant with an average noise level of 76dB L_{Aeq} each at 10m has been used for purpose of calculation to account for the mobile nature of plant and equipment in any working area. Table 13.69, outlines the typical CNL associated with the proposed works for this element of the Construction Phase at increasing distances from the works. Figure xx illustrates the location of utility diversion works across the proposed Project.

Table 13.69: Indicative Utility Diversion Construction Work Noise Calculations at Varying Distances

Average Plant Noise	Predicted CNL at Stated Distance from Edge of Works (dB LAeq,T)								
	10m	15m	20m	30m	50m	75m	100m	150m	250m
Average plant noise level at varying distances from source	84	81	78	74	70	66	64	60	56

During utility diversion works, the upper CNT value of 75dB $L_{Aeq,}$ daytime is likely to be exceeded at distances of up to 30m from the works boundary in the absence of any noise mitigation. Noise mitigation will therefore be required where this activity is scheduled within 30m of NSLs along the proposed Project.

Using the same calculated noise levels for MetroLink grid connection routing which will involve similar items of plant and equipment at any one time, the following locations are identified to potentially exceed the fixed construction noise level of 75dB $L_{Aeq.}$

Table 13.70: MetroLink Grid Connection routing - Potential Significant Construction Noise Impacts

Predicted Magnitude of Impact	Location		Calculated Impact
	Description	Closest distance to works (m)	
Route B	Collinstown Lane – cluster of houses to west	15	Moderate to significant
	Collinstown Lane	25	Slight to Moderate
Route C	Naul Road – Halting Site	25	Slight to Moderate
	Swords Road - Houses, Cloghran Guest House, Airport B&B	25 – 30	Slight to Moderate
Route D	Basin Lane residential properties	10 – 20	Moderate to significant to significant to very significant
	Malahide Road – residential properties, Hilton Hotel & Kinsealy National School	15 – 30	Moderate to significant
	Posey Road – residential properties	17	Moderate to significant
	Clonshaugh Road – residential properties	10	Significant to very significant

Predicted Magnitude of Impact	Location		Calculated Impact
	Description	Closest distance to works (m)	
	Clonshaugh Road – residential properties	20 – 30	Moderate to significant
	Belcamp residential estate, Balgriffin park apts, Burnell Park Apts,	15 – 20	Moderate to significant

During ESBN routing works, the upper CNT value of 75dB $L_{Aeq,}$ daytime is likely to be exceeded at distances of up to 30m from the works boundary in the absence of any noise mitigation. Noise mitigation will therefore be required where this activity is scheduled within 20m to 30m of NSLs along the proposed Project.

13.5.2.6.8 AZ4 Construction Vibration

Construction of station boxes in AZ4 will involve piling and D-wall construction, mechanical excavation, drill and blast methods and breaking ground at surface level. Vibration from these activities in AZ4 are discussed in Chapter 14 and buildings with potential vibration effects identified hence these are not replicated here.

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

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

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 to 0.25PPV (mm/s) at distances of 10 to 50m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.49 to 0.24PPV (mm/s) at distances of 10 to 50m respectively. Whilst these measurements relate to a solid concrete slab, the range of values recorded provides some context in relation to typical ranges of vibration generated by construction breaking activity using heavy breakers.

At distances of 20m from this activity vibration magnitudes are well below those associated with any form of cosmetic damage to protected, historic and identified vulnerable buildings. Where vulnerable buildings are at distances of less than 10m from such activities, ground excavation using breakers will be restricted to either low tonne breakers (< 3 tonne) or alternative methods.

Demolition of existing structures will involve careful deconstruction using controlled techniques. During the initial site establishment phases where demolition of structures or buildings are required this will be undertaken using top-down construction or deconstruction methods resulting in low vibration magnitudes. 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.

Vibroflotation and or vibroreplacement activities used for soil compaction tend to produce higher levels of vibration, however at distances typically beyond 5m from this source, vibration levels are expected to be below 3mm/s PPV. Given the proposed site layout of the various shafts, station and portal

compound and the location of equipment within these sites, the nearest sensitive properties to this source are at distances greater than 5m from these plant items and hence vibration levels will in turn be below the criteria set for the proposed Project for building and human response to avoid significant impacts.

13.5.2.6.9 AZ4: Construction Traffic

Using the methodology discussed in Section 13.2.5.1.3, the assessment of potential construction traffic noise impacts has been undertaken using the following approach:

- Traffic noise levels have been calculated along all modelled roads over the full extent of the ERM associated with the Do Minimum and Do Something scenarios for the northern peak year, 2028 using the AADT data per fleet type for each road.
- The calculated difference between the two scenarios along all roads are below 3dB along all roads with the exception of a small number of individual roads. Roads with changes in traffic noise levels below 3dB are determined to experience a neutral, imperceptible, and short-term impact to negative, not significant, and short-term impact due to the relatively low volume of additional traffic along the road network during the Construction Phase scenario when added to existing flows.
- Along all roads with a calculated change in noise level of 3dB and above, the closest NSLs to the road edge have been identified and the daytime traffic noise level has been calculated. The magnitude of change rating and the absolute traffic noise level have been used to categorise the significance of the impact at the closest properties with reference to Table 13.14 and Table 13.22.

Table 13.71 presents the calculated change in noise level along all road sections within AZ4 where a change in noise level of 3dB or above has been calculated and base traffic noise levels are above 55dB $L_{Aeq,16hr}$ at 5m from road edge.

Table 13.71: Construction Phase Traffic Noise Impacts – AZ4

Road	Closest NSL	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at Closest NSL,. LAeq,16hr	Noise Level Category	Overall Significance Rating
Eccles Street	Mater Hospital	+4.3	Moderate	69	Medium - High	Significant
Gold Smith Street, Phibsborough	Residential properties along road	+9.8 to 11	Major	52 to 53	Negligible - Low	Slight

During the assessed peak construction year (2028), the highest potential noise impacts are calculated along Eccles Street at the Mater Compound as a result of traffic flows and traffic management measures along this road. The change in traffic noise is defined as major with traffic noise level calculated at the closest NSLs along the roads categorised as medium to high. The overall impact is determined to be negative, significant and temporary.

Along Gold Smith Street, Phibsborough a change in traffic noise is calculated to be major with traffic noise level calculated at the closest NSLs along these roads categorised as negligible to low. Overall, a negative, slight, temporary impact is calculated at the closest NSL.

Along all other roads in the full extent of the ERM study area, construction traffic noise impacts are neutral to not significant based on the peak construction month in 2028. As noted above, the construction traffic volumes used in the assessment is based on the reasonable worst case peak scenario which reflects a 'worst case month' under which the construction of multiple work sections are taking place concurrently as part of the proposed Project in AZ3 and AZ4.

A further sensitivity assessment was undertaken for each of the main site compounds in AZ4 during the AM peak period using data for the most impacted traffic road section during this period as advised by the traffic team. The results are summarised in Table 13.72. The calculated traffic noise is made at 5m from the road edge, unless otherwise indicated in the table.

Table 13.72: AM peak Construction Phase Traffic Impacts surrounding site compounds – AZ4

Compound	Road	Maximum AM Peak Construction HGV	Increase above Do Minimum Scenario, dB	Magnitude of Change (Short Term)	Calculated Road Traffic Noise at road edge/NSL, dB $L_{Aeq,1hr}$	Noise Level Category	Overall Significance Rating
Ballymun	R108 North of Site Entrance	3 HGVs (6 movements)	+0.4	Negligible	68	Medium - High	Not Significant
Collins Avenue	R108 North of Site Entrance	4 HGVs (8 movements)	+0.7	Negligible	67	Medium - High	Not Significant
Griffith Park	Griffith Park R108 North of Site Entrance	6 HGVs (12 movements)	+1.5	Minor	68	Medium - High	Not Significant
Glasnevin	Prospect Road North	5 HGVs (10 movements)	+0.4	Negligible	67	Medium - High	Not Significant
Mater	Berkley Road South	5 HGVs (5 movements one direction)	+0.4	Negligible	67	Medium - High	Not Significant
	Berkley Road North	5 HGVs (5 movements one direction)	+1.3	Minor	62	Medium	Slight
O'Connell Street	O'Connell Street North of Site Entrance	5 HGVs (12 movements)	+1.8	Minor	65	Medium	Slight
Tara Street	Tara Street	5 HGVs (5 movements one direction)	+0.2	Negligible	71	High	Not Significant
	Townsend Street	5 HGVs (5 movements one direction	+1.7	Minor	61	Medium	Slight
St Stephens Green	SSG South	3 HGVs (6 movements)	+0.2	Negligible	71	High	Not Significant
Charlemont	Grand Parade	9 HGVs (18 movements)	+1.1	Minor	65	Medium	Slight

During the assessed AM peak hour for each construction site compound within AZ4, the highest change in noise levels are all below 3dB resulting in a negligible to minor change in traffic noise level along the local roads.

The calculated noise level along the road edge, whilst categorised as medium to high will not be altered to any perceptible level as a result of construction traffic flows and hence the overall impact is not significant.

13.5.3 Operational Phase

Once operational, sources of airborne noise include the operational railway in above ground sections, operational plant and ventilation sources, maintenance activities and changes to road traffic. These sources are discussed in each assessment zone and the potential for cumulative effects at NSLs from each discussed, where relevant.

13.5.3.1 Changes in Road Traffic Noise – Project Wide

The calculation methodology and assessment criteria discussed in Section 13.2.5.2 and 13.2.6.2 has been used to assess any changes in road traffic noise along the road network. The following approach has been undertaken:

- Traffic noise levels have been calculated along the modelled roads within the ERM study area of the proposed Project;
- Noise levels have been calculated for the Do Minimum scenario for the assessed opening and design years of 2035 and 2050 for Scenarios A and B;
- Noise levels have been calculated for the Do Something scenario for the assessed operational year of 2035 and 2050 for Scenarios A and B; and
- The change in traffic noise levels between the Do Minimum and Do Something scenarios has been calculated and the associated magnitude of change defined.

For all roads assessed within full extent of the ERM study area, changes in traffic noise level less than or equal to 1dB across 99.6% of the study area, representing over 39,000 road links assessed. Reference to Table 13.20 confirms an increase of this magnitude is negligible and is not significant. There are 17 road links where traffic noise increases are between 1 to 2.3dB and the calculated traffic noise level is below 55dB $L_{Aeq,16hr}$ at a distance of 5m from the road edge. The resulting impact is not significant along these roads. There are 11 road links where traffic noise increases are of the order of 1 to 2.3dB and the calculated traffic noise level is between 56 and 72dB $L_{Aeq,16hr}$ at a distance of 5m from the road edge. The resulting impact is not significant along these roads. The remaining road links where increases in traffic noise level greater than 1dB, the absolute road traffic noise level is below 50dB $L_{Aeq,16hr}$ along the road edge and hence represents a low volume of traffic with no significant noise impact. It is concluded, therefore that no negative noise impacts are associated with changes in traffic volumes or traffic re-distribution once the proposed Project becomes operational. The results above relate to both assessment years of 2035 and 2050.

Further discussion on traffic noise changes and cumulative noise impacts with rail and other sources are discussed in Sections discussing specific impacts for AZ1 and AZ3.

13.5.3.2 Fixed Sources and Stations – Route Wide

Fixed sources of plant will be required to service the proposed stations, shafts and power systems. These are summarised briefly below.

13.5.3.2.1 High Voltage (HV) Substation

There are two HV Substations proposed for the proposed Project, one at one at Dardistown and one at North Portal. As discussed in Section 13.2.5.2.2 the noisiest components of the proposed HV substations are the 110kV transformers in the outdoor compound. An operational noise level of 40dB(A) at 5m from boundary of the substation compound has been used which is taken from the Eirgrid *Evidence Based Environmental Studies Study 8: Noise (2016)*. This noise level relates to the overall substation, encompassing the outdoor 110kV transformers and the substation structures. The substations are enclosed buildings. On this basis, operational noise level of 40dB at 5m has been used at both locations

which has been used to estimate potential noise emissions at the closest NSLs to each, discussed under AZ2 and AZ3.

13.5.3.2.2 Medium Voltage, Traction Power and Auxiliary Power Substations

MV substations will be within enclosed structures which have minimal breakout beyond the unit in modern systems. Traction power substations will be underground along the proposed Project with the exception of one surface section at Estuary, and two within an open cut at Fosterstown and Dardistown. These are discussed under sections AZ1 and AZ3.

13.5.3.2.3 Ventilation Systems

The Tunnel Ventilation System (TVS) is a key provision for both normal operation and emergencies. During the former, it ensures air renewal and prevents over-heating within the enclosed parts of the Metro line. During a fire emergency, it allows for moving and exhausting smoke, creating safe paths for evacuation. Tunnel ventilation is performed by three main elements: Ventilation shafts, Over Track Exhaust systems (OTE) and Tunnel Jet Fans. All of the above sources have the potential to emit high levels of noise to the surrounding environment if unattenuated.

Tunnel ventilation shafts are located at both ends of each underground station: AZ2: Dublin Airport and AZ4: Northwood, Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater, O'Connell Street, Tara, St Stephens Green and Charlemont. In addition to these shafts, two intermediate ventilation shafts are situated along tunnel sections between Dublin Airport Station and Dardistown Station (Chainage 7+826) and between Collins Avenue Station and Griffith Park Station (Chainage 12+793).

The OTE systems are located in underground stations and their exhaust points are placed over the trackway zone where trains stop. These are used for extraction of heat produced by the trains in normal operation and, in case of an emergency, the smoke produced by a fire.

Jet fans are located inside the tunnels and are designed to help ventilation shafts drive the air longitudinally and also to provide ventilation in enclosed sections not equipped with ventilation shafts (i.e. cut and cover sections in the north part of the line). Inside the tunnel Jet Fans are only in operation in limited occasions for temperature regulation or in case of fire and smoke regulation.

All plant associated with the above systems are housed within back of house (BOH) plant rooms below ground level within the stations and hence will not generate any measurable airborne noise emissions at ground level.

The key potential noise source relates to breakout noise from ventilation shafts and grilles at surface level. An acoustic study for the proposed ventilation strategy has been undertaken as part of the design to inform the assessment. The study notes the dominant noise source relates to the TVS during a tunnel emergency situation. This indicates at 10m from the external grille noise levels are below 55dB L_{Aeq} with this source in operation in combination with other ventilation sources. For emergency use, this value is acceptable. During day-to-day operations in the absence of the emergency fans this level would pose potential significant noise impacts particularly during night-time periods without specific attenuation.

The specific noise level from ventilation systems will be calculated as part of the further design development. Specifically, the operational noise level from each shaft and surface grill will be calculated to the nearest sensitive areas and specific attenuation designed for each system to not exceed the relevant design criteria for each location.

As part of the further design development of the station plant and ventilation systems, the background noise level at the nearest and most exposed NSLs to each fixed item of plant will be determined for day and night-time periods. This data will be used to establish the magnitude above which the operational plants items operate above in accordance with the methodology described in 13.2.5.2.4, 13.2.6.2.4. All baseline noise values will be confirmed prior to the selection and design of the operational plant items through updated baseline noise surveys.

13.5.3.2.4 Public Address (PA) Systems

The majority of station structures for the proposed Project will be fully underground. Any breakout of noise from the station areas is likely to be via the access stairwells and escalators to ground surface. At Estuary, the proposed station will be at surface level and retained cut stations are Seatown, Swords Central and Fosterstown.

The design of the PA system will follow the following requirements:

- The PA system shall be designed to minimise noise disturbance to the specific surroundings. An acoustic simulation shall be developed to check audio levels at a later stage of the design; and
- Audio levels shall be simulated to ensure correct intelligible levels and audio distribution throughout the stations.

The best practice design principles which will be employed as part of the PA system design will have full regard to minimising noise breakout from these systems to the surrounding environment. The location of the surface and retained cut stations are sufficiently separated from NSL such that noise from these systems will be substantially masked by the prevailing noise environment in the area and screened by the station buildings and retained structures.

13.5.3.3 Maintenance of Railway System

Maintenance of the railway will be required over the lifespan of the proposed Project. A detailed maintenance plan will be developed by a future operator, covering all the proposed Project assets. The following maintenance activities will be undertaken to ensure efficient and reliable services:

- On-going condition-monitoring of assets;
- Inspection and maintenance of electrical and mechanical equipment;
- Rail re-profiling, rail grinding and other heavy-duty operations using the dedicated rail-mounted, Diesel-Powered Rail Maintenance Vehicles (DPRMV);
- Preventative maintenance for other equipment including 'maintenance by replacement' whereby components are exchanged and serviced offline in a depot or factory;
- Planned periodic refurbishment and replacement of assets; and
- General housekeeping, cleaning including all public areas, pest control and weed control.

In order to minimise impacts on services, maintenance schedules will cover both day and night, with certain activities possible only at night when services have ceased, including rail line maintenance. Weekend maintenance will be undertaken in cases where more extensive maintenance work is required, that could not be achieved over a night-time period. Where rail maintenance activities are scheduled over night-time periods along above ground sections of the alignment in AZ1 and AZ3, advance notice will be provided to affected residents providing notification of the dates and durations of the planned works. The majority of the Metrolink alignment outside the tunnel where these activities will pose the highest potential impact are along the R132 and Northwood at surface and elevated and sections of the alignment which are in proximity to a limited number of NSL. Maintenance activities along the rail line within retained cut sections will be substantially screened from adjacent NSLs by the alignment depth.

13.5.3.4 AZ1: Northern Section

13.5.3.4.1 AZ1: Road Traffic Noise

The key area of assessment relates to the R132 where potential cumulative effects resulting from above ground sections of the operational the Metrolink rail line have potential to add to the ambient traffic noise level. All changes in traffic noise along this road are below 1dB during both day and night-time periods along the R132. There are potential for traffic noise changes along this road due alterations in boundary treatments as a result of the MetroLink alignment and related urban realm upgrades in AZ1. The calculated change in traffic noise levels along the R132 between Estuary and the Naul Road is presented in Table 13.73 for the daytime period for both Scenario A and B during the year 2035. Similar

magnitudes of change and noise levels are also calculated for the year 2050. The traffic noise level is calculated at a distance of 5m from the road and is unscreened.

Table 13.73: Changes in Traffic Noise Level along R132 – Scenario A and Scenario B: 2035

Road	2035 – Scenario A			2035 – Scenario B		
	Do Minimum - Daytime LAeq,16hr	Do Something - 2035 - Daytime LAeq,16hr	Difference, dB	Do Minimum - Daytime LAeq,16hr	Do Something- 2035 - Daytime LAeq,16hr	Difference, dB
R132 Lissenhall Road - North of P&R	72	71	-0.3	72	72	-0.1
R132 Lissenhall road - South of P&R	69	69	-0.1	69	69	-0.1
R132 Lissenhall Road - Ennis Lane - Estuary Roundabout	69	69	-0.5	69	69	-0.1
R132 Estuary Roundabout - Seatown Road	69	69	-0.2	69	69	-0.3
R132 Seatown Road - Seatown Road Roundabout	72	71	0.0	72	71	-0.4
R132 Seatown Roundabout - Malahide Roundabout	71	71	-0.1	72	71	-0.1
R132 Malahide Roundabout - Pavillions	70	70	0.0	70	70	0.0
R132 Pavillions - Pinnock hill roundabout	69	69	0.0	69	69	0.0
R132 Pinnock Hill - Lakeshore Drive	71	71	+0.1	70	70	0.0
R132 Lakeshore Drive - N1 Business Park	71	71	0.0	70	70	-0.1
R132 N1 Business Park - Stockhole Lane	71	71	+0.1	70	70	0.0

Referring to Table 13.73, changes in traffic noise along the R132 are negligible between the Do Minimum and Do Something scenarios for both traffic scenarios assessed. Traffic noise levels are high along this road and residential properties located east and west of the R132 experience high road traffic noise levels, as discussed in Section 13.3.1 for the baseline noise environment. In order to ensure traffic noise levels are not increased at these locations where boundary walls are to be removed to facilitate construction and operation of the alignment, equivalent structures will be required along the road or property boundary, these are summarised in Table 13.74.

Table 13.74: Boundary Treatment Design for R132 at affected NSLs

Chainage	Boundary Change	NSLs	Design Requirement
2+230 – 2+480 (west)	Existing wall to be removed	Seatown Villas, Seatown West	Equivalent wall height or noise barrier along new kerb line of R132
2+440 – 2+620 (east)	Existing wall to be removed	Estuary Court	Equivalent wall height or noise barrier along new kerb line of R132
3+300 – 3+480 (east)	Existing wall to be removed	Ashley Avenue	Equivalent wall height or noise barrier along new kerb line of R132

With the inclusion of the reinstated boundary treatments to these specific areas, road traffic noise level will remain unchanged between the Do Minimum and Do Something Scenarios.

13.5.3.4.2 AZ1: Operational Airborne Rail Noise

Using the methodology, input and source data discussed in Section 13.2.5.2.1, operational rail noise levels have been calculated at the closest NSLs to the above ground section of railway across the proposed Project. The modelled locations are presented in Figure 13.3 alongside the operational rail noise contours for day and night-time periods. The calculated rail noise level at each NSL for day and night-time periods are presented in full in Appendix A13.8.

To assess the noise impact the following criteria have been applied:

- Residential: Daytime ($L_{Aeq,16hr}$) levels ≤55dB and Night-time (L_{night}t) levels ≤45dB = Not significant;
- Commercial/Offices: Daytime ($L_{Aeq,16hr}$) levels ≤60dB = Not significant;
- For noise levels above these thresholds the degree of impact is determined based on the change in noise level relative to the baseline as per the impact and significant scale in Table 13.19; and
- The rail noise level is added to the measured baseline noise levels deemed representative of each location to calculate a cumulative noise levels. The cumulative level is compared against the baseline noise level to determine the increase in noise levels. In line with the negligible change calculated traffic noise levels along the R132 in AZ1, the measured baseline noise levels are considered to remain a valid representation of the future traffic noise level in this area.

Table 13.75 presents the impact assessment for those locations where calculated rail noise levels are above the significance thresholds above for daytime periods for NSL in AZ1.

Table 13.75: AZ1 Rail Noise significance ratings at Impacted Locations in AZ1 - Daytime

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,16hr}$					
2	Emmaus Retreat	55	56	58 (UT2)	60	+2	Slight
7	Bostik Industrial Park	60	66	64 (UT3)	68	+4	Moderate
8	Montessori	55	65	64 (UT3)	68	+4	Moderate
45	Hertz	60	63	66 (UT5)	68	+2	Slight
181	Airside Business Park	60	62	74 (UT12)	74	0	Not Significant

The assessment has determined that highest operational daytime rail noise impacts are moderate NSLs in proximity to the rail viaduct at Broadmeadow.

Further analysis of the peak daytime hour is presented in Table 13.76. The proposed peak daytime hours for the proposed Project are between 07:00 and 10:00hrs. A comparison of the calculated peak hour rail noise level has been compared with the lowest ambient baseline noise level during this period, i.e. between 09:00 and 10:00hrs, outside of peak road traffic hours.

Table 13.76: AZ1 Rail Noise Significance Ratings at Impacted Locations – Daytime Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (09:00 – 10:00hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,1hr}$				
2	Emmaus Retreat	57	58 (UT2)	60	+2	Slight
7	Bostik Industrial Park	67	64 (UT3)	69	+5	Moderate
8	Montessori	67	64 (UT3)	68	+4	Moderate
9	Balheary Rd Business Campus	61	64 (UT3)	66	+2	Slight
45	Hertz (Commercial)	64	65 (UT5)	67	+3	Slight
181	Airside Business Park	64	73 (UT12)	73	+1	Slight
209	Residential dwelling, Fosterstown South	57	61 (UT18)	62	+1	Slight

The assessment confirms a moderate daytime noise impact at NSLs in proximity to the rail viaduct along Broadmeadow at a commercial facility and at a Montessori building at upper floor levels of the building.

Table 13.77 presents the impact assessment for those locations where calculated rail noise levels are above the significance thresholds above for night-time periods. Commercial and educational locations are not included in this assessment table for night-time periods.

Table 13.77: AZ1 Rail Noise Significance Ratings at Impacted Locations – Night-time

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB LAeq,8hr					
2	Emmaus Retreat	45	49	54 (UT2)	55	+1	Slight
209	Residential dwelling, Fosterstown South	45	49	56 (UT18)	57	+1	Slight

The assessment has determined a slight night-time noise impact is calculated at the Emmaus Centre adjacent to the surface Estuary Station. A slight noise impact is determined at a residential location in Fosterstown to the east of the Metrolink alignment which runs at shallow retained cut to surface level. Further analysis of the peak night-time hour is presented in Table 13.78. The proposed peak night-time hours for the MetroLink are between 05:30 and 07:00hrs. A comparison of the calculated peak hour rail noise level has been compared with the lowest ambient baseline noise level during this period, i.e. between 05:30 and 06:30hrs.

Table 13.78: AZ1: Rail Noise Significance Ratings at Impacted Locations – Night-time Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (05:30 – 06:30hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,1hr}$				
2	Emmaus Retreat	54	53 (UT2)	57	+4	Moderate
3	R132 Farm Residential	49	53 (UT2)	54	+1	Slight
13	Newcourt Estate	48	58 (UT4)	58	0	Not Significant
16	5 Seatown West	46	58 (UT4)	58	0	Not Significant
18	77-78 Seatown Villas	48	58 (UT4)	58	0	Not Significant
20	79-82 Seatown Villas	48	57 (UT5)	57	<1	Not Significant
59	19 Chapel Lane	50	64 (UT8)	64	0	Not Significant
63	13-15 Castle Park	47	64 (UT8)	64	0	Not Significant
84	21-25 Chapel Lane	47	64 (UT8)	64	0	Not Significant
87	47-51 Ashley Avenue	46	64 (UT8)	64	0	Not Significant
183	Swords Veterinary Hospital	47	57 (UT14)	57	0	Not Significant
207	Residential dwelling, Fosterstown South	46	58 (UT18)	58	0	Not Significant
209	Residential dwelling, Fosterstown South	54	58 (UT18)	59	+1	Slight

Whilst rail noise during the calculated peak night-time hour is higher than those associated with the total 8-hour emission value, the ambient baseline noise level during this period is also high due to road traffic flows during peak hours. The assessment confirms a not significant to moderate night-time noise impact at NSLs.

Noise mitigation is recommended at the Emmaus Retreat centre at Lissenhall given the proximity of the building to the station, rail alignment and the park and ride area and the night-time peak hour predicted impacts.

13.5.3.4.3 AZ1: Estuary Compound (Park and Ride)

A Park and Ride (P&R) facility is proposed at Estuary situated to the west of the R132 Swords Bypass and north of Ennis Lane. The main vehicle access to Estuary Station for buses, taxis and cars going to the Drop off point (DOP) will be from the south via the R132 and modified Ennis Lane onto the new one-way perimeter road around the P&R. The Swords Western Distributor Road (SWDR) will be used as the main access road to the Estuary P&R Facility from the north.

Noise sources associated with the facility are associated with traffic along the internal roads and entering and leaving facility via the access points described above. Vehicle movements within the car parking areas of the building are another source, however breakout will be minimal once inside the building. Whilst noise from a car parking facility is variable, the main sources are vehicles manoeuvring and car doors opening and closing. Noise levels from busy commercial car parks are of the order of 55dB at 10m from the boundary as measured for previous applications by AWN Consulting which accounts for the normal day to day movements described above. For the purpose of this assessment, 8 sources representative of a sound pressure level of 55dB at 10m have been modelled around the building perimeter at different floor heights to calculate car parking noise breakout from the building. Substation noise is modelled at this location also representative of a sound pressure level of 55 dB(A) at 2m from the unit.

Traffic along the access and internal roads of the P&R facility have been modelled using the Scenario B 2050 traffic model outputs where highest traffic flows are forecast accessing the P&R facility. During this period, approximately 11,500 AADT (two-way flow) are forecast along the SWDR accessing the facility. Related internal traffic movements along the internal and perimeter roads are also modelled. Traffic is modelled at a speed of 50km/hr along the SWDR, north and eastern access road and 30km/hr along the internal access road to the south.

The closest NSL to the P&R facility is the residential property to the east of the proposed site access along the SWDR and south-east of the main building. The orientation of farm buildings within this landholding results in the property being screened to a large degree by the P&R facility and the access road. The Emmaus Retreat centre is located north-west of the P&R facility.

Noise levels associated with the park and ride car parking activities, traffic flow and rail sources from this area have been combined to obtain a cumulative noise level. The results at the two closest NSLs are summarised in Table 13.79.

Table 13.79: Estuary Park and Ride and Rail Sources – Operational Noise Levels

Receptor		Daytime (07:00 – 23:00hrs)				Night-time (23:00 – 07:00hrs)			
ID	Description	Baseline	Operational Sources at Estuary (rail, road, car parking)	Cumulative (baseline + operation)	Impact	Baseline	Operational Sources at Estuary (rail, road, car parking)	Cumulative (baseline + operation)	Impact
2	Emmaus Retreat	58	55	60	Slight	54	47	55	Slight
3	R132 Farm Residential	68	63	69	Slight	62	56	63	Slight

Calculated noise levels at R3, residential property to the south-east of the P&R are screened by a large extent by the farm buildings along the western and northern boundary of the landholding. The prevailing noise environment is dominated by road traffic along the R132 which will remain the dominant source

once the proposed Project becomes operational. Rail noise sources are screened by the P&R building and the contribution of car park activities to the cumulative noise level is insignificant.

At the closest NSL to the north of the P&R, rail noise is the highest contributor to noise levels from this area of the site. The combined noise sources including rail, traffic and car parking activities are all below the prevailing ambient noise level at this location, resulting in a slight overall impact.

13.5.3.5 AZ2: Airport Section

Once operational, the Metrolink will be in tunnel within this section of the proposed Project. Operational noise sources in this section relate to fixed plant items include the HV substation to the east of DANP and tunnel and station ventilation systems at Dublin Airport and an intermediate ventilation shaft along the tunnel section south of Dublin Airport Station (Chainage 7+826).

The closest NSLs to the airport station is the Our Lady Queen of Heaven Church. Ambient noise levels are high in this area and the base system ventilation design would achieve acceptable noise levels in this area, inclusive of the emergency TVS. During the detailed design, however, a noise operational noise from the station and tunnel ventilation systems will be designed in accordance with BS 4142. The ventilation shaft south of the airport is in excess of 1km from existing NSLs and will not result in any increase in background noise levels to NSLs in the vicinity.

The HV substation to the east of the DANP will include an enclosed building and external transformers. The closest NSLs are to the south of the Naul Road at distances of greater than 100m which is a daytime sensitive receptor only (creche building). Given the operational noise level from the HV compound is of the order of 40dB at 5m, it will not be audible at the nearest NSLs and the impact is not significant.

13.5.3.6 AZ3: Dardistown to Northwood

13.5.3.6.1 AZ3: Operational Airborne Rail Noise

Using the methodology, input and source data discussed in Section 13.2.5.2.1, operational rail noise levels have been calculated at the closest NSLs to the above ground section of railway across the proposed Project. The modelled locations are presented in Figure 13.3 alongside the operational rail noise contours for day and night-time periods. The calculated rail noise level at each NSL for day and night-time periods are presented in full in Appendix A13.8.

To assess the noise impact the following criteria have been applied:

- Residential: Daytime ($L_{Aeq,16hr}$) levels ≤55dB and Night-time (L_{night}) levels ≤45dB = Not significant;
- Commercial/Offices: Daytime ($L_{Aeq,16hr}$) levels ≤60dB = Not significant;
- For noise levels above these thresholds the degree of impact is determined based on the change in noise level relative to the baseline as per the impact and significant scale in Table 13.19; and
- The rail noise level is added to the measured baseline noise levels deemed representative of each location to calculate a cumulative noise levels. The cumulative level is compared against the baseline noise level to determine the increase in noise levels. In line with the negligible change calculated traffic noise levels along roads in AZ3, the measured baseline noise levels are considered to remain a valid representation of the future traffic noise level in this area.

Table 13.80 presents the impact assessment for those locations where calculated rail noise levels are above the significance thresholds above for daytime periods for NSL in AZ3.

Table 13.80: Rail Noise Significance Ratings at Impacted Locations in AZ3 - Daytime

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,16hr}$					
216	St Annes Northwood	55	63	59 (UT23)	65	+6	Significant
217	1 Charter School Hill	55	57	59 (UT23)	61	+2	Slight
218	2 Charter School Hill	55	57	59 (UT23)	61	+2	Slight
219	3 Charter School Hill	55	58	59 (UT23)	62	+3	Slight
220	Housing shelter Northwood	55	59	59 (UT23)	62	+3	Slight
221	Housing shelter Northwood	55	57	59 (UT23)	61	+2	Slight

The assessment has determined a slight to significant daytime noise impact at NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station.

Further analysis of the peak daytime hour is presented in Table 13.81. The proposed peak daytime hours for the proposed Project are between 07:00 and 10:00hrs. A comparison of the calculated peak hour rail noise level has been compared with the lowest ambient baseline noise level during this period, i.e. between 09:00 and 10:00hrs.

Table 13.81: AZ3 Rail Noise Significance Ratings at Impacted Locations – Daytime Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (09:00 – 10:00hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,1hr}$				
216	St Annes Northwood	64	60 (UT23)	65	+6	Significant
217	1 Charter School Hill	59	60 (UT23)	62	+2	Slight
218	2 Charter School Hill	59	60 (UT23)	62	+2	Slight
219	3 Charter School Hill	60	60 (UT23)	63	+3	Slight
220	Housing shelter Northwood	60	60 (UT23)	63	+3	Slight
221	Housing shelter Northwood	58	60 (UT23)	62	+2	Slight

The assessment confirms a slight to significant daytime noise impact at NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station during peak daytime hours.

Table 13.82 presents the impact assessment for those locations where calculated rail noise levels are above the significance thresholds above for night-time periods. Commercial locations are not included in this assessment table for night-time periods.

Table 13.82: AZ3 Rail Noise Significance Ratings at Impacted Locations – Night-time

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,8hr}$					
211	Collinstown Lane Cottages	45	46	60 (UT22)	60	0	Not Significant
216	St Annes Northwood	45	56	55 (UT23)	59	+4	Moderate - Significant
217	1 Charter School Hill	45	51	55 (UT23)	56	+1	Slight
218	2 Charter School Hill	45	51	55 (UT23)	56	+1	Slight
219	3 Charter School Hill	45	51	55 (UT23)	56	+1	Slight
220	Housing shelter Northwood	45	52	55 (UT23)	57	+2	Slight
221	Housing shelter Northwood	45	50	55 (UT23)	56	+1	Slight

The assessment has determined a slight to moderate/significant night-time noise impact at NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station. Further analysis of the peak night-time hour is presented in Table 13.83. The proposed peak night-time hours for the MetroLink are between 05:30 and 07:00hrs. A comparison of the calculated peak hour rail noise level has been compared with the lowest ambient baseline noise level during this period, i.e. between 05:30 and 06:30hrs.

Table 13.83: AZ3 Rail Noise Significance Ratings at Impacted Locations – Night-time Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (05:30 – 06:30hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,1hr}$				
211	Collinstown Lane Cottages	47	64 (UT22)	64	0	Not Significant
216	St Annes Northwood	61	57 (UT23)	63	+5	Significant
217	1 Charter School Hill	56	57 (UT23)	60	+2	Slight
218	2 Charter School Hill	56	57 (UT23)	60	+2	Slight

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (05:30 – 06:30hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,1hr}$				
219	3 Charter School Hill	57	57 (UT23)	60	+3	Slight
220	Housing shelter Northwood	57	57 (UT23)	60	+3	Slight
221	Housing shelter Northwood	55	57 (UT23)	59	+2	Slight

Whilst rail noise during the calculated peak night-time hour is higher than those associated with the total 8-hour emission value, the ambient baseline noise level during this period is also high due to road traffic flows. The assessment confirms a slight to significant night-time noise impact at NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station. Mitigation measures to reduce operational rail noise at the identified NSL are included in Section 13.6.2.1.

13.5.3.6.2 Dardistown Depot Noise

Using the methodology input and source data discussed in Section 13.2.5.2.2, operational noise levels associated with ongoing operations at Dardistown Depot have been calculated at the closest NSLs. The results are a combination of rail noise emissions from rail movements in and out of the depot and along the retained cut mainline section, maintenance and stabling activities within the buildings, fixed roof mounted plant, substations and train washing equipment all operating simultaneously. This represents a worst-case scenario as the activity at the Depot will vary in intensity across a typical day and night and peak hour rail movements will only occur during the busiest periods where rail fleet are connecting into and out of the Metrolink system.

The closet NSLs to the Dardistown Depot are residential properties to the north-west along Collinstown Lane (Collinstown Lane Cottages) and a residential property to the north east along the Old Airport Road. The Silloge golf club is located along the western boundary of the proposed Depot. The calculated noise levels at these NSL are summarised in Table 13.84.

Table 13.84: Dardistown Depot and AZ3 Operational Noise Levels

Receptor		Daytime (07:00 – 23:00hrs)			Night-time (23:00 – 07:00hrs)		
ID	Description	Calculated Depot Noise Level, dB $L_{Aeq,16hr}$	Baseline Noise level, dB $L_{A90,\ 16hr}$	Impact	Calculated Depot Noise Level , dB $L_{Aeq,8hr}$	Baseline Noise level, dB $L_{A90,\ 8hr}$	Impact
210	Residence – Old Airport Road	42	54	Not Significant	41	49	Not Significant
211	Collinstown Lane Cottages	46	54	Not Significant	45	49	Not Significant
212	Collinstown Lane Cottages	44	54	Not Significant	42	49	Not Significant
213	Collinstown Lane Cottages	44	54	Not Significant	43	49	Not Significant

Receptor		Daytime (07:00 – 23:00hrs)			Night-time (23:00 – 07:00hrs)		
214	Collinstown Lane Cottages	44	54	Not Significant	43	49	Not Significant
215	Silogue Golf Club – club house	49	54	Not Significant	43	49	Not Significant

The assessment results indicate operational noise levels associated with various on-site activities and sources within Dardistown Depot are below the fixed daytime noise level of 50dB $L_{Aeq,16hr}$ and 45dB, $L_{Aeq.8hr}$ during day and night-time periods respectively at the closest NSLs. The specific noise level calculated from the facility is also of the order of 5dB below the measured background noise level during day and night-time periods, indicating a long-term, negative and not significant noise impact.

13.5.3.7 AZ4: Northwood to Charlemont

Once operational, the Metrolink will be in tunnel within this section of the proposed Project. The primary operational noise sources in this section relate to station and ventilation tunnel systems.

The specific noise level from ventilation systems will be calculated as part of the further design development. Specifically, the operational noise level from each shaft and surface grill will be calculated to the nearest sensitive areas to each and specific attenuation designed for each system to not exceed the relevant design criteria for each location.

As part of the design development of the station plant and ventilation systems, the background noise level at the nearest and most exposed NSLs to each fixed item of plant will be determined for day and night-time periods. This data will be used to establish the magnitude above which the operational plants items operate above in accordance with the methodology described in 13.2.5.2.4. All baseline noise values will be confirmed prior to the selection and design of the operational plant items through updated baseline noise surveys.

13.5.3.8 Operational Vibration

Operational vibration levels associated with the proposed alignment are assessed in Chapter 14 (Groundborne Noise & Vibration).

The are no other sources associated with the Operational Phase with potential to generate significant vibration levels.

13.6 Mitigation Measures

13.6.1 Construction Phase

13.6.1.1 General

The proposed Project has, where possible, designed a construction programme to avoid and reduce environmental impacts as is best practicable. In terms of above ground noise and vibration, the construction methodology proposed at station and shaft constructions sites has an inherent mitigation measure incorporated into the design through partially enclosing excavation and construction works beneath the roof slabs. Mitigation measures set out in this Section are those additional measures which are deemed necessary to further reduce identified negative impacts.

An outline Construction Environmental Management Plan (CEMP) has been prepared and is included as Appendix A5.1. The outline CEMP is a working document and the appointed contractor(s) will be responsible for updating the outline CEMP prior to the commencement of construction, in order to incorporate any conditions imposed as part of the Railway Order (RO). This responsibility will be included in the Works Requirements of the Contract. The outline CEMP will be maintained and updated

regularly as the proposed Project progresses. In addition to the various measures detailed in the outline CEMP, the following sections outline the noise mitigation measures required across the proposed Project to control airborne noise impacts during the Construction Phase.

13.6.1.2 Noise

The main principals and standards required for noise mitigation are outlined as follows:

- The Contractor undertaking the construction of the works will be required to take specific noise abatement measures to the extent required and comply with the recommendations of BS 5228–1 (BSI 2014a);
- The selection of plant items will be required to comply and European Communities Noise Emissions by Equipment for Use Outdoors (Amendment) Regulations 2006 (S.I. No 241/2006);
- The outline CEMP will encompass a Noise and Vibration Management Plan (CNVMP) which will be formulated for the construction phase and used by all contractors based on the mitigation measures outlined in this chapter, in Chapter 14 (Groundborne Noise & Vibration) and the outline CEMP (Appendix A5.1). The CNVMP will be a live document. This will involve a detailed investigation of potential noise and vibration impacts associated with each construction compound. The assessment will identify through modelling and calculation, predicted construction noise levels, identification of potential exceedance of CNTs, identification of required noise mitigation measures specific to each work area to minimise noise and vibration impacts so far as is reasonably practicable; and
- As part of the CNVMP a baseline noise study will be undertaken prior to the commencement of construction works to characterise the prevailing noise environment at impacted NSLs. This information will be used to inform the relevant CNTs.

The key principals relating to noise mitigation will be applied across all construction areas for the proposed Project:

- Noise control at Source: Selection of quiet plant, site layout, attenuation at source, operational control (hours and periods);
- Noise Control along Pathway: Localised screening to plant items on site, enclosures, site buildings, site hoarding and noise barriers; and
- Noise Control at Receiver: Noise Insulation (NI) and Temporary Rehousing (TRH).

The impact assessment has identified that mitigation measures are required across the proposed Project to control construction noise impacts. The approach for mitigation will follow the construction noise control hierarchy as above. BS 5228–1 (BSI 2014a) includes guidance on these measures which are set out briefly in the following paragraphs.

13.6.1.2.1 Selection of Quiet Plant

- The potential for any item of plant to result in exceedance of construction noise thresholds will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever practicable (e.g. plant items with sound attenuation incorporated). Should a particular item of plant already on the site be found to exceed the construction noise thresholds, the first action will be to identify whether the item can be replaced with a quieter alternative.
- The contractor(s) will evaluate the choice of piling, excavation, breaking or other working method taking into account various ground conditions and site constraints. Where alternative lower noise generating equipment that would economically achieve, in the given ground conditions, equivalent structural/excavation/breaking results, these will be selected to control noise emissions, where deemed feasible.
- For the proposed Project, the following low noise and or noise vibration construction methodologies will be used:

- The use of non-percussive piling methodologies will be used across the proposed Project to control noise and vibration impacts from construction compounds.

- Rock breaking will be undertaken using milling equipment and peckers will be avoided in station and shaft compounds to reduce overall noise and vibration impacts.
- Blasting will be undertaken at sites where it has been demonstrated the related vibration thresholds for building damage will not be exceeded. Whilst this methodology results in high intermittent audible noise and vibration, the effects are momentary during each blast compared a more prolonged the overall process using manual rock breaking; the net result being that the overall disturbance to the community will not necessarily be reduced.

13.6.1.2.2 Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, noise control "at source" will be followed. This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise. Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:

- For static plant such as compressors, generators, motors, pumps and ventilation fans within each construction compounds the units will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation, as required to ensure CNTs are not exceeded, particularly when operational at night. Further details relating to control of temporary ventilation fans is included in Chapter 5 and the outline CEMP;
- Where practicable, equipment powered by mains electricity shall be used in preference to equipment powered by internal combustion engines or locally generated electricity;
- For mobile plant items such as dump trucks, cranes, excavators and loaders, the installation of an acoustic exhaust, utilizing an acoustic canopy to replace the normal engine cover and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB;
- Reverse alarms from mobile plant within construction compounds, will be broadband to reduce tonal elements from this source;
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover;
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum;
- Mobile and stationary plant will be switched off or throttled back to a minimum when not in use (engines, motors and generators). Lorries, trucks and concrete vehicles will not be permitted to queue outside site compounds with engines left idling. Construction vehicles in lorry holding areas will be required to switch engines off when stationary;
- For percussive tools such as pneumatic concrete breakers and tools used for utility diversion works and surface level ground breaking for compounds, 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;
- For all materials handling within compounds, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials. This is an important consideration for site compounds where materials are loaded and unloaded;
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact;
- All items of plant will be subject to regular maintenance. All vehicles and mechanical plant will be maintained in good working order for the duration of the contract. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures; and
- Noise levels associated with additional surface construction works including utility diversions and ESBN routing will be restricted to the fixed noise limits set for the proposed Project. The impact from works outside of construction site hoarding boundaries will be controlled using the best practicable means set out above and restricting significant noise and vibration generating

activities to daytime hours where possible. Localised screening of noisy plant items will also be required to sufficiently reduce noise from these works when operating at distances of up to 30m from NSLs.

13.6.1.2.3 Construction Working Hours of Work

- One of the key principals relating to control of noise impacts from construction relates to the periods and hours during which the construction works will take place. The construction working hours for the proposed Project are set out in Section 13.2.5.1.1;
- The proposed construction working hours are for the majority limited to daytime hours only Monday to Friday and Saturday morning periods. This approach assists with limiting the duration over which NSLs are exposed to construction noise impacts;
- It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the project at surface level e.g. during concrete pours, batching plants, SCL, tracklaying and MEP fit out and track lowering at the locations and compounds discussed throughout Section 13.5.2. The compounds where scheduled 24/7 work and identified likely out of hours work are set out in Section 13.2.5 and are assessed in Section 13.5.2 of this chapter;
- Activities will be scheduled in a manner that reflects the location of the site and the nature of NSLs. Construction activities/plant items will be considered with respect to their potential to exceed CNTs at NSLs and will be scheduled according to their noise level, proximity to sensitive locations and possible options for noise control; and
- For compounds and work areas where night-time activities will be required at surface level during track lowering, track laying, MEP fit out and SCL, as far as practicable, activities with highest noise emissions will be scheduled during day time periods and/or daytime shifts will set up the relevant sites for night-time periods to avoid unnecessary use of mobile plant, cranes, and material handling to occur during night-time periods.

13.6.1.2.4 Screening

Typically, screening is an effective method of reducing the noise level from construction work areas and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver. The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source. BS 5228–1 (BSI 2014a) states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice, screens constructed of materials with a mass per unit of surface area greater than 10kg/m^2 will give adequate sound insulation performance.

The use of a standard 2.4m high construction site hoarding will be used as standard around all construction compounds including linear work areas along the R132 during the construction of the above ground rail and retained cut stations. The use of enhanced construction hoarding, acoustic screening or enclosures will be required at a number of construction compounds across the proposed Project. Table 13.85 includes locations where the requirement for enhanced hoarding heights have been identified based on the assessment undertaken using the proposed construction site layouts, plant items and construction sequencing.

Prior to the commencement of the construction works at each compound, the Contractor will conduct an individual site assessment as part of the CNVMP to verify the height and position of screening to control noise impacts based on the most up to date construction methodologies and input data.

Table 13.85: Construction Site Hoarding

Location	Site Boundary	Activity	Height
R132	Construction compound at Seatown	General Site Compound	4m

Location	Site Boundary	Activity	Height
	West R125/Lissenhall Roundabout – West of R132		
R132	Estuary Court – East of R132	Cut & Cover works	4m
R132	Seatown Station – east boundary	Station Construction	4m
R132	Ashley Avenue/Grove - East of R132	Cut & Cover works	4m
R132	Lakeshore Drive - east of R132	Retained cut/Cut and Cover works	4m
R132	R125/R132 Junction - east	Retained cut/Cut and Cover works	4m
R132	Nevistown West – west and east boundaries	Retained cut/Cut and Cover works	4m
Dublin Airport Compound	West boundary	Station Construction	4m
Collins Avenue Compound	East, South and North boundaries	Station Construction	4m
Griffith Park Compound	East and Southern boundary	Station Construction	4m
Glasnevin Compound	North, south & east Boundaries	Station Construction	4m
O'Connell Street Compound	North-west boundary	Station Construction	4m
Mater Compound	Mid-east, south & south-west boundaries	Station Construction	4m
O'Connell Street Compound	North-west boundary	Station Construction	4m
Tara Street Compound	West & south boundaries	Station Construction	4m
Charlemont Compound	North boundary	Station Construction	7m
	East, west and southern boundaries	Station Construction	4m

The following locations will require an enclosed working area to reduce night-time noise impacts:

- At Northwood Portal, an enclosed structure will be constructed around the surface working area prior to the operation of the TBM. The structure will achieve a weighted sound reduction index (R_w) of 24dB with acoustic internal lining of the structure to reduce reverberant noise build up. The enclosure design will be such that openings are sited away from NSL boundaries;
- At Albert College Park, during SCL night-time support works, surface activities will be enclosed within an acoustically clad steel framed building to control airborne noise breakout to surrounding sensitive properties. The structure will achieve a minimum sound reduction index of 24dB R_w with acoustic internal lining of the structure to reduce reverberant noise build up. The enclosure design will be such that openings are sited away from NSL boundaries as far as practicable;
- At Griffith Park, during track laying first fit concrete works, the batching plant operations will be enclosed within an acoustically clad steel framed building will be used within the compound to control airborne noise breakout to surrounding sensitive properties. The structure will achieve a minimum sound reduction index of 24dB R_w with acoustic internal lining of the structure to reduce reverberant noise build up. The enclosure design will be such that openings are sited away from NSL boundaries as far as practicable;

- At Charlemont, during SCL night-time support works, surface activities will be enclosed within an acoustically clad steel framed building to control airborne noise breakout to surrounding sensitive properties. The structure will achieve a minimum sound reduction index of 24dB R_w with acoustic internal lining of the structure to reduce reverberant noise build up. The enclosure design will be such that openings are sited away from NSL boundaries as far as practicable;
- Within construction compounds, the use of temporary and mobile acoustic screens, sheds and enclosures will be required around items of plant and equipment with high noise emissions which have the potential to result in exceedance of the CNTs;
- Annex B of BS 5228–1 (BSI 2014a) (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials. These items are recommended for locations where construction activities are identified to exceed construction noise thresholds at NSLs. A well placed and designed mobile temporary screen around a breaker or excavation can effectively reduce noise emissions by 10dB(A). These will be required around plant items including handheld pneumatic breakers and breaker mounted on excavators and drill bits when operating at ground level;
- Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary; and
- Within each construction compound, the placement of site buildings such as offices and stores between the site and NSLs can assist with breaking the line of sight between source and receiver and contribute to the overall level of noise reduction from a site. A detailed review of each site compound will be undertaken as part of the CNVMP.

13.6.1.2.5 Liaison with the Public

- The Contractor will provide proactive community relations and will notify the public and vibration sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works;
- The Contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration; and
- A designated noise liaison officer will be appointed to site during construction works. All noise complaints will be logged and followed up in a prompt fashion by the liaison officer.

13.6.1.2.6 Monitoring

During the Construction Phase the contractor will be required to carry out noise and vibration monitoring at representative NSLs to evaluate and inform the requirement and/or implementation of noise and or vibration management measures.

A full monitoring and auditing programme will form part of the CNVMP which will be agreed with the Local Authorities prior to the commencement of the Construction Phase. As a minimum the monitoring programme will include an alert system for threshold exceedances, remote access and a platform for sharing monitoring results between the contractor, TII, DCC and FCC.

13.6.1.2.7 Noise Insulation, Temporary Rehousing and Temporary Relocation

Where all reasonable measures have been taken to reduce noise levels using the above-mentioned mitigation measures through source and pathway control, but residual levels are such that widespread community disturbance or interference with sleep is likely to occur, TII will consider whether the provision of further Noise Insulation (NI) or Temporary Rehousing (TRH) will be appropriate at locations where eligibility for either has been established. The document *Transport Infrastructure Ireland (TII) Airborne and Groundborne Noise Mitigation Policy* (Appendix A14.6) sets out the further mitigation measures and supports which will be available to those who meet the eligibility criteria.

As the NI option will only control internal noise levels, noise levels at external areas will remain impacted by construction noise. In addition, this option will also result in indirect impacts to residents (alternative ventilation systems or temporary relocation). On this basis, this option should only be considered where all other reasonably practicable measures have been implemented.

Temporary relocation relates to buildings where isolated floors or façades are impacted by the works and will benefit from temporary relocation of any noise sensitive activities for the duration of the phase of works. Where this option is recommended, a consultation process will be established between TII, the contractor and the building occupants/owners.

The CNVMP will set out a detailed analysis of each construction compound relating to noise levels, durations and number of properties impacted and the planned approach for managing same. It is re-iterated again that prior to any construction work commencing on any of the main work sites a detailed acoustic impact assessment will be undertaken which will involve a baseline noise study, model of the contractors final site layout, plant and equipment models, numbers and on-site location and the inclusion of all available on-site noise control measures.

13.6.1.3 Construction Traffic

Mitigation measures to reduce noise from construction traffic are limited to restricting speed limits, maintaining road surfaces and ensuring all vehicles are properly maintained. In addition, any coverings on construction vehicles will be securely fastened before leaving site to avoid excessive 'rattling'.

13.6.1.4 Construction Vibration

Chapter 14 includes the specific control measures across the proposed Project to control vibration sources with potential to result in disturbance to building occupants or building damage.

13.6.2 Operational Phase

13.6.2.1 Rail and Road Noise Sources

Two areas have been identified that require noise mitigation to reduce airborne rail noise, at Lissenhall and east and west of the viaduct south of the M50 Motorway. The following mitigation measures will be included to reduce airborne noise at the identified NSLs in these areas:

Estuary: A 2m high barrier will be installed north-east of the Emmaus Retreat centre along the boundary of the realigned Ennis lane between Chainage 1+150 and 1+480.

The barriers will provide noise screening from rail activities in addition to road traffic and vehicle activity from the park and ride facility. The barrier is illustrated in the General Arrangement drawing for Estuary in the RO Drawing Packs.

Northwood: A noise barrier will be installed along the east of rail embankment south of the M50 Motorway between chainage 9+770 to 9+900. The barrier will be constructed along the rail edge at the top of the embankment.

A barrier will be installed along the west of rail embankment south of the M50 Motorway between chainage 9+800 to 9+940. The barrier will be constructed from the ground level at base of embankment to achieve a height of 1.8m above the rail level.

A barrier will be installed along the west of rail embankment south of the M50 Motorway between chainage 9+970 to 9+980. The barrier will be constructed from the ground level at base of embankment to achieve a height of 1.8m above the rail level.

The barrier is illustrated in the General Arrangement drawing for Estuary in the RO Drawings pack.

The range of allowable noise levels from each fixed source set will ensure that any impact will not be significant. The best practice measures outlined below will be considered during the detailed design.

13.6.2.2 Railway Maintenance

Where rail maintenance activities are scheduled over night-time periods along above ground sections of the alignment in AZ1 and AZ3, advance notice will be provided to affected residents providing notification of the dates and durations of the planned works.

13.6.2.3 Ventilation Systems

The following options will be considered when selecting suitable mitigation for tunnel ventilation systems (in order of priority):

- Selection of low noise rated equipment;
- Reduction of induct flow rates;
- Reduction of elements in the airflow;
- In duct attenuators;
- Orientation of grilles and louvres away from sensitive receptors;
- Acoustic louvres; and
- Anti-vibration mountings and couplings will be incorporated into the design to control vibration.

13.6.2.4 Public Address Systems

The majority of station structures for the proposed Project will be fully underground. Any breakout of noise from the station areas is likely to be via the access stairwells and escalators to ground surface. At estuary, the proposed station will be at ground level.

The following options will be considered when selecting suitable mitigation for station public address systems:

- Minimising the operational period of the system;
- Careful selection and location of speakers;
- Speaker zoning, so that announcements are made to the required location only;
- Reducing broadcast levels;
- Installation ambient noise sensing equipment;
- Staff training to ensure correct microphone usage;
- Centralised recording of announcements (to control output levels); and
- Screening of speakers using station features.

13.7 Residual Impacts

The residual impacts are those which take account of the proposed mitigation measures. These are discussed in the following sections.

13.7.1 Construction Phase

13.7.1.1 Construction Noise

Construction Phase noise models have been updated to include for localised screening and enhanced hoarding around construction site boundaries. The measures included in the mitigated scenarios are those which are deemed practicable and can be defined as part of this assessment.

For construction compounds where construction noise levels were calculated above the CNTs, the following on-site mitigation measures were included:

- Localised screening has applied to surface level breakers and drills; and
- Enclosures to compressors, generators, pumps, motors and ventilation fans.

It is noted, the mitigated modelled do not take account of other various measures set out in BS 5228-1 (BSI 2009 +A1 2014a) and summarised in Section 13.6.1.2 including selection of quieter plant, control of

noise at source and ongoing day to day best practice mitigation measures which control overall noise emissions from construction sites.

Where the application of the listed on-site mitigation resulted in residual significant impacts, models were calculated to include enhanced site hoarding as per Table 13.85. Using this approach, the residual noise level across a large number of construction site compounds are suitably reduced to below the CNTs.

Construction compounds with residual noise levels above the CNTs are discussed in the following sections. The full set of calculated residual construction noise levels inclusive of mitigation is included in Appendix A13.7.

13.7.1.1.1 AZ1: Northern Section

Residual construction noise levels at the various site compounds across AZ1 can be controlled to within the relevant CNTs through the use of site mitigation and enhanced hoarding. In this section, compounds with residual construction CNLs calculated to remain above the CNTs are discussed. The residual noise levels presented here are indicative as they are based on practicable control measures within site compounds. These CNLs will be confirmed as part of the detailed construction design and acoustic modelling which will be undertaken as part of the CNVMP.

Seatown Station

The range of residual CNLs at the most exposed façade of the Hertz service centre are calculated to exceed the CNT by greater than 5dB and hence a significant to very significant, short-term effect is identified. The calculated CNL is also above the typical fixed upper noise limit of 75dB $L_{Aeq,T}$.

Impacts at this building relate to the upper floor of the western façade. Consultation will be undertaken between TII, the contractor and the building occupants where eligibility has been established for further intervention measures in line with the TII Airborne and Groundborne Noise Mitigation Policy.

Cut and Cover and Retained Cut Works

During cut and cover, retained cut works and associated support compounds along the R132, a number of NSL are identified to remain above the CNT with the inclusion of on-site control measures and enhanced hoarding heights. The duration of works at any NSL is expected to exceed the duration for significant effects during this phase of works. The identified NSLs along this section of work are described in Table 13.86.

Table 13.86: Above Ground Rail Cut and Cover and Retained Cut Sections

Activity	Receptor		CNT		Further Control Measures	Residual Effect
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)		
Cut and Cover/Retained Cut Construction – Linear sequential works	20	77-78 Seatown Villas	75	75	Application of TII Airborne and Groundborne Noise Mitigation Policy where eligibility has been established	Impacts reduced to moderate
	34	7-8 Estuary Court	75	75		
	35	9 Estuary Court	75	75		
	36	10 Estuary Court	75	75		

Activity	Receptor		CNT		Further Control Measures	Residual Effect
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)		
	84	21-25 Chapel Lane	70	70		
	87	47-51 Ashley Avenue	70	70		
	91	28-38 Ashley Avenue	75	75		
	92	40-50 Ashley Avenue	75	75		
	93	52-58 Ashley Avenue	75	75		
	181	Airside Business Park (Lakeshore Drive)	75	75	Significant to Very Significant - temporary relocation of west facades of upper floor recommended	Residual temporary to short term effects
	182	Travelodge	75	75	Moderate to Significant	Moderate to Significant

Where eligibility of the TII Airborne and Groundborne Noise Mitigation Policy has been established following noise mitigation at source and pathway, residual impacts are determined to be moderate. At the Lakeshore Drive office building consultation will be undertaken between TII, the contractor and the building occupants/owner relating to potential relocation of any noise sensitive activities to alternative locations within the building for the duration of the impacted phase where eligibility of the TII Airborne and Groundborne Noise Mitigation Policy has been established.

Track Laying Activities for Overground Rail

During tracklaying activities, impacts will be brief at any one location due to the progression rate of approximately 100m per day or night. With the inclusion of enhanced site hoarding along the R132 and the use of best practice control measures, the overall range of impacts will be moderate at any one NSL. In line the construction noise and control mitigation approach, advance notice of these scheduled works will be communicated to NSLs.

13.7.1.1.2 AZ2: Airport Section

Residual noise levels calculated at the construction compounds in AZ2 are summarised in Appendix A13.7. At all NSLs, construction noise impacts are all below the NI thresholds. Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit at all NSLs, with the exception of the following locations:

- Dublin Airport: A moderate to significant impact is calculated at the airport church at during piling and excavation phases. All CNLs are below 75dB $L_{Aeq,T}$ at this location.

13.7.1.1.3 AZ3: Dardistown to Northwood Section

Residual noise levels calculated at the construction compounds in AZ3 are summarised in Appendix A13.7. Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit at all NSLs with the exception of the following locations:

- M50 Viaduct: a moderate to significant impact is calculated during the embankment construction at one location; and
- At Northwood portal, an acoustic enclosure will be installed prior to the commencement of 24/7 works at this site for TMB support and 24/7 batching plant works. With a suitably designed enclosure in place, night-time impacts will be controlled to operate at or below the CNTs.

13.7.1.1.4 AZ4: Northwood to Charlemont

Residual noise levels calculated at the construction compounds in AZ4 are summarised in Appendix A13.7. Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit of 75dB $L_{Aeq,T}$ at all NSLs with the exception of a small number of individual locations. The residual noise impacts are summarised below:

- Ballymun: Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit of 75dB $L_{Aeq,T}$ at all NSLs.
- Collins Avenue: Moderate to significant impact at the adjacent church during piling works. This impact only occurs if the church is occupied. The standard working daytime hours are planned for this compound with no evening or Sunday construction activities.
- At Albert College Park, there is potential for brief periods of noise levels above the night-time CNT, however these will be controlled through scheduling of works and suitable noise mitigation. It is not expected that ongoing night-works would trigger significant effects due to the nature of intermittent activities likely at this compound at night. Where night-time activities are continual and will result in exceedance of the CNT for periods exceeding of ten or more days of working in any 15 consecutive days or for a total of days exceeding 40 in any six-month period, then the compound will require an enclosure.
- At Griffith Park, an acoustic enclosure will be installed prior to the commencement of 24/7 batching plant works. With a suitably designed enclosure in place, night-time impacts will be controlled to operate at or below the CNTs.
- O'Connell Street: Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit of 75dB $L_{Aeq,T}$ at all NSLs.
- Tara Street: The residual significant noise impacts at the Tara Station are calculated along the east facades of the Irish Times Building (Offices). Calculated noise levels exceed the 75dB $L_{Aeq,T}$ daytime threshold for the majority of the work phases at this site. Given the proximity of the building and the range of calculated levels exceeding the upper fixed noise limit for the majority of the Construction Phase, application of TII Airborne and Groundborne Noise Mitigation Policy will be implemented where eligibility has been established.
- SSG: Residual noise levels are calculated to be controlled to below the CNT and/or below the upper construction limit of 75dB $L_{Aeq,T}$ at all NSLs.

Glasnevin Station and Rail Interchange

With the inclusion of enhanced hoarding and at source noise control measures, noise levels at NSL are controlled below the CNT at the majority of NSL. The following residual significant noise impacts at Glasnevin Station and Rail Interchange are summarised below.

Table 13.87: Glasnevin Station – Residual Significant Construction Noise Impacts - Daytime

Activity	Receptor		CNT		Further Control Measures		Residual Effect
	ID	Description	Weekday Day (07:00 - 19:00)	Weekday Day (07:00 - 19:00)			
All activities	13 - 15	1-18 The Court Apartments, Dalcassian Downs	65	65	Application of TII Airborne and Groundborne Noise Mitigation Policy where eligibility has been established		Impacts reduced to moderate
	16	19-36 The Court Apartments, Dalcassian Downs	65	65			
North and South Station Piling Works, North and South station excavation - ground level and lower ground level & piling works	22-26	Cross Gun Quay Apartments	65	65	Significant to Very Significant	Significant to Very Significant	CNTs below the upper CNL of 75dB LAeq,T and below NI trigger value

Where residual construction noise levels at The Court Apartments, Dalcassian Downs remain above the NI or TRH trigger values, application of TII Airborne and Groundborne Noise Mitigation Policy will be implemented where eligibility has been established.

Residual significant effects at Glasnevin station relate to Cross Gun Quay apartments during the phases identified in Table 13.87. The calculated noise level at these NSL facades do not exceed the NI trigger thresholds for daytime, but will result in a negative, short-term, significant to very significant noise impact. This is based on the mitigation measures assumed for this site. These NSLs will be given further consideration, where the application of TII Airborne and Groundborne Noise Mitigation Policy will be implemented where eligibility has been established.

The range of construction noise levels for the majority of other adjacent locations are at or below 70dB $L_{Aeq,T}$ which are in line with fixed limit values applied to other major construction projects in suburban and rural areas.

Track lowering and alignment works along the GSWR & MGWR will take place over a number of possessions which include weekend and night-time periods. With the inclusion of all best practice control measures at this site, the following NSLs have the potential to trigger the requirement for NI or TRH depending on the duration of the effect at each NSL. In general, works that occur within 200m of a property that is located along the track have the potential to cause a temporary, significant impact, however, as the works progress the impacts will become less significant at that property and the impacts will follow the work progress linearly along the track. Based on the track lowering and track works programme it is likely the significance durations will be exceeded at these properties for night-time works.

Mitigation measures are limited for these works due to the non-static nature of the sites and the plant involved. Works should be scheduled so that, where practicable, works with highest noise emissions undertaken close to residential properties are scheduled to occur during daytime working hours.

The range of residual CNLs at the most exposed façades of the identified buildings indicate significant to very profound noise impacts at impacted properties based on the CNL with noise mitigation during track lowering and track grading works. The overall impact is dependent on the duration over which the CNL will occur for. Where residual construction noise levels at these locations remain above the NI or TRH trigger values, application of TII Airborne and Groundborne Noise Mitigation Policy will be implemented where eligibility has been established.

Table 13.88: Glasnevin – Track Possession works - Potential Residual Night-time Significant Construction Noise Impacts

Activity	Receptor		CNT	Further Control Measures	Residual Effect
	ID	Description	Night-time (23:00 – 07:00)		
Track Alignment and Track Lowering	1 – 3	46 – 66 Dalcassian Downs	55	Application of TII Airborne and Groundborne Noise Mitigation Policy where eligibility has been established	Impacts reduced to moderate
	3 - 9	Dalcassian Downs	55		
	13	The Court Apartments	55		
	21 - 26	Cross Gun Quay Apartments	55		
	27 – 33	Shandon Mills	55		
	34 - 37	Shandon Park & Shandon Gardens	55		
	38	Coke Oven Cottages	55		
	39 - 52	Claremont Crescent & Clareville Grove	55		
	53 - 59	Claremont Lawns	55		
	60 - 62	Claremont Lawns	55		
	63 - 82	Dalcassian Downs (North) – Lindsay Road	55		
	83 - 86	David Park	55		
	89 - 92	Glengarrif Parade/Whitworth Road	55		

Mater Station

The residual significant noise impacts at the Mater Station and Shaft are summarised below. At all other locations, CNLs are calculated to be controlled to within the CNTs.

Table 13.89: Mater Station - Residual Significant Construction Noise Impacts

Activity	Receptor		CNT		Further Control Measures	Residual Effect
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)		
Advanced enabling, utility works & site preparation works	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
	11	St Joseph's Church	65	65		
Mater Station Piling (South)	5	Mater Hospital (39 - 51 Eccles St)	70	70	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65		
	11	St Joseph's Church	65	65		
Mater Station Piling Works (North)	1	Mater Hospital	70	70	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65		
	11	St Joseph's Church	65	65		
	19	12 - 17 Berkeley Rd	70	70		
	20	19 - 22 Berkeley Rd	70	70		
Vent Shaft Piling	20	19 - 22 Berkeley Rd	70	70	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
Mate Station Excavation Works – Ground Level	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
	11	St Joseph's Church	65	65		
Mater Station Excavation – below slab	6	Mater Hospital (39 - 51 Eccles St Rear)	65	65	NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.	Impacts reduced to moderate
	11	St Joseph's Church	65	65		

Construction noise levels at the rear of the 39 – 51 Eccles Street (Mater Hospital) are calculated to exceed the NI trigger value for a number of phases associated with this construction compound and a very significant residual effect is determined without further mitigation intervention. In this instance, NI is proposed the rear facades of this building in accordance with the TII Airborne and Groundborne Noise Mitigation Policy. The residual effects are determined to be negative, moderate and short-term.

Construction noise levels at the upper floors of the main Mater Hospital are calculated to exceed the NI trigger value for one phase when piling/D-wall activities are occurring for the north section of the station box. In this instance, NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.

Construction noise levels at 12 to 22 Berkeley Road are calculated to exceed the NI trigger value for one phase when piling for the intervention shaft is taking place in the immediate vicinity of these properties. Given the proximity of these properties to the station works, the provision of NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy to the front façade of these properties.

Residual significant effects at the Mater Station are calculated at St Joseph's Church. Consultations between the contractor, TII and church management will be established to work around time periods when the church is in use to reduce high level activity within the site, where feasible. Further control measures will be established as part of the TII Airborne and Groundborne Noise Mitigation Policy.

At all other locations construction noise impacts are not significant to moderate to significant. Given the significance thresholds at NSLs in the vicinity of this compound are set at the lowest category (Category A), the range of construction noise levels for the majority of locations are at or below 75dB $L_{Aeq,T}$ which are in line with fixed limit values applied to other major construction projects in urban areas.

Charlemont Station

The residual significant noise impacts at Charlemont Station are summarised below.

Table 13.90: Charlemont Station – Residual Significant Construction Noise Impacts

Activity	Receptor		CNT		Further Control Measures	Residual Effects
	ID	Description	Weekday Day (07:00 - 19:00)	Saturday Morning (07:00 - 13:00)		
All activities	34 - 35	10 -11 Cambridge Square	65	65	Application of TII Airborne and Groundborne Noise Mitigation Policy where eligibility has been established	Impacts reduced to moderate
	60	2 Grand Parade	75	75		
	61	Hines Building South	70	70		
	62	Hines Building (East)	70	70		

Construction noise levels at No.s 10 to 11 Cambridge Square are calculated to exceed the NI trigger value for a number of phases associated with this construction compound and a very significant residual effect is determined without further mitigation intervention. In this instance, NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy. The residual effects are determined to be negative, moderate and short-term.

Construction noise levels along the rear (south) façade of 2 Grand Parade exceed the 75dB $L_{Aeq,T}$ daytime threshold by a moderate to significant margin for the majority of the work phases at this site. Given the proximity of the building and the range of calculated levels exceeding the upper fixed noise limit for the majority of the Construction Phase, NI or temporary relocation is proposed in accordance with the TII Airborne and Groundborne Noise Mitigation Policy.

Construction noise levels along the south and east façade of the Hines building (over site development) exceed the NI threshold for all work phases at this site. Given the proximity of the building and the range of calculated levels exceeding the upper fixed noise limit for all of the Construction Phase, a review of control measures to the façade of the building will be undertaken in consultation with TII, the building owners/tenants and the contractor. The sound insulation performance of this building façade will be established as part of the specific impact assessment at this building. This will include a review of the acoustic performance of the glazing system installed and the ventilation system used for the building. The acoustic rating of glazing to modern commercial buildings are typically high due to the combined requirement for energy rating and sound control and commonly incorporate mechanical ventilation systems thus avoiding the requirement for passive ventilation. These factors will reduce the ultimate noise impact within the building itself. Where required, NI will be provided in accordance with the TII Airborne and Groundborne Noise Mitigation Policy where eligibility has been established.

At all other locations construction noise impacts are not significant to moderate to significant. Given the significance thresholds at NSLs in the vicinity of this compound are set at the lowest category (Category A), the range of construction noise levels for the majority of locations are at or below 70dB $L_{Aeq,T}$ which are in line with fixed limit values applied to other major construction projects in suburban and rural areas.

13.7.2 Operational Phase

13.7.2.1 Rail Noise

Table 13.91 presents the residual assessment for those locations where calculated rail noise levels were calculated above the significance thresholds for daytime periods across AZ1 and AZ3. Residual rail noise levels are presented in Appendix A13.8.

Table 13.91: Residual Rail Noise significance ratings at Impacted Locations - Daytime

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,16hr}$					
2	Emmaus Retreat	55	54	58 (UT2)	59	+1	Slight
7	Bostik Industrial Park	60	66	64 (UT3)	68	+4	Moderate
8	Montessori, Balheary business park	55	65	64 (UT3)	68	+4	Moderate
45	Hertz	60	63	66 (UT5)	68	+2	Slight
181	Airside Business Park	60	62	74 (UT12)	74	0	Not Significant
216	St Annes Northwood	55	54	59 (UT23)	60	+1	Slight
217	1 Charter School Hill	55	50	59 (UT23)	60	+1	Not Significant
218	2 Charter School Hill	55	49	59 (UT23)	59	0	Not Significant

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,16hr}$					
219	3 Charter School Hill	55	50	59 (UT23)	60	+1	Slight
220	Housing shelter Northwood	55	49	59 (UT23)	59	0	Not Significant
221	Housing shelter Northwood	55	48	59 (UT23)	59	0	Not Significant

The assessment indicates rail noise impacts are reduced to negative, slight and long term at the Emmaus retreat centre during daytime periods. A negative, moderate and long-term impact is calculated at an industrial / commercial building to the west of the Broadmeadow viaduct.

A negative, moderate and long-term impact is calculated at a Montessori building at Balheary at the upper floor of the building along a corridor area. At ground floor level where classrooms and external play areas are located, a residual long term slight noise impact is calculated.

A negative, slight and long term to negative, moderate and long-term impact is calculated at a small number of commercial buildings.

At NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station during daytime periods, a negative, not significant and long-term to negative, slight and long-term impact is calculated.

A comparison of the calculated residual peak hour rail noise level has been compared with the lowest ambient baseline noise level during this period, i.e. between 09:00 and 10:00hrs.

Table 13.92: Residual Rail Noise significance ratings at Impacted Locations – Daytime Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (09:00 – 10:00hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,1hr}$				
2	Emmaus Retreat	55	58 (UT2)	60	+2	Slight
7	Bostik Industrial Park	67	64 (UT3)	69	+5	Moderate
8	Montessori	67	64 (UT3)	69	+5	Moderate
9	Balheary Rd Business Campus	61	64 (UT3)	66	+2	Slight
45	Hertz	64	65 (UT5)	67	+3	Slight
181	Airside Business Park	64	73 (UT12)	74	+1	Slight
209	Residential dwelling, Fosterstown South	57	61 (UT18)	62	+1	Slight
216	St Annes Northwood	56	60 (UT23)	61	+2	Slight
217	1 Charter School Hill	52	60 (UT23)	60	+1	Slight

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (09:00 – 10:00hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Daytime, dB $L_{Aeq,1hr}$				
218	2 Charter School Hill	51	60 (UT23)	60	1	Slight
219	3 Charter School Hill	51	60 (UT23)	60	1	Slight
220	Housing shelter Northwood	51	60 (UT23)	60	1	Slight
221	Housing shelter Northwood	50	60 (UT23)	60	0	Not Significant

The assessment indicates a residual, negative and slight impact is calculated during the daytime peak hour at the Emmaus Retreat Centre at Estuary.

A negative, moderate impact is calculated during the daytime peak hour at a Montessori building at Balheary at the upper floor of the building. At ground floor level where classrooms and external play areas are located, a residual slight noise impact is calculated during this peak hour.

At NSLs in proximity to the rail viaduct between the M50 Viaduct and Northwood Station, a not significant to slight impact is calculated for the daytime peak hour.

A residual negative, slight to moderate impact is calculated at a small number of commercial buildings during the daytime peak hour.

Table 13.93 presents the residual night-time rail noise impact assessment for locations calculated above the rail noise thresholds.

Table 13.93: Residual Rail Noise significance ratings at Impacted Locations – Night-time

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,8hr}$					
2	Emmaus Retreat	45	47	54 (UT2)	55	<1	Not Significant
209	Residential dwelling, Fosterstown South	45	49	56 (UT18)	57	<1	Not Significant
211	Collinstown Lane Cottages	45	46	60 (UT22	60	0	Not Significant
216	St Annes Northwood	45	48	55 (UT23)	56	<1	Not Significant
217	1 Charter School Hill	45	43	55 (UT23)	55	0	Not Significant
218	2 Charter School Hill	45	43	55 (UT23)	55	0	Not Significant

Receptor		Rail Noise Threshold	Calculated Rail Noise Level	Measured Baseline Noise Level (Reference location)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,8hr}$					
219	3 Charter School Hill	45	43	55 (UT23)	55	0	Not Significant
220	Housing shelter Northwood	45	43	55 (UT23)	55	0	Not Significant
221	Housing shelter Northwood	45	41	55 (UT23)	55	0	Not Significant

The assessment has determined a negative, not significant and long-term night-time noise impact is calculated at the Emmaus Centre adjacent to the surface Estuary Station at a residential dwelling at Fosterstown South, at Collinstown Lane Cottages and at NSLs adjacent to the rail embankment south of the M50 Motorway.

Further analysis of the residual peak night-time hour is presented in Table 13.94.

Table 13.94: Rail Noise significance ratings at Impacted Locations – Night-time Peak Hour

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (05:30 – 06:30hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,1hr}$				
2	Emmaus Retreat	52	53 (UT2)	56	+3	Slight
3	R132 Farm Residential	49	53 (UT2)	54	+1	Slight
13	Newcourt Estate	48	58 (UT4)	58	0	Not Significant
16	5 Seatown West	46	58 (UT4)	58	0	Not Significant
18	77-78 Seatown Villas	48	58 (UT4)	58	0	Not Significant
20	79-82 Seatown Villas	48	57 (UT5)	57	<1	Not Significant
59	19 Chapel Lane	50	64 (UT8)	64	0	Not Significant
63	13-15 Castle Park	47	64 (UT8)	64	0	Not Significant
84	21-25 Chapel Lane	47	64 (UT8)	64	0	Not Significant
87	47-51 Ashley Avenue	46	64 (UT8)	64	0	Not Significant
183	Swords Veterinary Hospital	47	57 (UT14)	57	0	Not Significant

Receptor		Calculated Peak Rail Noise Level	Measured Baseline Noise Level (05:30 – 06:30hrs)	Cumulative Noise Level	Increase above Baseline	Significance rating of noise change from baseline
ID	Description	Night-time, dB $L_{Aeq,1hr}$				
207	Residential dwelling, Fosterstown South	46	58 (UT18)	58	0	Not Significant
209	Residential dwelling, Fosterstown South	54	58 (UT18)	59	+1	Slight
211	Collinstown Lane Cottages	47	64 (UT22)	64	0	Not Significant
216	St Annes Northwood	53	57 (UT23)	59	+1	Slight
217	1 Charter School Hill	49	57 (UT23)	58	<1	Not Significant
218	2 Charter School Hill	48	57 (UT23)	58	0	Not Significant
219	3 Charter School Hill	48	57 (UT23)	58	0	Not Significant
220	Housing shelter Northwood	48	57 (UT23)	58	0	Not Significant
221	Housing shelter Northwood	47	57 (UT23)	58	0	Not Significant

The assessment indicates rail noise impacts are negative, not significant and long term to negative, slight and long term during the night-time peak hour at at NSLs in proximity to Estuary, along the R132 and along the rail viaduct between the M50 Viaduct and Northwood Station.

13.7.2.2 Commentary on Rail Noise Levels against WHO (2018) Guidance

The section of railway associated with the proposed Project with potential for airborne noise emissions is AZ1 which runs along the R132 Road and in AZ3 along a small section between Dardistown and Northwood. Road traffic noise dominates the prevailing noise environment in both these zones with aircraft noise an additional contributor. The WHO 2018 noise guidelines do not provide guidance for assessing the cumulative effects of a source into an existing noise environment.

In terms of potential health effects discussed in the WHO 2018 document, the potential for occupants of buildings to be sleep disturbed due to a source is of greatest risk in terms of health compared to the other indicators (potential for being highly annoyed (HA)) and hence the calculated rail night-time noise levels are commented on here.

The residual impact assessment results discussed in Section 13.7.2.1 and presented in full in Appendix A13.8 indicate that 4 NSLs with night-time sensitivity (Residences, Emmaus Retreat,) exceed the WHO night-time recommended rail noise threshold of 44dB $L_{night.}$ The calculated noise levels range between 46 and 49dB L_{night} at these locations. Those above 45dB L_{night} are discussed in Table 13.93 and confirm that when added to the prevailing ambient noise environment, the impact is slight. The calculated rail noise levels across the proposed Project are therefore not significant in terms of any widespread community disturbance and results in a not significant to slight impact when added to the prevailing noise environment.

13.7.2.3 Dardistown Depot

Residual noise impacts at the closest NSLs to the Dardistown Depot are negative, not significant and long term.

13.7.2.4 Fixed Noise Sources

The range of operational noise levels from each fixed source will be controlled in accordance with best practice guidance to control significant noise impacts. The residual impacts are negative, slight and long term.

13.8 Difficulties Encountered

No difficulties were encountered during the planning of this phase.

13.9 Glossary

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Construction Compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (i.e. engineering, planning and construction delivery) and for office-based construction personnel. The main construction compounds will include: offices and welfare facilities, workshops and stores, and storage and laydown areas for materials and equipment (e.g. aggregate, structural steel, and steel reinforcement).
Cut and Cover	Cut and cover construction involves using excavation equipment to dig a large trench or rectangular hole in the ground which is then covered by a concrete roof slab. Once the slab is in place, surface activity can largely resume as construction works continue below.
Diaphragm walls or 'D-walls'	Underground structural elements commonly used as retention systems and permanent foundation walls. Similar to secant piles, in that they are excavated from the surface and then filled with reinforcing steel and concrete. However, they are constructed as rectangular sections of trench, rather than circular piles.
Enabling Works	These are works to prepare a site in advance of the main construction works, for example; demolition, removal of vegetation, land levelling, utility diversions, establishment of temporary traffic measures.
Environmental Impact Assessment	The assessment of the environmental consequences of a plan, policy, program or project prior to the decision to move forward with the proposed action.
Hydrofraise	A reverse circulation excavation tool comprising a heavy steel frame with two drive gears attached to cutter wheels at its bottom end. It is used for the construction of diaphragm and cut-off walls in difficult conditions, typically the excavation of rock and hard layers of soil. The hydrofraise is also called a hydromill and trench cutter (or just cutter).
Intervention Shaft	A vertical shaft excavated to provide emergency access/ egress and ventilation between the railway tunnel at depth and the surface.
Intervention Tunnel	A tunnel parallel to the railway tunnel to provide emergency access / egress from the tunnel to the surface.
Logistics Site	During construction logistics sites will be established to help manage the flow of materials to and from the construction sites.
Noise Sensitive Location	Locations where particular sensitivities to noise exist, e.g. residential areas, schools, hospitals, parks etc.
Operation Control Centre	A single central space from where public transport network operations and services are monitored, evaluated, recorded and analysed.
Park & Ride Facility	A location usually sited out of the main urban areas comprising a large car park and connected with a mass transit system, in the case of MetroLink an urban metro to attract potential travellers to drive and park at the facility and take the metro into Dublin City Centre and avoid driving into Dublin City Centre
Public Address System	An electronic system comprising of microphones, amplifiers, loudspeakers and related equipment.
Railway Order	The approval from the planning authority (An Bord Pleanála) for permission to build and operate a Strategic Infrastructure Development (in this case, MetroLink).
Retained Cut	A section of the railway constructed primarily below ground level with vertical retaining walls either side of the alignment and no roof or enclosure overhead.
Retained Cut Station	A railway station constructed primarily below ground level with vertical retaining walls either side of the alignment to reinforce the walls. Canopies provide shelter over the platforms.
Rolling Stock	A generic term referring to all vehicles that run on rails.

Term	Meaning
Satellite Compound	A works compound usually smaller than the main compound which may provide: local office and welfare facilities, local storage for plant and materials, and limited parking for construction vehicles.
Secant Piles	A construction method used to form a retaining wall for ground retention prior to excavation. The walls are formed by boring circular sections from the surface down into the top of the bedrock and filling the resulting opening with steel reinforcing cages surrounded by concrete.
Surface Station	A railway station designed at ground level
Tunnel Boring Machine	A machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata.
Underground Stations	A railway station located fully underground with a roof slab over the station to enclose it, with entrances above ground.
U-section	A construction technique involving temporary excavation support with either sheet piles or battered excavations (as opposed to secant piles).
Ventilation Tunnel	A tunnel parallel to the railway tunnel to support the ventilation system in the operational phase.

13.10 References

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