18. Noise and Vibration

18.1 Introduction

As set out in Chapter 1 of this updated EIAR, this is an update to Chapter 17 of the EIAR submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended) (the "Section 51 Application"). Noise and Vibration now falls under Chapter 18 of this updated EIAR, as air quality and climate are now considered separately in standalone chapters, both of which precede this chapter. It forms part of the response to the request by ABP for further information in December 2023 where they (in addition to a number of other requests) requested GCC to "*Update the Environmental Impact Assessment Report".* This chapter consists of an appraisal of the Project (for EIA and AA purposes) under the heading of noise and vibration. Where there have been any changes to the assessment and or any updates since the 2018 EIAR, these have been set out in this updated chapter.

This chapter initially sets out the methodology followed in carrying out the appraisal for this update (Section 18.2), describes the receiving environment whilst noting any significant changes since the 2018 EIAR (Section 18.3) and summarises the main characteristics of the Project which are of relevance for noise and vibration (Section 18.4). The evaluation of impacts of the Project on noise and vibration are described (Section 0). Measures are proposed to mitigate these impacts (Section 18.6), residual impacts are described (Section 18.7) and the cumulative impacts (Section 0). The chapter concludes with a summary (Section 18.9) and reference section (Section 18.10).

This chapter has utilised, where relevant, the information gathered during the constraints and route selection studies for the proposed N6 GCRR, the studies to inform the 2018 EIAR, for the 2019 Response to Request for Further Information and for the oral hearing in 2020 plus data gathered during site visits undertaken in 2023/2024 to inform the noise and vibration impact appraisal for this updated EIAR. Sections 4.15, 6.5.10 and 7.6.10 of the Route Selection Report considered the noise and vibration constraints within the scheme study area and compared the potential noise and vibration impacts of the proposed route options respectively. These sections of the Route Selection Report contributed to the design of the proposed N6 GCRR which forms a major part of the Project that this chapter appraises.

The key guidance documents referred to in this chapter, which are still the current guidelines and unchanged since the 2018 EIAR are the TII 2004 *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* and the TII 2014 Document *Good Practice Guidelines for the Treatment of Noise during the Planning of National Road Schemes,* referred to as the TII 2004 Noise Guidelines and the TII 2014 Noise Guidelines respectively within this chapter.

The key changes to the chapter since the 2018 EIAR involve:

- Reviewing and updating elements of the chapter to address points raised from the Brief of Evidence presented to An Bord Pleanala (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated June 2021
- Update to the assessment of significance of effects having regard to the EPA 2022 EIAR guidelines, Design Manual for Roads and Bridges (DMRB) Sustainability & Environmental Appraisal LA 111 Noise and Vibration, Revision 2. (UKHE 2020), WHO European Noise Guidelines (2018), the Galway City Council Draft Noise Action Plan 2024 – 2028 and the Galway County Council Draft Noise Action Plan 2024 – 2028
- Updated operational traffic modelling based on the most up to date traffic forecasts for the revised opening and design years of the Project
- Update of Appendices 18.1 and 18.2 and Figures 18.1.1 to 18.1.15 to take account of additional noise monitoring and noise modelling results

18.2 Methodology

18.2.1 Introduction

In order to assess the noise impact of the Project, the following methodology has been adopted:

- The first stage is to assess and quantify the existing noise environment in the vicinity of sensitive receptors that may be affected by the Project. Noise sensitive receptors include residential properties, education buildings, hospitals and areas of high amenity value in existing low noise settings. In the case of a road scheme, the selected noise-sensitive locations are those in closest proximity to the Project and along sections of existing roads where changes in traffic volumes are expected.
- The noise levels resulting from both the construction and operational phases for the future years are then calculated using established prediction techniques.
- The results of the predicted assessment are compared against the most appropriate criteria for both construction and operational phases. Where predicted noise levels are in excess of the adopted criteria, mitigation measures are proposed.

Further details of each phase of the assessment are set out in the individual sections of this chapter.

18.2.2 Relevant Guidelines

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration from road traffic which are set out within the relevant sections of this chapter and included in the references section. Specifically, as noted in Section 18.1, the key guidance documents relating to noise and vibration assessment referenced within this chapter are summarised in Table 18.1. Where updated, new or additional guidance has been used in this chapter compared to the 2018 EIAR, it is noted in the table also.

Table 18.1 Standards and Guidelines used for Assessment

Guidance	Description	Updated/ New/ Additional Since 2018 EIAR?	Relevance to Assessment
Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA EIAR Guidelines) (EPA 2022)	This document outlines EPA guidance for conducting Environmental Impact Assessments (EIAs) / EIARs and provides the fundamental requirements of the EIAR	Yes – Updated Version	This guidance has been used to inform the significance of effect for all topics in the noise and vibration assessment and refers to the most up to date version of the document
British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +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 2009+A1:2014)	A code of practice for assessing noise from construction sites	No	Informs construction noise calculation and mitigation measures
BS 5228-2:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter	Code of practice for assessing vibration from construction sites	No	Informs construction vibration assessment and mitigation

Guidance	Description	Updated/ New/ Additional Since 2018 EIAR?	Relevance to Assessment
referred to as BS 5228 – 2 2009+A1:2014)			
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)	Guide to assessing building damage from vibration	No	Informs construction vibration assessment
BS 6472-1: 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 2008)	Guide to assessing vibration with respect to the human response	No	Informs vibration limits for humans
BS 6472-2: 2008 Guide to evaluation of human exposure to vibration in buildings, Part 2 Blasting Induced Vibration (hereafter referred to as BS 6472 – 2 2008)	Guide to assessing vibration with respect to the human response to blasting	No	Informs vibration limits for blasting relating to human response
Environmental Protection Agency (EPA) Environmental Management in the Extraction Industry (2006)	Guide to controlling environmental effects from blasting within the Irish extractive industry	No	Informs vibration limits for blasting for structural response
United Kingdom Highways England (now National Highways) (UKHE) Design Manual for Roads and Bridges (DMRB) Sustainability & Environmental Appraisal LA 111 Noise and Vibration, Revision 2. (UKHE 2020) (hereafter referred to as DMRB Noise and Vibration (2020))	Guide to assessing noise and vibration from roads projects to nearby sensitive receptors	Yes – Updated Version	Informs the of magnitude of change in traffic noise categorisation The magnitude of change tables are unchanged since the 2018 EIAR from DMRB Informs the of significance of construction noise and vibration effects. This is additional since the 2018 EIAR
Galway City Council Draft Noise Action Plan 2024 – 2028 (hereafter referred to as Draft Galway City NAP)	Noise action plan for Galway City Council for the years 2024 to 2028	Yes	Informs noise policy approach for the assessment area An updated NAP has been published since the 2018 EIAR

Guidance	Description	Updated/ New/ Additional Since 2018 EIAR?	Relevance to Assessment
Galway County Council Draft Noise Action Plan 2024 – 2028, (hereafter referred to as Draft Galway Co.Co. NAP)	Noise action plan for Galway County Council for the years 2019 to 2023	Yes	Informs noise policy approach for the assessment area An updated NAP has been published since the 2018 EIAR
S.I. No. 663/2021 – European Communities (Environmental Noise) (Amendment) Regulations 2021	Guidance for implementing a common noise strategy across Europe, specifically for Ireland	Yes	Informs noise assessment and noise action plans. Updated since 2018. The update does not affect the impact assessment within this chapter
S.I. No. 241/2006 - European Communities Noise Emission by Equipment for Use Outdoors (Amendment) Regulations 2006	Provides guidance for outdoor equipment noise	No	Informs regulations pertaining to noise control and limits for construction plant items
ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures	Guidance for undertaking noise measurements for environmental noise	No	Informs noise measurement methodology
ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels	Guidance for undertaking noise measurements for environmental noise	No	Informs noise measurement methodology
Transport Infrastructure Ireland (TII) (previously National Roads Authority (NRA)) 2004 Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA 2004) (hereafter referred to as the TII 2004 Noise Guidelines)	Guidance for assessing road traffic noise in Ireland	No	Informs the noise survey measurement methodology, construction and operational noise and vibration limits and assessment methodology for the Project
TII (NRA) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA 2014) (hereafter referred to as the TII Noise Guidelines 2014)	Guidance for assessing road traffic noise in Ireland	No	Informs the noise survey measurement methodology, construction and operational noise and vibration limits and assessment methodology for the Project

Guidance	Description	Updated/ New/ Additional Since 2018 EIAR?	Relevance to Assessment
The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as the CRTN) (UK Department of Transport 1988)	Guidance for the calculation of road traffic noise levels	No	Informs the noise survey measurement methodology and traffic noise calculation methodology
World Health Organization (WHO) Environmental Noise Guidelines for the European Region (2018) (hereafter referred to as WHO (2018)	Guidance for appropriate noise levels for human health	Yes	Informs noise assessment This was published after the 2018 EIAR but was assessed as part of oral hearing process

18.2.2.1 Construction Phase

Guidelines relating to construction noise and vibration limits are set out within the TII guidance documents and other relevant national and international documentation for the control of noise and vibration from construction sites. These are discussed in the following sections.

Construction Noise

The 2004 and 2014 TII noise guidance documents specify noise levels that are deemed acceptable in terms of construction noise for new national roads. These limits are set out in Table 18.2 and are unchanged from the 2018 EIAR. Following discussions at the oral hearing in 2020 on the appropriate construction noise thresholds, ABP's inspector concluded in their report dated June 2021 the use of the TII noise limits to be appropriate for the construction phase, noting that the higher level of noise allowed is not a permanent noise source, and that a balance is required between speed of construction (thus reducing duration of impacts) and control of noise.

An Bord Pleanála's Inspector's Report dated 22 June 2021:

"Notwithstanding the applicant's assessment, I consider that there is an inherent uncertainty with regard to construction phase noise due to the scale of the PRD, the range of activities and plant types, variable ground conditions etc. and, in this regard, I consider that the applicant has adopted an appropriate approach of setting limit values in accordance with TII Guidance and implementing a broad suite of mitigation measures and best-practice noise control/abatement measures in accordance with British Standard BS 5228-1:2009+A1:2014. These measures are incorporated into the Schedule of Environment Commitments and/or the CEMP. Monitoring, noise control audits and public liaison (including prior notification of noisy activities and complaints procedures) will also be implemented during the construction phase to ensure compliance with TII and BS guidance."

Table 18.2 Maximum Permissible Noise Levels at the Facade of Dwellings during Construction Phase

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq,1hr}$	L_{ASmax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

Note *Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the local authority.

The TII guidelines do not include specific night-time construction noise limit values. In order to determine appropriate limits for any scheduled night-time works, best practice guidelines are taken from the British Standard BS5228 – 1 (2009 +A1 2014). The standard provides guidance on setting appropriate limit values for construction based on exiting ambient noise levels in the absence of construction noise. The guidance levels for night-time periods are summarised in Table 18.3 and are unchanged from the 2018 EIAR.

Table 18.3 Example Threshold of Significant Effect at Dwellings

Days and Times	Threshold Values (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time 23:00 to 07:00hrs	45	50	55

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

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

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

Construction Vibration

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

Building Response

With regards to construction vibration, the TII guidelines outline the following limits in respect of ensuring that no cosmetic damage occurs to buildings in the vicinity of construction works.

Table 18.4 Allowable Vibration during Road Construction in order to Minimise the Risk of Building Damage

Allowable Vibration Velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8mm/s	12.5mm/s	20mm/s

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 (2009 +A1 2014) notes that vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. Table 18.5 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS 5228–2, DMRB Noise and Vibration (2020) and associated EPA EIAR (2022) guidelines significance ratings.

Table 18.5 Human Response Vibration Significance Ratings

PPV range	Description of Effect	DMRB Impact Magnitude	EPA Significance Ratings
≥10 mm/s PPV	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments	Major	Very Significant
≥1 to <10 mm/s mm/s	Increasing likelihood of perceptible vibration in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate	Moderate to Significant
≥0.3 to <1 mm/s	Increasing likelihood of perceptible vibration in residential environments	Minor	Slight
0.14 to <0.3 mm/s PPV	Vibration might be just perceptible in residential environments towards the upper levels in this range	Negligible	Not Significant
<0.14	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction		Imperceptible

Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects. The TII 2004 Noise Guidelines notes higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5mm/s during the daytime and the evening if those affected are aware of the duration and origin of the vibration.

Construction vibration shall constitute a likely significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding: 1) 10 or more days or nights in any 15 consecutive days or nights; or 2) a total number of days exceeding 40 in any 6 consecutive months.

Blasting

When assessing the potential impact of blasting, the relevant parameters used are both air overpressure and Peak Particle Velocity (PPV) mm/s. The TII guidelines recommends a PPV limit value of 12mm/s for blasting control. The Irish EPA Guidance *Environmental Management in the extraction industry* (2006) also recommend a PPV limit of 12mm/s in addition to an acceptable limit for air overpressure of 125dB (Lin) Peak Value. In addition, the EPA recommends blasting is only carried out between 09:00 – 18:00 Monday to Friday.

BS 6472-2 (2008) suggests satisfactory vibration magnitudes from blasting relating to human response. The document notes that for up to three blasts per day, a PPV limit value between 6 and 10mm/s is deemed reasonable, however it states these limit values relate to long term blasting operations from surface mineral extraction sites. The standard notes that *for civil engineering projects, such as tunnel and foundation excavations, it should be recognised that the application of human response criteria, rather than conservative damage criteria, could significantly prolong project durations. In turn this could lead to increased complaint levels.*

The standard notes higher levels may be more appropriate for short term projects, where good public relations, property surveys etc. are undertaken.

The frequency of blasting for the Project will be no greater than one blast per day in any one site. Taking the blasting frequency into account, the nature of this engineering project and to expedite works as far as practical in excavation areas to avoid prolonged impacts, the limit values relating to structural damage are considered the most appropriate for this Project, i.e. 12mm/s. This is unchanged since the 2018 EIAR.

Disturbance of Particularly Vibration-Sensitive Equipment and Processes

There are no standard criteria for assessing the potential impact of vibration on sensitive equipment or processes. British Standard BS 5228–2 (2009 +A1 2014) 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. The most advisable approach for the control of potential vibration impacts at areas of vibration sensitive equipment or processes, is to review each location on its own merit in order to determine the site specific vibration limits taking into account any building or machinery isolation already in place. In this instance, where a receptor has been identified or made known within the Assessment Boundary that is potentially sensitive to vibration through questionnaires and consultations, this area is highlighted as one for consideration and consultation. In these instances, it is not possible to set specific vibration limits at this stage of this updated EIAR due to complexities in both the level of detail available at this stage and knowledge of the receptor. Further discussion on particularly sensitive equipment/processes are set out in Section 18.6.3.

Construction Traffic Noise

To assess the potential impact of additional traffic on the human perception of noise, the following guidelines are referenced*:* DMRB Noise and Vibration (2020) and the EPA EIAR Guidelines (2022). The EPA significance of effects have been added to the DMRB magnitude tables assessment since the 2018 EIAR to align with the categorisation of effects from the EPA EIAR Guidelines (2022).

Table 18.6 includes guidance as to the likely magnitude of impact associated with construction traffic noise, relative to the change in sound level. This guidance is derived from Table 3.17 of DMRB Noise and Vibration (2020) and adapted to include the relevant significance effects from the EPA EIAR Guidelines (2022).

For construction traffic noise, due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the ‘short term’ period in accordance with the DMRB Noise and Vibration (2020) document. Table 18.6 relates changes in traffic noise levels to impact on human perception based on the guidance contained in these documents.

Table 18.6 Classification of Magnitude of Noise Impacts in the Short Term

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant to Slight
3 – 4.9	Perceptible	Moderate	Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

18.2.2.2 Operational Phase

TII Noise Guidance Documents

As in 2018, there are no statutory guidelines relating to noise from road schemes in Ireland. In the absence of statutory guidance, the most commonly applied standard is that issued by the TII within their 2004 and 2014 noise guidance documents. Both documents specify that the following absolute noise design criterion for new national road schemes in Ireland is appropriate:

Day-evening-night value of: **60dB L_{den}.**

This is a free field façade criterion, i.e. does not take account of reflections from building facades.

L_{den} is the 24hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5dB penalty) and the L_{night} (plus a 10dB penalty). L_{den} is calculated using the following formula:

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

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
- $L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year
- 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

This criterion applies to new national roads. The following three conditions must be satisfied under the TII guidelines in order for noise mitigation to be provided:

a. The combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed N6 GCRR together with other traffic in the vicinity is greater than the design goal of 60dB L_{den}

b. The relevant noise level is at least 1dB more than the expected traffic noise level without the proposed N6 GCRR in place

c. The contribution to the increase in the relevant noise level from the proposed N6 GCRR is at least 1dB

The proposed N6 GCRR under consideration is a new national road and hence the design goal and assessment methodology set out in the TII guidelines for the assessment of potential noise impacts from national road schemes are deemed directly applicable.

It should be noted that the design goal is applicable to new road schemes only. In addition, the design goal is applied to existing receptors in respect of both the year of opening and the Design Year, typically 15 years after projected year of opening. In the case of this proposed N6 GCRR a commencement year of 2031 and a future Design Year of 2046 have been assessed for this updated assessment. These are different design and opening years to those assessed within the 2018 EIAR (2024 and 2039 respectively).

WHO Environmental Noise Guidelines for the European Region

The World Health Organisation (WHO) published Environmental Noise Guidelines for the European Region in October 2018. These guidelines are new since the 2018 EIAR was published but were assessed during the oral hearing in 2020. The guidelines have been taken into account in this updated EIAR. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation (road traffic, railway and aircraft), wind turbine noise and leisure noise. The guidelines set out recommended exposure levels for environmental noise in order to protect population health. The guidelines recommend L_{den} and L_{night} levels above which there is risk of adverse health risks for each source type.

The health related effects for road traffic noise discussed within the WHO (2018) document relate to direct and indirect health effects such as increased risk of ischemic heart disease (IHD), high levels of annoyance and sleep disturbance. WHO (2018) found that a 5% relevant risk increase of the incidence of IHD occurs at a noise exposure level of 59.3 dB L_{den}. This value is closely aligned (within 0.7dB) with the TII Noise Guidelines of 60 dB L_{den}. WHO (2018) cites moderate quality evidence that there is an absolute risk of 10% of the population being 'Highly Annoyed' (HA) by road traffic noise at a level of 53.3 dB L_{den}. With regards sleep disturbance, WHO (2018) notes there is a risk of 3% of the population being as 'Highly Sleep Disturbed' (HSD) by road traffic noise at a level of 45 dB L_{night}.

The application of the WHO guidelines relates to controlling noise exposure at a population level on a European and national strategic level. Those guidelines are primarily considered in the context of national and local policy making to adopt and propose noise levels for use, should they deem feasible based on a range of factors which must be considered. In making these decisions, economic, physical (engineering), and social considerations all need to factor in. They are not intended to be noise limits for specific or individual properties. The WHO (2018) 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."

Ultimately, it is at the discretion of national and local policy makers to adopt the WHO guidelines in the context of reviewing and managing, on a population level, the health effects of transport related noise.

An important part of the WHO Guidelines relates to the recommended interventions or mitigation measures to be considered with respect to controlling and reducing road traffic noise exposure across populations. These include:

- Changes in infrastructure
- Reduction in road traffic flows
- Pathway interventions (barriers)
- Quieter road surfaces

The Draft Galway City NAP (2024 to 2028) and the Draft Galway County Council NAP (2024 to 2028) have set out the adopted approach to review population exposure to transport noise in line with WHO (2018) and the intervention or management options available to reduce traffic noise exposure across the population. These are discussed in the following section.

Galway City and Galway County Council Draft Noise Action Plans 2024 - 2028

The Draft Galway City NAP and the Draft Galway County Council NAP relates to the management of environmental noise in accordance with the Environmental Noise Directive (END) (2002/49/EC). These Plans are new since the 2018 EIAR and have been taken into account in this updated EIAR. The purpose of the Action Plan is to manage and reduce, where necessary, environmental noise through the adoption of the action plans.

The plan refers to the various EU, national, regional and local guidelines, policies and standards relating to environmental noise and sets out an approach for managing transport related noise for the city and county. The parameters and thresholds couched in the plans relate to those in the WHO (2018) document.

TII as the designated noise mapping body for national roads, prepared strategic noise maps for major and non-major non-national roads carrying in excess of 3 million vehicles per annum within Galway City and Galway County. The noise mapping was undertaken in 2021 and 2022 as part of the Round 4 Noise Mapping.

Article 6.2 of the Environmental Noise Directive (END) specifies the use of two noise level indicators when preparing environmental noise maps and action plans, the L_{den} and L_{night}.

- L_{den} – as defined above, is the noise indicator used for overall annoyance prescribed in the END and used in the NAP
- L_{night} – as defined above, is the noise indicator for sleep disturbance, prescribed in the END and used in the NAP

The results of the strategic noise maps provide information on the predicted noise levels at all noise sensitive properties within the assessment area, with an estimate of the number of inhabitants. The outcome of the mapping within the NAP is to identify areas for focused review in terms of noise management and noise preservation relating to health related transport noise impacts. The first area of focus in the Draft NAPs are Important Areas (IAs), where long term noise exposure to noise from infrastructure has potential to have adverse effects on the health of the exposed population. Following on from this, the Most Important Areas (MIAs), which are a subset of the IAs where the health effects are potentially the highest are determined. Once these areas are identified, a further subset of Priority Important Areas (PIAs) are identified and prioritized for which an assessment of noise mitigation measures will be undertaken within the life cycle of the Noise Action Plans.

The Draft Galway City NAP notes the following with respect to the IAs and MIAs

"It should be noted that the process of identifying the Important Areas and Most Important Areas is of a statistical nature and pertains to the entire population encompassed by the noise maps. The Most Important Areas should not be construed as a precise assessment of harmful effects for specific buildings, nor are the extents of the Most Important Areas definitive. The Most Important Areas are indicative for the identification of areas with a relatively high number of people who may be potentially highly annoyed due to road noise."

A total of six PIAs have been selected for inclusion within the Draft Galway City NAP which relate to locations with high levels of health impact due to both noise exposure and population density. These are located along the L1013 Western Distributor Road, R864 Newcastle Road, 2 locations along the R336 Bohermore Road, N6 Bóthar na dTreabh and N6 Bóthar na dTreabh at Briarhill. Details relating to the assessment approach and location of these areas are available in the Draft NAP 2024 to 2028. These areas have the potential to experience a change in traffic noise level as a result of the Project and will be considered as part of this assessment.

A total of ten PIAs have been selected for inclusion within the Draft Galway County Council NAP. These are located in Moycullen, Bearna, Oranmore and Claregalway. These areas are sufficiently set back from the Project such that no material change in traffic noise is expected to occur (positive or negative) as a result of the Project.

The Draft Galway City NAP and the Draft Galway County Council NAP refer to the TII 2004 and 2014 Noise Guideline documents which are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration during the Constraints, Option Selection, Environmental Impact Assessment and construction phases of road planning and development undertaken in accordance with TII's Project Management Guidelines (PMGs).

The Draft Galway City NAP notes the current design goal for all national road schemes should be designed, where feasible, to meet 60 dB L_{den} (free-field residential façade criterion) at both the year of opening and in the design year. It also notes the guidelines put forward measures for mitigation of the adverse effects of road construction in so far as possible using measures such as alignment changes, barrier construction and the use of low noise road surfaces.

Both Draft NAPs include further mitigation options to reduce traffic noise at exposed populations as part of the next 4 year plan. The following types of measures are set out in the plans as potential options to consider for PIAs with exposure to road traffic noise:

- Re-surface roads with 10mm stone mastic asphalt (SMA)
- Re-surface roads with low noise road surfaces, or thin surface treatments
- Vehicle speed management, or speed limit reductions
- Traffic management – routes and HGVs
- New road construction (bypass)
- Roadside noise barriers and screening measures

The Draft Galway City NAP identifies the proposed N6 GCRR as a future development that both the City Council and the County Council is proposing to develop around Galway City. It also discusses the implementation of the proposals set out in the Galway Transport Strategy (GTS) and the Galway City Centre Transport Management Plan as a means to improve public transport facilities and infrastructure and walking and cycling infrastructure. The modal shift to more sustainable modes of transport has potential to impact positively on road traffic noise levels.

In terms of Regional and Local Policy, the Draft Galway County Council NAP notes it is necessary to consider Regional and local policies and strategies which relate to noise management or may affect local noise management. Of specific relevance, the NAP refers to the Northern & Western Regional Assembly (NWRA) Regional Spatial and Economic Strategy 2020-2032 (RSES) policy objective 3.6.7 which supports the delivery of the proposed N6 GCRR which represents a key priority for the Galway metropolitan area, and the Galway Transport Strategy (GTS).

The proposed N6 GCRR (being the main element of the Project as considered assessed for EIA purposes), therefore forms a key part of implementing the noise mitigation strategies discussed within the NAP which also align with the recommended interventions and overall policies of the WHO Environmental Noise Guidelines (WHO 2018) to reduce population exposure to road traffic noise.

Proposed Criteria

On consideration of the documents discussed above, the traffic noise design goal of 60 dB L_{den} included with the TII noise documents remains the design goal for determining noise mitigation for the Project.

The operational phase of the Project will be reviewed in the context of the identified PIAs within the Draft Galway City NAP to review the related change in traffic noise as a result of changes in traffic flows with the implementation of the Project.

18.2.2.3 Evaluation of Potential Noise and Vibration Impacts

Construction Phase

To assist with interpretation of the significance of effect associated with Construction Noise Levels (CNLs), Table 18.7 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the Construction Noise Threshold (CNT) set for a given period (i.e. daytime, evening or night-time). 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 EIAR Guidelines (2022). This is an additional approach taking into account the updated DMRB document since the 2018 EIAR.

In accordance with the DMRB Noise and Vibration document (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
- A total number of days exceeding 40 in any six consecutive months

Table 18.7 Construction Noise Significance Rating

Construction Noise Levels (CNL) per Period	DMRB - Magnitude of Significance	EPA EIAR Significance Effects	Determination
Below or equal to baseline noise level	Negligible	Not Significant	Depending on CNT, duration, and baseline noise level
Above baseline noise level and below or equal to CNT	Minor	Slight to Moderate [A]	
Above CNT and below or equal to CNT +5 dB	Moderate	Moderate to Significant	
Above CNT +5 to +15 dB	Major	Significant, to Very Significant	
Above CNT +15 dB		Very Significant to Profound Note B	

Note A: 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 and Vibration (2020) and BS 5228-1 ((BSI 2014a), noise levels below the CNT are deemed 'Not Significant'

Note B: 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 if the relevant durations discussed above are exceeded

The adapted DMRB guidance outlined is used to assess the predicted CNLs at Noise Sensitive Locations (NSLs) and comment on the likely impacts during the construction stages.

Operational Phase

There are no guidelines in Ireland for assigning significance criteria for new road developments. The TII Guidance for noise does not prescribe a methodology for evaluating the magnitude or significance of road traffic noise from a new road development. The use of an absolute criterion is used as a threshold value above which noise mitigation measures are to be provided, assuming the 3 conditions for noise mitigation are met. The 60dB L_{den} design goal takes into consideration the alignment of the majority of new national roads in Ireland across a range of different environments including rural, semi-rural, suburban and urban locations.

In order, therefore, to evaluate the potential significance of the noise levels associated with the operation of the Project, consideration needs to be given to issues such as the absolute level of noise under consideration, the magnitude of change in noise levels at a given location and the receptor sensitivity.

(a) Magnitude of Change

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 2020 document. This document provides suggested magnitude rating tables relating to changes in road traffic noise. The document suggests that during the year of opening, the magnitude of impacts between the Do-Minimum and the Do-Something scenarios are likely to be greater compared to the longer term period when people become more habituated to the source.

This document suggests that changes in noise levels between the Do-Minimum and Do-Something scenarios for the year of opening are compared and categorised in line with the 'short term' table reproduced in Table 18.8. Longer term impacts are assessed by comparing the Do Minimum noise level calculated for the opening year against the Do Something scenario for the design year (typically 15 years after opening) as reproduced in Table 18.8.

It should be noted the tables below relates to the $L_{A10,18hr}$[1] parameter as opposed to the L_{den} which is the assessment parameter for road traffic noise in Ireland.

[1] This parameter refers to the $L_{A10,18hr}$ parameter which is the traffic noise parameter used in the CRTN 1988 and the DMRB 2020 Documents. For the purposes of this assessment, the same category of change is assigned against L_{den} traffic noise levels.

Table 18.8 Classification of Magnitude of Noise Impacts in the Short Term

Noise Change, dB(A)	Magnitude of Impact
0	No Change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major

Table 18.9 Classification of Magnitude of Noise Impacts in the Long Term

Noise Change, dB(A)	Magnitude of Impact
0	No Change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

(b) Significance Ratings

The absolute noise level associated with the Project is an important consideration when evaluating the impacts of the Project. In instances where an increase of noise levels of +5dB(A) are calculated during the year of opening, resulting in a 'major' significance rating, for example, the actual level of traffic noise at the property may be below a level considered to cause any significant effect. Conversely, in areas of existing high traffic noise levels, a small change in traffic noise level may be more significant.

The approach for categorising the significance effects relating to operational noise has been updated since the 2018 EIAR to take account of the TII 2004 and 2014 Noise Guidelines, the Draft Galway City and County NAPs (2024), the WHO (2018) Noise Guidelines and the DMRB (2020) documents discussed above. The following overall significance ratings for the Operational Phase of the Project are applied taking account of both the calculated changes in road traffic noise levels in the short and long term periods (Table 18.8 and Table 18.9 from DMRB) and the absolute noise level. The approach adopted combines the absolute noise level category and the change in traffic noise as a result of the Project to apply a significance rating.

Traffic noise levels at or below 50 dB L_{den} are deemed to be negligible and will not generate any significant impact in terms of annoyance or other health related impacts in line with the various guidance documents discussed above. Changes in traffic noise levels up to this level are therefore deemed Not Significant.

Traffic noise levels between 51 and 54 dB L_{den} are categorised as low. The percentage of the population deemed highly annoyed (HA) by road traffic in this range are 9 to 10% in line with the community response studies from the WHO (2018) Noise Guidelines. There are no significant health related noise effects at or below these levels. Changes in noise levels categorised as Moderate or Major in accordance with the DMRB magnitudes are categorised as Slight to recognise perceptible changes.

Traffic noise levels between 55 and 60 dB L_{den} are categorised as medium. The percentage of the population deemed HA by road traffic in this range are 11 to 15% in line with the community response studies from the WHO (2018) Noise Guidelines. At 59.3 dB $L_{den,}$ the WHO (2018) Noise Guidelines quote a 5% relevant risk increase of the incidence of IHD, and hence traffic noise levels at or below this level are not considered to pose any significant physical health risk. 60 dB L_{den} is the design goal for new national road schemes in Ireland set by TII and referred to within the Draft Galway City and County NAPs. A moderate or major change in noise level up to this range of traffic noise level is categorised as a Moderate impact.

Traffic noise levels between 61 and 64 dB L_{den} are categorised as high. The percentage of the population deemed HA by road traffic in this range are 16 to 20% in line with the community response studies from WHO (2018) Noise Guidelines. Noise levels in this range are also above the TII design goal for road traffic noise for new national road schemes. A minor change in noise level up to this range of traffic noise level is categorised as a Moderate to Significant. A moderate and major change in noise level up to this range of traffic noise level is categorised as a significant impact.

Traffic noise levels at or above 65 dB L_{den} are categorised as very high. The percentage of the population deemed HA by road traffic in this range are >20% in line with the community response studies from WHO (2018) Noise Guidelines and noise levels in this range are above the TII design goal for road traffic noise for new national road schemes. Smaller changes in traffic noise levels up to these ranges are categorised with higher impacts. A minor change in noise level up to this range of traffic noise level is categorised as significant. A moderate or major change in noise level up to this range of traffic is considered to be significant to very significant.

The specific impact per location is assessed on a case by case basis taking account of the increase in noise level, the absolute noise level with this range and the receptor sensitivity. It is important to note that this assessment criteria are applied on an individual receptor basis across the Project. The individual impacts, however, must be considered in the context of the population as a whole when reviewing the overall impact of the Project on the wider surrounding environment in line with the approaches of the Draft Galway City NAP, the Draft Galway County Council NAP and the WHO (2018) Noise Guidelines.

Table 18.10 presents the assessment matrix for the categorisation of significance of effects which combines the change in noise levels and the noise level category.

Table 18.10 Significance Ratings for Operational Phase Traffic Noise Impacts

Noise Level Range, dB L_{den}	Noise Level Category (% Population HA)	Magnitude of Change in Noise Levels (Short and Long Term)				
		No Change / Reduction	Negligible	Minor	Moderate	Major
≤50	Negligible (<9%)	Imperceptible / Positive	Not Significant	Not Significant	Not Significant	Not Significant
51 – 54	Low (9 to 10%)	Imperceptible / Positive	Not Significant	Not Significant	Slight	Slight
55 – 60	Medum (11 to 15%)	Imperceptible / Positive	Not Significant - Slight	Slight	Moderate	Moderate
60 – 64	High (16 – 20%)	Imperceptible / Positive	Not Significant - Slight	Moderate – Significant	Significant	Significant
≥65	Very High (>20%)	Imperceptible / Positive	Not Significant - Slight	Significant	Significant	Very Significant

(c) Receptor Sensitivity

Other considerations relating to the evaluation of impacts relates to the sensitivity of the receptor under consideration. The following sensitivity is assigned against the property types along the route of the Project.

Table 18.11 Classification of Receptor Sensitivity to Noise

Sensitivity of Receptor	Description
High	Residential properties, hospitals, nursing homes, educational buildings (daytime)
Medium	Places of worship, community facilities, amenity areas
Low	Commercial and industrial premises

The noise sensitive receptors assessed along route of the Project are predominately residential properties. There are two schools (St. James' National School, Bushypark and Castlegar School, on School Road) a nursing home on School Road (Castlegar Nursing Home) and Galway Clinic along R446 Road, all of which are categorised as High Sensitive receptors.

One church (St. James' Church, Bushypark) is included in the assessment which is defined as a medium sensitive receptor. The community facilities and amenity areas of the University of Galway (UoG) Sporting Campus, Menlo Castle and Galway Racecourse are also included in the assessment and are considered to be of medium sensitivity. A small number of commercial premises are assessed along the N83 Tuam Road and Parkmore and Ballybrit area and are defined as being of low noise sensitivity. Vibration sensitive locations are addressed separately.

The above information will be used as a basis for evaluating potential noise impacts from the Project.

18.2.3 Data Sources and Consultations

Information relating to the Project has been obtained primarily from the design team. Any comments that related to noise and vibration from consultations undertaken by the design team with stakeholders during the design development process were considered during the preparation of this chapter.

The following items of information were supplied by the design team which formed the main basis for the impact assessment:

- Background OS Mapping of the study area updated since 2018
- Mapping of developments built but not shown on the OS Mapping
- 3D ground contour mapping
- 3D road alignment drawings for the proposed N6 GCRR
- 3D drawings for the proposed temporary and permanent stables
- Traffic flow forecasts for future opening and design years for the study area predicted for this updated EIAR
- Ongoing consultation feedback relevant to noise and vibration issues from interested and affected parties
- Landscaping proposals identified for this updated EIAR
- Construction plan information (compound locations, major earthworks, structures, areas of blasting, construction traffic information etc.)

18.2.4 Study area and Baseline Data Collection

The study area for the noise and vibration impact assessment is focused on the areas likely to be affected by the operation of the Project. This includes the closest noise/vibration sensitive locations along the route of the Project in addition to those in proximity to existing roads in the vicinity of the Project. Noise sensitive locations within a study area of approximately 300m from the centreline of the proposed N6 GCRR were focused on for the baseline noise studies which is considered to capture the baseline noise environment at locations likely to be impacted by the Project.

A comprehensive baseline noise study has been undertaken within the study area in order to provide a context of the typical noise environment and to determine the main contributors to the existing environment.

The surveying was completed in accordance with relevant guidance and standards discussed in Table 18.1.

The survey locations were selected to represent the environments through which the Project will pass which is predominately residential. Survey locations were therefore focused on residential areas set back from existing roads along the route of the Project, residential estates, and residential properties located along local, regional and national roads. Additional surveys were undertaken at recreational facilities, schools and crèches, a church, a hospital, and commercial facilities. These were surveyed to gain information specific to these locations in addition to representing general ambient noise levels in the areas which they are located. Further details are set out in Section 18.3.

Unattended 24-hour monitoring stations were selected to represent specific noise environments (including those listed above) and a range of satellite attended measurement locations were monitored in the vicinity of these locations to characterise the noise environment within each area.

Given the extent of the baseline study area, it was not possible to gain access to all locations requested as part of the baseline study. In these instances, attended noise measurements were made at proxy locations to the nearest sensitive properties and unattended noise measurements were conducted, as far as practicable, at adjacent properties, depending on access being granted to private lands.

The surveying programme during 2016 and 2017 encompassed attended surveys at 73 locations and unattended surveys at 33 locations. A summary of results is presented and discussed in Section 18.3.

An updated round of unattended noise surveys within each key section of the study area was undertaken at 28 locations during 2023 and 2024. The updated survey locations were monitored at the same locations as the original surveys or at equivalent adjacent locations to evaluate the change in the ambient noise environment over time. The updated locations chosen reflect the most impacted areas across the study area of the Project and were used to validate the result from the original surveys. Attended surveys were not resurveyed as the results obtained from the longer unattended survey data provided sufficient data within each geographic area the baseline sections are broken into. The survey results are used to validate the baseline noise model which remains valid with the updated survey results.

In line with standard approach for environmental noise and vibration assessments, baseline vibration surveys are not carried out unless there are measurable sources of vibration in the surrounding environment. Road traffic does not contribute to any appreciable levels of ambient vibration in the environment (as opposed to rail movements or some heavy industry etc.) and hence baseline vibration surveys are not undertaken as standard for new road projects. Baseline vibration surveys were not undertaken for this Project in line with this approach. Furthermore, vibration was not perceptible at any of the noise survey locations. Information on vibration sensitive equipment is set out in Section 18.6.2.3.

18.2.4.1 Unattended Measurements

During the 2016 / 2017 noise surveys, the continuous unattended measurements were conducted using a Brüel & Kjær UA 1404 Environmental Outdoor Kit, with either Brüel & Kjær Type 2238 or 2250 Sound Level Meters.

During the 2023 /2024 noise surveys, the continuous unattended measurements were conducted using Rion NL-42 sound level meters with environmental outdoor kits.

The measurement apparatus was check calibrated before and after each survey using a Brüel & Kjær Type 4231 Sound Level Calibrator. The results were saved to the instrument memory for later analysis.

Continuous unattended measurements were conducted over at least 24-hour periods at all locations. L_{den} values are derived directly from the measured $L_{Aeq,1\ hour}$ measured data using the formula included in Section 18.2.2.2.

18.2.4.2 Attended Measurements

The attended measurements were performed using Brüel & Kjær Type 2250, or 2260 Sound Level Meters. Attended measurements were conducted at survey locations on a cyclical basis. Sample periods were 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

The survey work was conducted in accordance with the short-term measurement procedure as specified in the TII noise guidance documents.

When surveying traffic noise, the acoustical parameters of interest are $L_{A10(1hour)}$ and $L_{A10(18hour)}$, expressed in terms of decibels (dB) relative to 2x10-5Pa.

The value of $L_{A10(1hour)}$ is the noise level exceeded for just 10% of the time over the period of one hour. $L_{A10(18hour)}$ is the arithmetic average of the values of $L_{A10(1hour)}$ for each of the one-hour periods between 06:00 and 24:00hrs. $L_{A10(18hour)}$ is the parameter typically used in for the purposes of assessing traffic noise, where relevant.

The shortened measurement procedure involves a method whereby $L_{A10(18hour)}$ and L_{den} values are obtained through a combination of measurement and calculation as follows:

- Noise level measurements are undertaken at the chosen location over three consecutive hours between 10:00 and 17:00hrs
- The duration of the sample period during each hour is selected to encompass sufficient traffic flows to ensure reliable results
- The $L_{A10(18hour)}$ for the location is derived by subtracting 1dB from the arithmetic average of the three hourly sample values, i.e.
- $L_{A10(18hour)} = ((\sum L_{A10(15\ minutes)}) \div 3) - 1$ dB
- The derived L_{den} value is calculated from the $L_{A10(18hour)}$ value, i.e.
- $L_{den} = 0.86 \times L_{A10(18hr)} + 9.86$ dB

The L_{den} is a long-term average indicator and represented the annual daily noise level.

The guidelines note that *where traffic is not the dominant noise source, then the normal correction cannot be applied to convert the 15 minute samples to an 18-hour value. However, it may be possible to derive a site specific correction from a nearby long-term site affected by the same noise sources. If there is not comparator site, a short-term measurement is inappropriate and a 24-hour measurement will be required.*

The baseline survey locations were selected to ensure that where traffic was not the dominant source at monitoring positions that an unattended 24-hour survey was conducted in order to directly derive a L_{den} from the measured data and satellite attended measurements were conducted in the vicinity of this location, where relevant.

18.2.4.3 Monitoring Locations

The location of the surveyed baseline monitoring positions is presented in Figure 18.1.01 to 18.1.15.

The majority of monitoring locations were positioned within gardens of residential properties or at proxy locations to residential locations in public areas where access to private lands were not possible. Additional surveys were undertaken at the Sporting Campus of UoG (10b), Dangan House Commercial/Recreational (10c), St. James' Church, Bushypark (9g), Castlegar School (11i/11g), Ballybrit Industrial Estate (13a), Galway Clinic (14b) and Galway Racecourse (13h and 13a).

The location of the monitoring positions and the calculated L_{den} for each position is included in Table 18.12 in Section 18.3. Baseline monitoring which are grouped in attended and unattended satellite locations are presented together. Full survey results for all locations are included in Appendix A.18.1.

18.2.4.4 Survey Periods

The baseline survey was undertaken between February and June 2016, August 2017, December 2023 and between January and May 2024. The specific dates and times for each monitoring position is included in Appendix A.18.1.

18.2.4.5 Personnel and Instrumentation

The baseline surveys were undertaken by Enfonic and AWN Consulting Ltd. This involved installing all noise monitoring equipment at the monitoring locations and conducting the attended surveys.

18.2.5 Impact Assessment Methodology

18.2.5.1 Construction Phase Impact Assessment

Assessment of potential impacts during the construction phase is limited to information available at EIAR stage. Whilst the phasing of works and location of activities and work sites have been progressed to detailed stages as part of this updated EIAR (refer Chapter 7, Construction Activities), the specifics in terms of plant items, plant numbers, their locations and operational duration will be subject to site conditions, work scheduling and contractor proposals. In this instance, it is not possible to perform detailed calculations or detailed impact assessment for any one area given the variations in the items above on a week to week or day to day basis. It is however possible to determine noise levels from typical construction activities associated with the various phases.

The TII 2004 and 2014 Noise Guidelines specifically note that there is limited information available on specific construction methods, numbers and types of plant before the appointment of a Contractor, which will normally happen after a scheme has been approved. The guidelines note that it is more appropriate to address the way in which potential construction impacts will be assessed and how they will be managed, including forms of mitigation and codes of practices that will be applied.

The guidelines do note, however, that areas of major earthworks or blasting should be noted and locations where particularly noisy activities such as piling (depending on the method used), rock breaking, and or night-works are identified.

The TII 2004 noise guidelines note that in the absence of an Irish or international standard relevant to construction noise, reference can be made to BS 5228-1 (2009 +A1 2019). This standard includes recommended methodologies for calculating construction noise levels and includes a range of best practice mitigation and management measures for the control of noise and vibration from construction sites.

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

18.2.5.2 Operational Phase Impact Assessment Process

The impact assessment methodology used for this chapter is based on the guidance contained within the 2004 and 2014 TII noise guidance documents, DMRB Noise and Vibration (2020) and the EPA EIAR Guidelines (2022). It predominantly relates to the operation of proposed N6 GCRR (Phase 2 of the Project) as noise due to the operation of a road has the potential to significantly impact human beings and there are no significant impacts due to noise on human health associated with the operation of racecourse stables. The following methodology has been undertaken in accordance with the relevant guidelines:

- Characterise the existing baseline noise environment through environmental noise surveys
- Develop a 3D noise model of the study area and calculate noise levels for a baseline model to calibrate the model output

- Calculate the traffic noise levels at the nearest noise sensitive locations which are affected by the operation of the proposed N6 GCRR for the following scenarios:
  - Do-Minimum – Opening Year 2031 (i.e. proposed N6 GCRR is not built)
  - Do-Something – Opening Year 2031 (i.e. the proposed N6 GCRR is built)
  - Do-Minimum – Design Year 2046
  - Do-Something – Design Year 2046
- Assess the calculated noise levels for each scenario at the assessment locations to determine if the three conditions for noise mitigation have been met (Refer to Section18.2.2.2). The cumulative impact assessment is incorporated into the modelling scenarios for the various scenarios defined above.
- Where the three conditions for noise mitigation have been met, a review of potential noise mitigation measures is conducted for each assessment location to reduce noise levels to within the design goal, where practicable
- Determine the residual noise impacts taking into account the proposed mitigation measures at the sensitive locations along the route of the proposed N6 GCRR
- Characterise the residual noise impacts of the proposed N6 GCRR through reference to relevant criteria.

Noise Modelling

A computer-based prediction model has been prepared to quantify the traffic noise level associated with the operational phase of the Project and associated road traffic changes on the surrounding network. This section discusses the methodology behind the noise modelling process.

SoftNoise Predictor

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, SoftNoise *Predictor*, calculates traffic noise levels in accordance with the UK's Department of Transport, CRTN (1988) document and relevant TRL correction procedures for calculating L_{den}.

Predictor calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- The magnitude of the noise source in terms of sound power or traffic flow and average speed
- The distance between the source and receiver
- The presence of obstacles such as screens or barriers in the propagation path
- The presence of reflecting surfaces
- The hardness of the ground between the source and receiver

Prediction of Traffic Noise

Noise emissions during the operational phase of the Project have been modelled in *Predictor* using the CRTN methodology and the TRL 'Method 1' calculation procedure to calculate L_{den} values, using hourly traffic flows. The CRTN method of predicting noise from a road development consists of the following five elements:

- Divide the proposed road into segments so that the variation of noise within this segment is small
- Calculate the basic noise level at a reference distance of 10 metres from the nearside carriageway edge for each segment
- Assess for each segment the noise level at the reception point taking into account distance attenuation and screening of the source line

- Correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment
- Combine the contributions from all segments to give the predicted noise level at the receiver location for the whole proposed road.

Note that all calculations are performed to one decimal place. For the purposes of comparison with the design goal of 60dB L_{den}, the relevant noise level is to be rounded to the nearest whole number in accordance with TII guidance.

Model Inputs

The noise model was prepared using the following data:

- 3D road alignment drawings of the proposed N6 GCRR supplied by the design team
- 3D topographical contour data for the surrounding study area incorporating the noise sensitive assessment locations and existing road network
- background ordnance survey mapping
- buildings in the study area of the full extent of the Project
- the Annual Average Daily Traffic (AADT), % Heavy Goods Vehicles (HGV's) and traffic speeds computed for this updated EIAR

Traffic flow data was provided for the Do-Minimum and Do-Something scenarios for the Opening Year of 2031 and Design Year of 2046. (Refer to Chapter 6 of this updated EIAR, for traffic figures used in the modelling exercise).

The CRTN base noise emission for road traffic is based a Hot Rolled Asphalt (HRA) road surface. This surface is no longer a typical road surface used on national roads in Ireland and results in higher noise emission compared to the most commonly used road surfaces by TII across the national road network. In this instance, a road surface with a source correction of -2.5 dB compared to HRA has been included as standard within the base calculation and is therefore defined as a Low Noise Road Surface (LNRS). Two of the most common road surfaces, Stone Mastic Asphalt (SMA) 10 or 14 (SMA 10 or SMA 14) will achieve this correction against HRA.

The 2018 EIAR included this correction to the road surface as part of the noise mitigation strategy and hence there is no change in the ultimate proposals set out in this updated EIAR. The difference between the two assessments, is the inclusion of this surface correction as part of the base Do Something scenario.

Model Calibration and Validation

The purpose of noise model validation is to ensure that the software is correctly interpreting the input data and providing results that are valid for the scenario under consideration. It should be noted that the purpose of the model validation is not to validate the prediction methodology in use as the CRTN prediction methodology has itself been previously validated.

Given the nature of the scale of the proposed N6 GCRR in question, the most appropriate mechanism for calibration is standard to compare the output of the calculation model scenario, using the AADT traffic flows for the existing road network, with the measured L_{den} values at the unattended survey locations in the vicinity of the existing national road network. The reason for choosing those survey locations along the existing national road network for the purposes of calibration, is to ensure that the noise environment was dominated by road traffic noise during the survey period. Noise levels calculated at 9 unattended locations in proximity to existing roads are presented in Table 18.12 and compared against those measured during the baseline noise surveys. The variation in calculated noise levels is between 0 and ±1dB L_{den} at the assessment locations and hence is considered a strong correlation. It should be noted that the model results reflect road traffic noise only whereby the baseline noise environment has other contributing sources from other local roads, environmental conditions (leaf rustle, bird song etc.) industrial, commercial and or residential type sources, where relevant.

The results of the calibration are presented in Table 18.12.

Table 18.12 Model Calibration

Survey Location	Incident to Road	Measured L_{den}, dB	Model Predicted L_{den}, dB	Variation (dB)
R1c	R336 Bearna	65	64	1
R3a	Na Foraí Maola	45	44	1
R9c	N59 Moycullen Road	62	61	1
R11g	School Road	52	52	0
R12e	N83 Tuam Road	72	72	0
R13d	Monivea Road R339 East	62	62	0
R14a	N6 Bóthar na dTreabh	57	56	1
R14b	R446	64	65	-1
R17b	N84 Headford Road	56	56	0

Receiver Locations

Free-field traffic noise levels have been predicted at properties in the vicinity of proposed and existing roads. For single storey properties, noise levels are calculated to a height of 1.5m above ground. For multiple storey properties, the calculated noise level is made at the height of the most exposed window (e.g. first, second or third floor).

A total of 309 noise sensitive buildings were assessed as part of the considered in this assessment. This comprises 270 assessed as part of the 2018 EIAR and an additional 40 locations representing newly built properties, extensions to existing buildings (i.e. Castlegar School and Castlegar Nursing Home) and permitted but not yet constructed noise sensitive properties for this updated EIAR. For certain properties, receiver locations have been positioned at two or more locations around the building to assess noise levels associated with different facades facing different noise sources thus resulting in a total of 342 modelled receiver locations. The properties were selected based on proximity to the existing and proposed roads. The modelled locations represent the closest noise sensitive locations to the proposed N6 GCRR and along sections of the existing road network where traffic volumes are modelled to change as a result of the proposed N6 GCRR. Receptor locations were positioned at locations representing clusters or rows of properties where a number of noise sensitive buildings are in close proximity to each other.

The locations of all receptors are shown on Figure 18.1.01 to 18.1.15.

Model Output

The output of the model is a calculated traffic noise levels in terms of the L_{den} parameter at specific modelled receiver locations.

Four scenarios have been considered as follows:

- Year 2031 – Do-Minimum (i.e. proposed N6 GCRR is not built)
- Year 2031 – Do-Something (i.e. proposed N6 GCRR in place)
- Year 2046 – Do-Minimum
- Year 2046 – Do-Something

Criteria for Noise Mitigation

The calculated noise levels at each modelled location are reviewed and compared against the three criteria for noise mitigation set out in the TII noise guidance documents as included in Section 18.2.2.2.

Where modelled locations are determined to meet the three criteria, the use of noise mitigation has been recommended to reduce noise levels to within the relevant design criterion.

18.3 Receiving Environment

The receiving environment for the Project is a mixture of semi-rural and suburban lands on the fringes of Galway City. In the case of a road development, the selected noise-sensitive locations are those in closest proximity to the Project and those along existing roads which are being traversed by the Project. Both the construction and operational phases of the Project are reviewed when selecting appropriate measurement locations.

18.3.1 Summary of Survey Results

A summary of the measured and derived L_{den} values for each monitoring location is presented in Table 18.13. The baseline monitoring which are grouped in attended and unattended satellite locations are presented together for each area.

Full survey results for all attended and unattended survey locations, along with the derived L_{den} values, are presented in Appendix A.18.1.

Table 18.13 Summary of Baseline Survey Results

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
1c	Unattended	Along R336, Bearna	65	1a	Unattended	Along R336, Bearna	55
1a	Attended		60				
1d	Attended		67				
1e	Attended		66				
1f	Unattended	Na Foraí Maola	47	1g	Unattended	Na Foraí Maola	47
2d	Attended		48				
1b	Attended		44				
2c	Attended		43				
2b	Attended		44				
2a	Unattended		43				
2f	Attended		45				
3c	Attended	Na Foraí Maola	48	3a	Unattended	Na Foraí Maola	45
3e	Attended		46				
3a	Unattended		45				
2e	Attended		52				
3b	Attended		45				
3d	Attended		45				

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
3f	Attended		42				
4a	Unattended	Troscaigh	43	4a	Unattended	Troscaigh	41
4b	Attended		47				
4c	Attended		48				
4d	Attended		43	4g	Unattended	Troscaigh	49
4e	Attended		46				
4f	Attended		49				
5a	Unattended	Ballard West	50	5a	Unattended	Ballard West	49
5b	Attended	Ballard West	49				
5c	Attended	Ballard West	46				
5d	Unattended	Cappagh Road	52	5g	Unattended	Cappagh Road	59
5e	Attended	Cappagh Road	48				
5f	Attended	Cappagh Road	52				
6a	Unattended	Ballyburke / Ballymoneen Road	43	6e	Unattended	Ballymoneen Road	43
6b	Attended	Ballyburke / Ballymoneen Road	45				
6c	Attended	Ballymoneen Road	64				
6d	Attended	Ballymoneen Road	53				

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
6e	Attended	Ballymoneen Road	54				
7a	Unattended	Árd na Gaoithe, Ballymoneen	46	7g	Unattended	Árd na Gaoithe, Ballymoneen (adjacent property to 7a)	49
7b	Unattended	Rahoon Road	44	7e	Unattended	Rahoon Road	49
7c	Attended		57				
7d	Attended		58				
7e	Attended		51				
7f	Attended		64				
8a	Attended	Rosán Glas / N59 Link Road. Letteragh	45	8a	Unattended	Rosán Glas / N59 Link Road. Letteragh	48
8b	Attended		63				
8c	Unattended	Letteragh Road	51	8g	Unattended	Knocknabrona	42
8c	Attended		51				
8f	Attended		56				
8d	Unattended	An Chloch Scoilte	50				
8e	Attended		49				
8g	Unattended	Knocknabrona	47				

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
9a	Unattended	The Heath / Upper Dangan	54	9k	Unattended	The Heath / Upper Dangan (property to south of 9a)	51
9b	Unattended		47	9j	Unattended	The Heath / Upper Dangan (property to north east of 9b)	46
9d	Attended		58	9d	Unattended	The Heath / Upper Dangan	59
9e	Unattended		53	9m	Unattended	St. James National School - Playing pitches (south of monitoring location 9e)	57
9f	Attended	Upper Dangan / N59 Moycullen Road	71				
9c	Unattended		62				
9g	Attended	N59 Moycullen Road	64				
9h	Unattended	Knockadoney	56	9l	Unattended	Knockadoney (property opposite monitoring location 9h)	55
9i	Attended	St. James' Church / N59 Moycullen Road	58				
18f	Attended	N59 Moycullen Road	71				
18e	Attended	N59 Moycullen Road	68				
18b	Attended	N59 Moycullen Road	63				

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
18c	Attended	N59 Moycullen Road	66				
10a	Unattended	Aughnacurra	53	10i	Unattended	Property adjacent to monitoring position 10a	47
10h	Attended	Aughnacurra	51				
10b	Attended	UoG Sporting Campus	52	10b	Unattended	UoG Sporting Campus	55
10c	Unattended	Dangan House	49				
10d	Unattended	Menlo / Coolough	51	10j	Unattended	Property to the north of monitoring position 10d within Menlo / Coolough	50
10e	Attended	Menlo / Coolough	47				
10f	Attended	Menlo / Coolough	54	10k	Unattended	Property to the north-east of monitoring position 10f within Menlo / Coolough	49
10g	Attended	Coolough Road	63				
11a	Unattended	N84 Headford Road	54	11j	Unattended	Property to the north of monitoring position 11a along N84 Headford Road	62
11b	Attended		66				
11c	Attended		78				
17b	Unattended		56				
17a	Attended		77				
11d	Unattended	Bóthar an Chóiste / Castlegar	47	11d	Unattended	Bóthar an Chóiste / Castlegar	48
11f	Attended	Bóthar an Chóiste / Castlegar	50				

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
11e	Attended	Bóthar an Chóiste / Castlegar	54				
12b	Attended	School Road- Castlegar	45				
11g	Unattended	School Road - rear of house	52	11k	Unattended	Castlegar / School Road (rear garden of residential property)	57
11h	Attended	School Road - front of house	56				
11i	Attended	School – Castlegar, front of building	63				
12c	Attended	School Road South (close to road)	67				
12a	Unattended	N83 Tuam Road Junction South	61	12f	Unattended	Property adjacent to monitoring location 12a off N83 Tuam Road	58
12g	Attended	N83 Tuam Road Junction South	46				
12d	Attended	N83 Tuam Road Junction North	48				
12e	Unattended		72				
16a	Attended	N83 Tuam Road North	77				
16b	Attended	N83 Tuam Road North	65				
16c	Attended	N83 Tuam Road North	68				
13a	Unattended	Ballybrit, Racecourse Avenue	50	13i	Unattended	Galway Racecourse (residential property)	55

2016 / 2017 Surveys				2023 / 2024 Surveys			
Location Reference	**Survey Type**	**Location**	**Calculated Lden**	**Location Reference**	**Survey Type**	**Location**	**Calculated L_{den}**
13b	Attended	Ballybrit,	57				
13c	Unattended	Ballybrit Crescent	57	13c	Unattended	Ballybrit Crescent	56
13d	Unattended	R339 Monivea Road East	62				
13e	Attended	Briarhill N6 Coolagh Junction	61				
13f	Attended		63				
13g	Attended		66				
13h	Unattended	Galway Racecourse, Ballybrit	53 - 63	13h	Unattended	Ballybrit, Racecourse Avenue	55
14a	Unattended	Coolagh, east of N6 Coolagh Junction	56	14a	Unattended	Coolagh, east of N6 Coolagh Junction	57
14c	Attended		50				
14e	Attended		48				
14b	Unattended	R446 Doughiska - Galway Clinic	64				
15a	Attended	N6 South of Ballybrit – The Meadows Estate, on green	54				
15b	Attended	Along Monivea Road	72				
15c	Attended	South of existing N6 on green	61				

18.3.2 Discussion of Baseline Environment

The results of the baseline surveys indicate the range of noise levels measured across the extent of the study area. The receiving environment for the Project is described on a section-by-section basis with reference to the chainage along the proposed N6 GCRR below.

18.3.2.1 R336 Coast Road to Cappagh Road (Ch. 0+000 – 4+450)

At the western end of the Project at properties along the R336 Coast Road, noise levels are dominated by traffic flows along this road. Noise levels were measured in the range of 55 to 67 dB $L_{den,}$ the main difference in the measured levels being the proximity to and line of sight from the road of the monitoring position. The monitoring results between 2016 and 2024 at Monitoring Location 1a are within 5 dB and the difference in monitoring data relates to different monitoring positions within the grounds of the property and the unattended versus attended data. Road traffic along the R336 and Cappagh Road were the dominant noise sources.

Within Na Foraí Maola, residential properties are set back from heavily trafficked roads such as the R336 Bearna Road at distances of approximately 200m to 1km and are influenced predominately by local passing traffic, local activities within the residential areas and environmental sources including bird song, leaf rustle etc. Noise levels were measured in the range of 42 to 52 dB L_{den} at the surveyed locations. The higher noise levels measured in this area were typically associated with intermittent local sources during the surveys, e.g. local deliveries to properties (post-delivery, oil deliveries, garden activities etc.). The monitoring results between 2016 and 2024 at monitoring location 1f and new adjacent location 1g measured the same value. At monitoring Location 3a, results between 2016 and 2024 are the same, indicating no significant change in the prevailing noise environment within this area.

Surveyed locations in the vicinity of Troscaigh and Ballard West were measured in the range of 41 to 50 dB $L_{den.}$ The monitoring results between 2016 and 2024 at Monitoring Location 4a are within 2 dB(A). A new monitoring location 4g within Troscaigh measured 49 dB L_{den}. The measured noise level at this location is in line with similar monitoring locations during the 2016 survey. The monitoring results between 2016 and 2024 at Monitoring Location 5a are within 1 dB(A). Noise levels at the surveyed locations were noted to be influenced by passing traffic along the local roads in proximity to the monitoring positions in addition to local activities within gardens and bird song during both rounds of surveys in this area. The survey results between 2016 and 2024, indicating no significant change in the prevailing noise environment within this area.

18.3.2.2 Cappagh Road to Rahoon Road (Ch. 4+450 – 6+650)

Noise monitoring locations within the gardens of properties in the vicinity of Cappagh Road, Ballymoneen Road and Árd Na Gaoithe in Ballymoneen set back from passing traffic were measured in the range of 43 to 45 dB $L_{den.}$ Noise levels at property facades located along the Cappagh and Ballymoneen Roads, were of the order of 52 and 59 dB L_{den}. An additional monitoring location was surveyed in this area at Location 5g, along the Cappagh Road which measured 59 dB L_{den}.

The 2024 monitoring results at location 6e are 11dB(A) lower than the 2016 survey. This relates to the 2024 monitoring position located to the rear of the property, set back from the Ballymoneen Road, versus the attended 2016 monitoring position located to the front of the house. An additional monitoring location was surveyed in this area at Location 7g, within rear garden of Árd na Gaoithe, at property adjacent to monitoring position 7a. Measured levels were 3 dB higher during the 2024 survey at this location and were noted to be influenced by some construction works in the area.

The highest noise level measured in this area was at monitoring location 6c which was measured at the front gate of a property along the footpath of Ballymoneen Road which was dominated by passing traffic. An L_{den} noise level of 64 dB was measured at this location.

Surveyed properties along the Rahoon Road were measured in the range of 44 to 64 dB $L_{den.}$ At survey locations set back from the existing road and screened from passing road traffic by the property buildings, noise levels were measured in the range of 44 to 51 dB L_{den}. The monitoring results between 2016 and 2024 at monitoring location 7e are within 2 dB(A).

At locations located in closer proximity to the existing road, noise levels were in the range of 57 to 64 dB $L_{den,}$ the higher noise level being recorded at location 7f which was noted to be influenced by passing road traffic.

18.3.2.3 Rahoon Road to N59 Moycullen Road (Ch. 6+650 – 8+550)

Noise levels at two areas in the vicinity of Rosán Glas within Letteragh were surveyed. At survey location 8a an attended L_{den} value of 45 dB(A) was derived during the 2016 survey at the side of the property. During the 2024 survey an unattended survey was undertaken at the rear of the property and measured 48 dB L_{den}. Noise levels at this location were influenced mainly by intermittent passing vehicles entering the estate along Bóthar Diarmuida and bird song. During the 2024 survey, distant construction and resident activities also contributed to the measured noise levels. At location 8b passing traffic was noted to be significantly more frequent and the monitoring location closer to the road side. In addition, a greater level of local estate activities was noted resulting in noise levels of 63 dB L_{den} being measured at this location.

Noise levels measured in the vicinity of Letteragh Road and Knocknabrona (survey locations 8c to 8g) were measured in the range of 42 to 56 dB L_{den}. The 2024 monitoring results at location 8g are 5dB(A) lower than the 2016 survey. Local activities in the vicinity of this property are the dominant influence on measured noise levels which will fluctuate over a given survey period. Similar to the above areas, at survey locations set back from passing road traffic, lower noise levels were measured, typically in the range of 42 to 51dB L_{den} which were noted to be influenced by distant and intermittent passing traffic and bird song. The highest noise level of 56 dB L_{den} was measured at location 8f due to the proximity and line of sight to passing road traffic.

In the vicinity of the proposed N59 Letteragh Junction and proposed River Corrib Bridge, noise levels varied at the surveyed locations depending on their distance to existing road traffic. At monitoring locations within The Heath and Knockadoney within Upper Dangan (9a to 9d), noise levels were measured in the range of 47 to 56 dB L_{den}. A new monitoring location 9k measured south of monitoring location 9a was surveyed in 2024. The measured L_{den} at this location was 51 dB L_{den}. A new monitoring location 9m measured south of monitoring location 9e within the grounds of St James National School was surveyed in 2024. The measured L_{den} at this location was 57 dB L_{den}. At all locations road traffic from the N59 Moycullen Road and birdsong was noted to be the main noise sources noted.

Higher noise levels were recorded at properties located closer to the N59 Moycullen Road (i.e. location 9d & 9c) measuring noise levels in the range of 59 to 62 dB L_{den}. The 2024 monitoring results at location 9d are 1dB(A) higher than the 2016 survey.

Properties directly accessing the N59 Moycullen Road (9g, 9f, 18a, 18b, 18c, 18e and 18f) measured highest noise levels in this area, ranging between 63 to 71 dB L_{den} depending on the proximity of the measurement position to the existing road.

18.3.2.4 N59 Moycullen Road to Menlough (Ch. 8+550 – 11+000)

In the vicinity of UoG Sporting Campus and Aughnacurra (10a, 10b, 10c, 10h and 10i), measured noise levels were recorded in the range of 47 to 55 dB L_{den} which were noted to be influenced predominately by distant road traffic, grounds works, birdsong and plant noise from an adjacent business campus.

The 2024 monitoring results at location 10b within UoG grounds are 3 dB(A) higher than the 2016 survey. At monitoring position 10i, (a new unattended monitoring position within the garden of an adjacent property to 10a), noise levels measured 47 dB L_{den} which were 6 dB (A) lower than those at location 10a during the 2016 survey. Dog barking was noted as a contributor during the 2016 surveys in the garden of the residential property which is likely the main factor between the two data sets.

Noise levels recorded in the vicinity of Menlough and Coolough (locations 10d, 10e, and 10f) were the range of 47 to 54 dB L_{den} which were noted to be influenced by intermittent traffic, bird song, dog barking and leaf rustle.

An additional survey location 10j was installed within grounds of a property north of monitoring position 10d. The measured noise level was within 1 dB (A) at the two locations, measuring 50 and 51 dB L_{den} respectively.

An additional survey location 10k was installed within grounds of a property during the 2024 survey north-east of the original monitoring position 10f. The measured noise level was 5 dB (A) lower at monitoring location 10k due to its location some 60m further back from the Coolough Road.

Highest noise levels were recorded at Location 10g (63 dB L_{den}) due to the proximity of the monitoring location along the Coolough Road.

18.3.2.5 Menlough to N83 Tuam Road (Ch. 11+000 – 14+450)

To the east of Coolough the proposed N6 GCRR passes through a more built up environment crossing a number of main routes into Galway City, namely the N84 Headford Road, N83 Tuam Road and existing N6.

In the vicinity of the N84 Headford Road and proposed new junction, noise levels were measured in the range of 54 to 77 dB L_{den}. Noise levels of 54 and 56dB L_{den} were recorded at the unattended monitoring positions located to the rear and side of properties set back from the N84 Headford Road (locations 11a and 17b). A new monitoring position 11j was located in garden of property along the Headford Road and measured an L_{den} value of 62 dB $L_{den.}$

Higher noise levels were measured to the front of properties facing directly into the existing road with survey locations 17a and 11c recording highest levels due to their close proximity to the existing road.

Within the area of Castlegar, noise levels were measured in the range of 45 to 54 dB L_{den} which were noted to be influenced by road traffic from School Road, the N84 Headford Road and from passing local traffic. Properties located off School Road measured noise levels in the vicinity of 63 to 67 dB L_{den} when measured at the property boundaries in close proximity to the existing road. At monitoring locations set back from the road edge, noise levels measured 56 dB L_{den} (11g) and were lower again at the rear of properties along this road shielded by road traffic noise (11g), measuring 52dB L_{den}.

A repeat survey was undertaken at monitoring location 11d during 2024. Noise levels were within 1 dB(A) between the 2016 and 2024 surveys at this location.

An additional survey location 11k was installed within the garden of a property off School Road within Castlegar. The measured noise level was 57 dB L_{den} at this location and is in line with measured noise level at adjacent properties in the area.

Noise surveys undertaken at properties in the vicinity of the proposed N83 Tuam Road Junction were predominately influenced by traffic along the N83 Tuam Road. Monitoring locations fronting properties along this existing road were in the range of 61 to 77 dB L_{den} (locations 12a, 12e, 16a, 16b and 16c).

An additional survey location 12f was installed within the garden of a property off N83 Tuam Road. The measured noise level was 58 dB L_{den} at this location and is in line with measured noise level at adjacent properties in the area.

Lowest noise levels in this area were recorded at location 12d (48 dB L_{den}) which is set back from the N83 Tuam Road and was shielded from the road traffic by local topography.

18.3.2.6 N83 Tuam Road to Coolagh Junction (Ch. 14+450 - 17+500)

Noise surveys conducted in the area of Ballybrit and Briarhill ranged between 50 and 57dB L_{den} (locations 13a, 13b, and 13c). Higher noise levels were recorded at locations 13b and 13c due to their proximity to road traffic from Ballybrit Crescent and local passing traffic.

Within Galway Racecourse, noise levels recorded at location 13h during 2016 represent those when no race activity was taking place. This represents lowest noise levels in this area when the facility is typically not in use. Noise levels were measured in the range of 53 to 63 dB L_{den} over a 5 day monitoring period. A repeat survey was undertaken during 2023 adjacent to the existing stable buildings. The dominant source of noise noted at this location was vehicular movements within the racecourse grounds, activities within the adjacent carpark and distant traffic. The measured L_{den} at this location was 55 dB L_{den}

A new monitoring location, 13i was recorded during the updated round of surveys in 2023. The monitoring position was located within the garden of a residential property within the north-west of the racecourse. The

dominant noise at this location was distant road traffic from the N83 Tuam Road, aircraft overhead and local activities adjacent to the property. The measured L_{den} at this location was 54 dB L_{den}.

At surveyed locations along the R339 Monivea Road and the existing N6 in the vicinity of the Ballybrit and Doughiska (locations 13d, 13e, 13f, 13g, 14b), noise levels were measured in the range of 61 to 66 dB L_{den} which were all influenced by passing road traffic.

To the east of the proposed Coolagh Junction within Coolagh (locations 14a, 14c and 14e), noise levels were measured in the range of 48 to 56 dB $L_{den.}$ The dominant sources at these locations were noted to be road traffic and birdsong. An unattended noise survey was undertaken at Location 14a in 2024 which recorded an L_{den} value of 57 dB(A). This value is 1 dB higher than the 2016 survey at this location.

At survey locations along the R339 Monivea Road to the south of the existing N6 (locations 15a, 15b and 15c) noise levels were measured in the range of 54 to 72 dB $L_{den.}$ Lowest noise levels were measured at location 15a which was positioned within a green area fronting houses within The Meadows Estate which was shielded from road traffic. Highest noise levels were recorded at locations 15b due high volumes of traffic passing along the R339 Monivea Road in addition to the existing N6.

18.3.3 Summary of Noise Survey Results

The results of the baseline noise survey indicate that the noise environment varies across the Project depending on the surrounding noise sources. In general, properties facing directly onto existing roads are dominated by road traffic and experience noise levels in excess of 60dB L_{den}. Properties in more rural settings set back from road traffic experience noise levels typically in the range of 42 to 50 dB L_{den} depending on local sources in the vicinity.

The variation in the prevailing ambient noise levels between 2016/2017 surveys and the updated 2023/2024 surveys show a minor difference when compared against the same monitoring conditions. Variations in measured noise levels are noted to be influenced by the position of the monitoring equipment (closer to or set back from road traffic) or from localised temporary sources in the area (e.g. from construction activities).

A notable variation in ambient noise levels were measured along Cappagh Road, corresponding to the noted increased traffic flows along this road. For the most part, the prevailing noise environment described in the 2018 EIAR is largely unchanged compared to the current scenario within a tolerance of 1 to 2 dB. For the most part, therefore the prevailing noise environment described in the 2018 EIAR is largely unchanged compared to the current scenario.

The range of noise levels measured during the baseline surveys are found to be represent an accurate representation of the baseline noise environment at properties likely to be affected by the Project.

18.4 Characteristics of the Project

A detailed description of the Project and construction activities are provided in Chapter 5, Project Description and Chapter 7, Construction Activities.

There are five phases in the Project as set out below. The main characteristics of the Project of relevance to the noise and vibration assessment are outlined under construction and operation phases. Phase 2 comprises the most significant characteristic of the Project.

18.4.1 Construction Phase

18.4.1.1 Phase 1 Construction Phase

Phase 1 includes the construction of a temporary stableyard including horsebox parking, machinery shed, maintenance shed, ESB substation, two wells, new pre-parade ring and pavilion on Galway Racecourse lands (Approval for which was granted by Galway City Council in December 2024 Planning Ref. No.:24/60279).

It does not form part of the Section 51 Application however it does form part of the overall Project that has been considered and assessed for EIA and AA purposes and is assessed in this chapter.

The temporary stables construction will comprise:

- Cut and fill earthworks to level land at the site
- Laying of base material and flooring
- Construction of pre-cast concrete stable and washroom units, loading bays, retaining walls, pavilion, machinery shed, maintenance shed, pre-parade ring and ESB sub-station
- Additional access roads

18.4.1.2 Phase 2 Construction Phase

Phase 2 will include the following:

- The provision of the proposed N6 GCRR in two stages which will take place concurrently:
  - Stage A - N6 Coolagh Junction to N59 Letteragh Junction
  - Stage B - N59 Letteragh Junction to R336 west of Bearna
- Existing stableyard to be demolished, including existing machinery shed
- Existing commercial building on lands to the north of the Galway Racecourse to be demolished and the site cleared
- Existing horse box parking off Racecourse Avenue to be demolished, including removal of existing access arrangement to the Ballybrit graveyard, to accommodate the Galway Racecourse Tunnel as part of the proposed N6 GCRR

In addition to the earthworks construction the main activities will involve the following:

- Road Works – sub-base and base construction, bituminous pavement, surfacing
- Drainage – the installation of pipe culverts, filter drains, linear grassed channels and wetlands
- Structures – the construction of retaining walls, piling works, construction of bridges and viaducts including their foundations, piers, abutments and the installation of large beams and other reinforced concrete works
- Tunnels – the construction of a mined tunnel and a cut and cover tunnel
- Blasting – excavation of rock for cuttings and tunnels. (See also Chapter 9, Soils and Geology)
- The diversion and construction of utilities and services
- Ancillary roadworks including the installation of safety barriers, signage and road marking
- Accommodation works for landowners such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services
- Temporary traffic management

18.4.1.3 Phase 3 Construction Phase

Phase 3 of the Construction phase does not form part of the Section 51 Application however it does form part of the overall Project that has been considered and assessed for EIA and AA purposes and is assessed in this chapter. Works undertaken as part of Phase 3 will include the construction of the new permanent stableyard including horsebox parking post-handover of the proposed N6 GCRR (Approval for which was granted by Galway City Council in December 2024 Planning Ref. No.:24/60279).

The works involved in constructing the permanent stables will be similar to those involved in constructing the temporary stables.

18.4.1.4 Phase 4 Construction Phase

Phase 4 of the Construction phase does not form part of the Section 51 Application however it does form part of the overall Project that has been considered and assessed for EIA and AA purposes and is assessed in this chapter.

Works undertaken as part of Phase 4 will include demolition of the temporary stableyard constructed in Phase 1 and the reinstatement of the site of the temporary stableyard as car parking. It also includes for retention of the ESB sub-station, pavilion, machinery shed, maintenance shed and pre-parade ring.

The main construction activities during this phase will involve the following:

- Demolition of concrete structures and other buildings
- Clearing demolished materials from site
- Providing suitable surface for car parking

The works involved in Phase 4 will be similar to those involved in Phase 1 and 3.

18.4.1.5 Construction Phase Assessment

The key construction phases with the potential for significant effects associated with the Project will involve ground breaking, earthworks and earthworks haulage, drainage works, construction of drainage ponds, surfacing works, construction of tunnels, bridges, overpasses and structures, as well as the movement of machinery and materials within and to and from the construction compounds and along local roads.

A variety of items of plant will be in use during these construction works all of which have the potential to generate high levels of noise and potential levels of perceptible vibration. These will include breakers, rock drills, excavators, dump trucks, and generators in addition to general road surfacing and levelling equipment.

Blasting of bedrock will also be required on certain sections of the Project depending on the ground conditions and the required depth of excavations. Chapter 7, Construction Activities provides a full description of the proposed construction phasing and works for the Project.

It is envisaged that an east to west build will be adopted for the construction of the proposed N6 GCRR (Phase 2). The construction of the proposed N6 GCRR has been sub divided into 15 sub sections. Sections may be completed simultaneously and combined in certain areas. Specific details relating to chainages, estimated construction duration and any working constraints in each is described in Chapter 7, Construction Activities.

In general, road building works by their nature are transient in nature as the works progress along the length of the route of the proposed N6 GCRR. This includes excavation and fill works, structures, and road completion works. Site compounds will be set up typically at the commencement of the works and remain in place until all construction in the area is completed.

The construction period for the Project is estimated to take 60 months. Phase 1 is likely to be completed in 12 months and will be undertaken in advance of Phase 2. Phase 2 has an estimated construction duration of 36 months. A period of 12 months is estimated for Phases 3 to 4 which will follow Phase 2.

Typical working hours during the construction of the Project are:

- 0700 - 1900 Monday – Friday
- 0700 - 1600 Saturday

It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the Project. There may be some periods where 24hr work and supervision is required. Over the expected 36-month construction phase the proposed N6 GCRR (Phase 2 of the Project), there will be up to 10 weeks of night time working along different sections of the proposed N6 GCRR primarily to facilitate bridge works over existing roads. There is no night-time construction works proposed for Phases 1, 3, or 4.

The potential noise and vibration impacts associated with the construction of the Project are set out within Section 18.5.3.

18.4.2 Operational Phase

The temporary stables constructed during Phase 1 of the Project will be operational during Phases 2 and 3. The proposed N6 GCRR constructed during Phase 2 of the Project will be operational during Phases 3, 4 and 5. The permanent stables constructed during Phase 3 of the Project will be operational during Phases 4 and 5. Phase 5 is the operational phase of the Project where the proposed N6 GCRR and the permanent stables will be operational.

The operational phase for the proposed N6 GCRR will involve a new road alignment, junctions, overpasses, tunnels and bridges. The proposed N6 GCRR will introduce traffic noise to areas which are not currently exposed to any significant level of road traffic, particularly at properties set back from existing local roads in rural settings. The character of the noise environment will be altered at properties where intermittent traffic forms part of the noise environment to a more continual source of noise as a result of the operational phase. In addition to the above, the proposed N6 GCRR will divert traffic flows from sections of existing roads across the city and hence, will result in a reduction in traffic noise along sections of these roads once operational.

With regards to the operation of the temporary and permeant stables and associated infrastructure, the operational noise impacts will be negligible. This element of the Project, while re-routing access routes and creating a slightly different set up to what currently exists, will not increase the traffic or capacity of Galway Racecourse, and therefore the likely impacts of noise and vibration when the racecourse resumes normal operation, post construction, will not be altered.

The operational phase will be of long-term duration and will alter the existing noise environment at properties in proximity to the proposed N6 GCRR and along existing roads to different extents.

The potential impacts associated with the operation of the Project are set out within Section 18.5.4.

18.5 Evaluation of Effects

18.5.1 Introduction

The potential impacts of noise and vibration as a result of the Project will vary depending on the proximity of sensitive locations to the proposed road alignment, the noise levels in an area and the duration of the impacts considered. During construction, potential noise and vibration impacts will be more significant compared to the operational phase but the duration will be temporary to short-term in nature. The operational phase will result in long-term effects but the significance of which will vary depending on the sensitivity of the existing environment and the magnitude of change against the Do-Minimum scenario, and the absolute noise levels under consideration.

18.5.2 Do-Nothing Effect

The Do-Nothing impact of the Project assumes the proposed N6 GCRR and the proposed development at Galway Racecourse are not built and traffic management plans within the Galway City area are not in place. In line with traffic growth factors, traffic volumes will continue to increase along the existing routes accessing Galway City as part of the Do-Nothing Scenario. From a noise point of view, this has the potential to result in increased noise levels over and above the current scenario at properties located along the main national and regional roads. At properties set back from trafficked roads, noise levels measured as part of the baseline survey are expected to remain broadly similar. Noise levels at properties identified within the PIAs for noise management within the Draft Galway City NAP (2024 – 2028) will remain above the threshold noise levels for noise management and have the potential to experience further increase in traffic noise levels over time as a result of increased traffic volumes.

18.5.3 Potential Construction Effects

18.5.3.1 Noise

As per the TII Noise Guidelines 2004 and 2014, indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in BS 5228-1 (2009+A1:2014). This standard sets out sound power and sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels. However, it is not possible to conduct

detailed accurate prediction calculations for the construction phase of the Project in support of this updated EIAR due to the limitations previously discussed in Section 18.2.5.1.

The following section discusses typical noise levels associated with road construction activities and comments on potential noise impacts across the Project. It is noted the construction methodologies and associated calculated construction noise levels are predominately unchanged compared to the 2018 EIAR. This updated EIAR includes all five phases of the Project. This updated EIAR has also expanded the section describing the significance of effects for construction noise and vibration referring to the relevant updated guidance from DMRB Noise and Vibration (2020) and EPA EIAR Guidelines (EPA 2022).

Intrusive Works and High Noise Activities

Reference to BS 5288:2009+A1 2014: Part 1 indicates that highest noise levels are associated with activities associated with rock breaking, rock drilling, rock crushing and some impact piling works. Noise levels from these activity types are typically in the range of 85 to 95dB L_{Aeq} at 10m. All of the above activities will be required as part of the construction of the Project.

For construction activities associated with rock extraction and processing, a total construction noise level of 93dB L_{Aeq}, at 10m has been used for the purposes of indicative calculations. This would involve for example, 1 item of plant at 90dB L_{Aeq} and 3 items of plant at 85dB L_{Aeq} operating simultaneously within one work area which is considered a worst-case scenario.

Utilities, Bulk Excavation, Bridge Works & Road Works

For construction works associated with activities such as site clearance, excavation, and fill, bridge works etc. including excavators, loaders, dozers, cranes, generators, concreting work, auger or hydraulic sheet steel piling etc. noise levels are typically in the range of 68 to 80dB L_{Aeq} at 10m.

For ongoing construction activity associated with the above activities, a total construction noise level of 85dB L_{Aeq} at 10m has been used for the purposes of indicative calculations. This would include, for example two items of plant at 80dB L_{Aeq} and three items of plant at 75dB L_{Aeq} operating simultaneously within one work area.

Compounds and Lower Noise Activities

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

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

The closest properties to the Project which are not being acquired or demolished are at distances of approximately 20m. Remaining properties are located at distances of 50 to >300m from different work phases.

Table 18.14 presents the calculated noise levels at distances between 20 and 250m representing the closest noise sensitive properties to the construction works. The calculations assume that plant items are operating for 66%[2] of the time and do not include any attenuation from screening of site hoarding, road cuttings, buildings or structures, hence relate only to distance attenuation over hard ground. These are unchanged from the 2018 EIAR.

[2] This estimate that assumes that the plant will operate a full 8-hour shift over the proposed 12 hour working period which equates to a 66% on time over a daytime period or 40 minutes over a 1-hour period. The dynamic nature of construction sites is such that this is deemed to be a conservative estimate, particularly for breaking and drilling work.

Table 18.14 Indicative Construction Noise Calculations at Varying Distances

Construction Activities	Combined L_{Aeq} at 10m	Calculated Noise Level at Increasing Distances					
		20m	50m	80m	100m	150m	250m
Rock Breaking / Drilling / Rock Crushing / Impact Piling	93	85	77	73	71	68	63
Site Clearance Utilities Excavation & fill Structures Road Works	85	77	69	65	63	60	55
General site work	78	70	62	58	56	52	48

The reference values outlined in Table 18.14 indicate that for construction activities with highest noise levels (L_{Aeq} up to 93dB at 10m), the daytime construction noise limit value of 70dB L_{Aeq} Monday through Friday (07:00 to 19:00hrs) is likely to be exceeded at distances of up to 100m from the works boundary in the absence of any noise mitigation. Evening and weekend construction noise limits would be exceeded at distances up to 250m in the absence of noise mitigation. Noise mitigation will therefore be required to reduce construction noise levels from this type of activity during all periods at the closest properties.

During normal road construction works including site clearance, bulk excavation, structures etc. with site works up to 85dB L_{Aeq} at 10m, the daytime construction noise limit value of 70dB L_{Aeq} Monday through Friday (07:00 to 19:00hrs) is likely to be exceeded at distances of up to 50m from the works boundary in the absence of any noise mitigation. Evening and weekend construction noise limits would be exceeded at distances up to 150m in the absence of any mitigation. Noise mitigation will therefore be required to reduce construction noise levels from this type of activity, particularly during any scheduled evening and weekend works.

During general site work with lower noise emissions (L_{Aeq} up to 78dB at 10m) the daytime construction noise limit value of 70dB L_{Aeq} Monday through Friday (07:00 to 19:00hrs) can be complied with at distances of 20m and beyond. Evening and weekend construction noise limits would be exceeded at distances up to 80m in the absence of any mitigation. Noise mitigation will therefore be required to reduce construction noise levels from this type of activity, specifically during any scheduled evening and weekend works.

It should be noted that the calculations set out in the above tables are indicative and are used for the purposes of comparison only with the adopted criteria. Where exceedance of the recommended criteria is expected, the use of noise mitigation measures will be used as part of the construction works. Further details are set out in Section 18.6.2.

In line with the TII 2004 and 2014 Noise Guidelines, assessment of construction noise impacts for areas of major earthworks, blasting, piling (depending on the method to be used) and structures should be identified. In addition, given two tunnel sections form part of the proposed Project, discussion of these areas should be included also. These are discussed in turn below.

Major Earthworks

Areas of major earthworks are associated with large cuttings and embankment construction involving activities including excavation works, drill and blast techniques, rock crushing and fill works.

There are no major earthworks associated with Phases 1, 3 and 4 of the Project that would give rise to any significant noise or vibration impacts outside of the racecourse boundary. Major earthworks associated with the Project will take place during Phase 2, during the construction of the proposed N6 GCRR. Each of the construction section for Phase 2 (as shown on Figures 7.001 and 7.002) are discussed below with the resultant impacts without mitigation discussed in Table 18.15.

Construction Section S1 - R336 Baile Nua to Aille

The proposed N6 GCRR in this section is largely at-grade or in slight fill and hence will not involve major earthworks. The Aille Road L5384 will be raised by c. 4m as the mainline will cross under the local road and will be in a cutting. The main access to this site will be from the R336 at Baile Nua and L-1321 Bearna to Moycullen Road. There are NSLs within 50m and greater from this working area (excluding those to be acquired) and construction noise levels can likely operate within the CNT during daytime periods but potentially exceed the Saturday CNT without mitigation.

Construction Section S2 - Aille to Ballymoneen Road

Construction of the mainline of the proposed N6 GCRR below the Aille Road L5384 will require a substantial amount of material excavation most likely using drill and blast techniques. Given the extent of the work in this area, it is likely that excavated material will be segregated, graded and crushed using mobile plant items within the excavated area. The closest NSL to these works is approximately 30m north of the earthworks cutting boundary with other properties at distances in excess of 80m. The closest NSLs to the other road works involving excavation and fill, and standard road works are of the order of 30 to 60m. During the early stages of construction involving excavation in this area including drill and blast, crushing and excavation works, the daytime CNT will be exceeded in the absence of mitigation at the closest property within 30m. As the excavation works progress, the lowered ground level and screening from the cutting will reduce noise levels at the closest NSLs. The use of specific noise mitigation measures will be applied in this area therefore including scheduling of works, choice of plant, screening etc. Further discussion on mitigation measures are discussed in Section 18.6.2.

Construction Section - S3 and S4 - Ballymoneen Road to Letteragh Junction and Letteragh Junction to Rahoon Road (N59 Link Road South & Gort na Bró Upgrade)

Construction of the Letteragh Junction and approach roads will require a substantial volume of engineering fill and an element of cutting for slip roads. Closest NSLs are between 50m and 60m from these junction works. The closest NSLs are likely to experience construction noise levels within the CNT for daytime periods. During weekend daytime periods, the CNT has the potential to be exceeded without mitigation.

Construction of the N59 Link Road South consists of 930m single carriageway in both directions. Due to undulating landscape in the area the lengths of cut and fill vary. The section going from north to south is largely in cut for c.300m and rises to an at-grade signalised junction at Letteragh Road, then continues on embankment for c.200m and lowers to at-grade again to join with the Rahoon Road. The closest NSLs to this link road construction are within 25m of the edge of the works and are likely to experience construction noise levels above the CNT for daytime and Saturday periods without mitigation.

Construction Section S5 - N59 Letteragh Junction to N59 Moycullen Road (N59 Link Road North)

Construction of the N59 Link Road North involves deep excavation towards the N59 Moycullen Road tie in, therefore a substantial volume of soil and rock excavation will be required which will likely require drill and blasting excavation. Closest NSLs are approximately 50m from the excavation works. Whilst significant excavation works will take place within the cutting area, it is proposed that crushing and regrading works will take place within site compound (SC07/01) located along the N59 link Road North, set back at distances of greater than 250m from NSLs. In the absence of specific noise mitigation measures, it is likely that the CNT for weekday and Saturday periods will be exceeded during the early stage excavation works at ground level and in shallow cut, specifically during the intermittent use of high noise activities (rock drilling, breaking, if required). It is noted that the use of drill and blast methodologies proposed in this area, will however reduce the requirement or duration for breaking activities. As the works progress vertically into the cutting, a significant element of screening will be afforded by the cutting face itself, and construction levels will be reduced by the order of 10dB or greater once the line of sight is screened. The use of specific noise mitigation measures will be applied in this area therefore including scheduling of works, choice of plant, screening, monitoring etc. Further discussion on mitigation measures are discussed in Section 18.6.2.

Construction Section S6 - N59 Letteragh Junction to River Corrib

Construction of the N59 Letteragh Junction involves an extensive area of cuttings which will likely require drill and blast excavation. The closest NSLs are approximately 25m from the excavation works. Whilst significant excavation works will take place within the cutting area using drill and blast techniques, it is

proposed that crushing and regrading works will take place within the adjacent site compound (SC07/01) located along the N59 link Road North, set back at distances of greater than 250m from noise sensitive properties. Taking account of the proposed major earthworks in this construction section and the proximity of NSLs to the drill and blast and excavation works, the construction noise limits during, day, evening and weekend periods will be exceeded during the early stage works when activities are occurring at ground level and shallow cut areas, specifically during the intermittent use of high noise activities (rock drilling and breaking). It is noted that the use of drill and blast methodologies proposed in this area, will however reduce the requirement or duration for breaking activities. As the works progress vertically into the cutting, a significant element of screening will be afforded by the cutting face itself, and construction levels will be reduced by the order of 10dB or greater once the line of sight is screened. The use of controlled noise mitigation measures will be required in this area to reduce construction noise levels at the nearest noise sensitive locations. Further discussion on mitigation measures is discussed in 18.6.2.

Construction Section S10 - Menlough Viaduct to Lackagh Tunnel

Construction Section S10 involves construction of a large embankment connecting to the Menlough Viaduct. Moving east, construction of the proposed N6 GCRR will involve a deep cutting as it approaches the Lackagh Tunnel. A combination of retaining systems will be required along the Western Approach and above the western tunnel portal at Lackagh Tunnel (Ch. 10+850 to Ch. 11+150). The construction methodologies for the retaining structures will require rock excavation using drill and blast methods or a hydraulic hammer in isolated areas.

The closest NSLs in this area are approximately 40m from the embankment fill works and 180m from the closest excavation works for the retaining wall systems. At the closest NSLs to the embankment works there is potential for the daytime CNT to be exceeded by a small margin during weekdays and the Saturday CNT to be exceeded in the absence of mitigation.

During excavation and rock breaking works for the retaining structures along the western approach to Lackagh Tunnel, construction noise levels are likely to be below or within the weekday and Saturday CNT.

Construction Section S11 - Lackagh Tunnel

Construction of the Lackagh Tunnel will be undertaken in an east to west direction and will involve major earthworks for the tunnel excavation and portal construction using drill and blast techniques. The tunnel portal and main works area will be within the Lackagh Quarry site compound. The closest NSLs to the tunnel are over 500m and hence are well set back from the main excavation and earthworks works in this area. The impacts can be controlled to below the CNT for the various working periods. Further comment on Lackagh Quarry site compound is discussed separately in Construction Section 12 below.

Construction Section S12 - N84 Headford Road Junction/Lackagh Quarry to School Road

Construction of the N84 Headford Road Junction and the cutting on the eastern side of Lackagh Quarry and east of School Road will involve substantial earthworks for both cutting and embankment construction. There will be a large cutting into the eastern face of Lackagh Quarry within the eastern end of this section which is located some 300m from the nearest NSLs. Construction of the N84 Headford Road Junction will involve extensive engineered fill works to cross the existing N84 Headford Road with an element of cutting required for slip roads. The closest NSLs are within 40 to 50m from these works and hence there is potential for construction noise levels to exceed the weekday and weekend CNT in the absence of noise mitigation measures.

Construction Section S13 - School Road to Galway Racecourse Tunnel

Construction Section S13 between School Road to Galway Racecourse Tunnel will involve a large number of major earthworks including a large cutting east of School Road and a grade separated junction at the N83 Tuam Road involving engineered embankments to cross the existing N83 Tuam Road. Moving east, the mainline will cut into a hill as far as the portal of the proposed Galway Racecourse Tunnel, thus requiring extensive excavation in this area. Drill and blast will be required for the main excavated sections in these areas. The material excavated from the cutting at School Road, Castlegar will be drawn back to either site compound SC 11/01 (Lackagh Quarry) or SC 14/01 (Twomileditch) for processing. Construction traffic will be transported along the proposed road alignment in this area and will not be along the local School Road. Further assessment of construction traffic is discussed in Section 18.5.3.2.

The closest NSLs to the excavation works east of School Road are between 30 and 50m thus the construction noise criteria for weekday and Saturday periods are likely to be exceeded in the absence of mitigation measures. The Castlegar National School is some 30m north of the earthworks boundary and approximately 55m from the road edge. The Castlegar Nursing home is located some 40m south of the closest earthworks boundary and some 65m from the road edge (at the bottom of the cutting).

As the works progress vertically into the cutting, a significant element of screening will be afforded by the cutting face itself, and construction levels will be reduced by the order of 10dB or greater once the line of sight is screened. Given the sensitive NSLs in this area including a school and nursing home, controlled noise mitigation measures will be required in this area to reduce construction noise levels. Further discussion on mitigation measures are discussed in Section 18.6.2.

Construction Section S14 - Galway Racecourse Tunnel

Construction Section S14 involves the construction of the Galway Racecourse Tunnel using cut and cover techniques. Excavation will likely involve drill and blast to remove the shallow rock head in this area. The works will be scheduled in consultation with Galway Racecourse to minimise the disruption to the commercial practice of the business throughout the year. The construction works will be phased and will cease for the racing period. The closest NSLs to the tunnel works are typically 90 to 100m at commercial premises to the north and residential properties to the southeast. During short term intermittent periods of high noise activities (drill and blast, rock crushing etc.) there is potential for the CNT to be exceeded in the absence of mitigation for weekdays and Saturday periods. During the main construction of the tunnel structure and ancillary elements, construction noise levels will be further reduced to within the CTN at the closest NSLs.

Construction Section S15 - Galway Racecourse Tunnel to Coolagh Junction

The construction Section S15 between Galway Racecourse Tunnel and Coolagh Junction will involve excavation works to the east of the tunnel portal and the connection with the existing N6/M6 at Coolagh. Drill and blast excavation is possible at these locations due to the presence of shallow rock. There is a large amount of engineering fill required in this section due to the proposed overbridges and raised junction at Coolagh which will require a large number of earthworks mobile plant and machinery. The closest noise sensitive locations to large excavation works are at distances of approximately 90m. Assuming the use of high noise activities for drill and blast or rock breaking, there is potential for temporary exceedance of the construction noise criteria during weekday and Saturday periods in the absence of noise mitigation at these properties.

The closest noise sensitive locations to the Coolagh Junction are between 80 and 100m. It is possible to work within the construction noise criteria at these distances from the main engineering fill works, depending on the activities involved.

Table 18.15 Major Earthworks Potential Noise Impacts – Without Mitigation

Construction Section Reference	Chainage Reference		Area	Construction Activity	Nearest NSL to Edge of Works (m)	Predicted Total CNL (dB $L_{Aeq,T}$)	Estimated Construction Time (months)	Duration of Impacts	Pre-Mitigation Predicted EPA Significance Impact	
	Start	End							Weekdays	Saturday
S1	0+000	3+300	R336 to Aille	Excavation & fill, Road Works	50	69	6 to 9	Temporary	Slight to Moderate	Moderate to Significant
S2	3+300	5+650	Aille to Ballymoneen Road	Rock Breaking / Drilling / Rock Crushing - at surface level	30	81	<6	Temporary	Significant to Very Significant	Profound
				Rock Breaking / Drilling / Rock Crushing - within cut	30	71	6 to 9	Temporary	Moderate to Significant	Significant to Very Significant
				Excavation & fill, Road Works	30	73	6 to 9	Temporary	Significant to Very Significant	Significant to Very Significant
				Excavation & fill, Road Works	50	69	6 to 9	Temporary	Slight to Moderate	Moderate to Significant
S3	5+650	7+550	Ballymoneen Road to proposed N59 Letteragh Junction	Excavation & fill, Road Works	50	69	9 to 12	Temporary	Slight to Moderate	Moderate to Significant
S4	LRS 1+050	2+020	Proposed N59 Link Road South (LRS)	Excavation & fill, Road Works	25	75	9 to 12	Temporary	Moderate to Significant	Significant to Very Significant
S5	LRN 0+000	0+950	Proposed N59 Link Road North (LRN)	Drill & blast excavation at surface level	50	77	<9	Temporary	Significant to Very Significant	Significant to Very Significant
				Drill & blast excavation within cutting	50	67	9 to 12	Temporary	Slight to Moderate	Moderate to Significant

Construction Section Reference	Chainage Reference		Area	Construction Activity	Nearest NSL to Edge of Works (m)	Predicted Total CNL (dB $L_{Aeq,T}$)	Estimated Construction Time (months)	Duration of Impacts	Pre-Mitigation Predicted EPA Significance Impact	
	Start	End							Weekdays	Saturday
				Excavation & fill, Road Works	50	69	9 to 12	Temporary	Slight to Moderate	Moderate to Significant
S6	7+550	8+850	Proposed N59 Letteragh Junction to River Corrib	Drill & blast excavation at surface level	25	83	<6	Temporary	Significant to Very Significant	Profound
				Drill & blast excavation within cutting	25	73	6 to 9	Temporary	Moderate to Significant	Significant to Very Significant
				Excavation & fill, Road Works	25	75	6 to 9	Temporary	Moderate to Significant	Significant to Very Significant
S10	10+430	11+150	Proposed Menlough Viaduct to Proposed Lackagh Tunnel	Excavation & fill, Road Works	40	71	24 to 36	Short-term	Moderate to Significant	Significant to Very Significant
				Rock Breaking & piling	180	65	24 to 36	Short-term	Slight to Moderate	Slight to Moderate
S11	11+150	11+400	Proposed Lackagh Tunnel	Rock Breaking / Drilling / Rock Crushing	500	57	24 to 36	Short-term	Slight to Moderate	Slight to Moderate
S12	11+450	13+150	Proposed Lackagh Tunnel to School Road	Excavation & fill, Road Works	40	71	12 to 18	Short-term	Moderate to Significant	Significant to Very Significant
				Rock Breaking / Drilling / Rock Crushing	300	63	12 to 18	Short-term	Slight to Moderate	Slight to Moderate

Construction Section Reference	Chainage Reference		Area	Construction Activity	Nearest NSL to Edge of Works (m)	Predicted Total CNL (dB $L_{Aeq,T}$)	Estimated Construction Time (months)	Duration of Impacts	Pre-Mitigation Predicted EPA Significance Impact	
	Start	End							Weekdays	Saturday
S13	13+150	14+950	School Road to Proposed Galway Racecourse Tunnel	Drill & blast excavation	30	81	12 to 18	Temporary	Significant to Very Significant	Profound
				Drill & blast excavation within cutting	30	71	12 to 18	Short-term	Moderate to Significant	Significant to Very Significant
				Drill & blast excavation – surface level	50	77	12 to 18	Temporary	Significant to Very Significant	Significant to Very Significant
S13	13+150	14+950	School Road to Proposed Galway Racecourse Tunnel	Drill & blast excavation within cutting	50	67	12 to 18	Short-term	Slight to Moderate	Moderate to Significant
				Excavation & fill, Road Works	30	73	12 to 18	Short-term	Moderate to Significant	Significant to Very Significant
				Excavation & fill, Road Works	50	69	12 to 18	Short-term	Slight to Moderate	Moderate to Significant
S14	14+300	15+150	Proposed Galway Racecourse Tunnel	Drill & blast excavation	90	72	24 to 36	Temporary to Short-term	Moderate to Significant	Significant to Very Significant
				Excavation & fill, Road Works	90	64	24 to 36	Short-term	Slight to Moderate	Slight to Moderate
S15	15+150	17+450	Proposed Galway Racecourse Tunnel to Proposed Coolagh Junction	Drill & blast excavation	90	72	12 to 18	Temporary to Short-term	Moderate to Significant	Significant to Very Significant
				Excavation & fill, Road Works	80	65	12 to 18	Short-term	Slight to Moderate	Slight to Moderate

Structures

Phase 1 of the Project will involve constructing the temporary stableyard machinery shed, maintenance shed, ESB substation, two wells, new pre-parade ring and pavilion on Galway Racecourse lands. These structures will involve foundations and standard construction techniques. The closest NSLs to these works are over 300m. Reference to Table 18.14 indicates construction noise levels beyond 250m are below the weekday and Saturday CNT and are not significant

Phase 2 of the Project, the proposed N6 GCRR, includes various bridge structures over and under existing roads, the River Corrib Bridge Crossing, Menlough Viaduct, Lackagh and Galway Racecourse Tunnel Structures and retaining walls. These will involve standard construction techniques which will likely involve piling (type and method dependent on ground conditions), engineered fill structures, lifting equipment etc. Daytime construction noise limits can typically be complied with at distances of 50m and beyond from these works, assuming a total construction noise level of 85 dB L_{Aeq} at 10m associated with the works involved for these elements.

Table 18.16 summarises the closest NSLs to the major structures within Phase 2 not discussed above.

Table 18.16 Major Structures Potential Noise Impacts - Without Mitigation

Structure / Section	Nearest NSL to Edge of Works (m)	Predicted Total CNL (dB $L_{Aeq,T}$)	Estimated Construction Time (months)	Duration of Impacts	Pre-Mitigation Predicted EPA Significance Impact	
					Weekdays	Saturdays
River Corrib Bridge Construction Section 7	50	69	18 - 24	Short-term	Slight to Moderate	Moderate to Significant
River Corrib Bridge to Menlough Viaduct Section 8	40	71	9 - 12	Temporary	Moderate to Significant	Significant to Very Significant
Menlough Viaduct Section 9	100	63	18 - 24	Short-term	Slight to Moderate	Slight to Moderate

Where sheet piling is required for retaining wall structures, construction noise levels will be higher, and the CNT likely exceeded within 20m of the works. The key areas of retaining wall structures are in Construction section S10 and closest NSLs are some 180m from these activities.

Embankments will be constructed for the majority from self-supporting fill material. Where during the detailed design, the requirement for soil retention is identified, the use of reinforced concrete retaining walls may be used. Should piling works be used in these areas, there is potential for the daytime CNT to be exceeded at distances of up to 50m.

Temporary night-time closure of existing roads will be required where overbridges are to be constructed at locations such as the Rahoon Road, Letteragh Road, N59 Moycullen Road, Menlo Castle Bóthrín, Bóthar Nua, An Seanbóthar, N84 Headford Road, N83 Tuam Road, Briarhill Business Park Road and R339 Monivea Road. This is required to avoid road closure during day time periods to facilitate lifting beams into place and other key works. Heavy or noisy construction activities will be avoided outside normal hours and the amount of work outside normal hours will be strictly controlled.

Noise levels associated with night-time works will typically involve lifting equipment for beam construction. There is potential for the use of generators to power temporary lighting and other small items of mobile plant. Noise levels will be strictly controlled during these phases to ensure noisy items of plant are sited away from noise sensitive properties (e.g. generators), are enclosed or screened. Specific noise limits for night-time works will be set taking into account the pre-existing noise environment as per Table 18.3. These limits are site specific, hence will be fully reviewed prior to commencement of any night works and specific noise control measures put in place. Best practice control measures that will form part of the noise mitigation are included in Section 18.6.2.

The use of specific noise mitigation measures will be applied in this area therefore including scheduling of works, choice of plant, screening etc. Further discussion on mitigation measures are discussed in Section 18.6.2.

Phase 3 will involve construction of the permanent stableyard including horsebox parking to the north of the temporary stables. This will be completed after completion of Phase 2, the proposed N6 GCRR. The works involved in constructing the permanent stables will be similar to those involved in constructing the temporary stables. The closest NSLs to the permanent stables as part of Phase 3 are some 170m to the southeast. Reference to Table 18.15 indicates construction noise levels for structures and general works beyond 150m are below the weekday and Saturday CNT and are not significant.

Phase 4 involves the demolition of the temporary stables. The area previously used for the temporary stables will then be reutilised as car parking. Construction works will involve demolition and clearance of the concrete structures and other buildings and creation of car parking. The closest NSLs to these works are over 300m. Reference to Table 18.14 indicates construction noise levels beyond 250m are below the weekday and Saturday CNT and are not significant.

Site Compounds

There are thirteen sites identified as potential site compounds across the Project. There is one additional site compound (SC 14/05) since the 2018 EIAR to facilitate Phases 1, 3 and 4 of the Project. The siting of compounds has been chosen based on proximity to major works, proximity to residential properties and other environmental constraints. The site compounds are listed in Table 18.17 with approximate distance to nearest noise sensitive locations and general comments on potential noise impacts included.

Table 18.17 Site Compound Potential Noise Impacts

Site No.	Location	Main Construction Activities	Closest Noise Sensitive Locations (m)	Potential Impacts
SC 00/01	R336 Baile Nua	Phase 2: Western tie-in for proposed N6 GCRR	10	Potential exceedance of construction noise criteria to east of compound. Boundary screening, working hours, site layout planning to be undertaken prior to commencement of works
SC 04/01	Aille	Phase 2: Aille Cutting, Rock Crushing Plant	320	No significant impacts expected due to distances to NSLs. Assessment of rock crushing equipment siting within compound and noise impacts required prior to commencement
SC 05/01	Ballymoneen	Phase 2: Aille Cutting, Letteragh and Rahoon Road Overbridge	50 – 100	Potential exceedance of construction noise criteria to southeast of compound, depending on siting of on-site activities. Boundary screening to south / south east and site layout planning will be undertaken
SC 07/01	Letteragh	Phase 2: Major cut at Letteragh for GSJ and River Corrib Bridge (western section) Rock Crushing & Regrading Plant	250	Impacts can be suitably controlled through siting high noise activities away from noise sensitive boundaries and use of on-site and boundary screening
SC 08/01	Dangan (Aughnacurra)	Phase 2: River Corrib Bridge (western section). Used for storage only.	10 – 20	Storage only. No significant activities on site. No significant impacts expected

Site No.	Location	Main Construction Activities	Closest Noise Sensitive Locations (m)	Potential Impacts
SC 09/01	Menlough (East of River Corrib)	Phase 2: River Corrib Bridge (eastern section) & Menlough Viaduct	400	No significant impacts expected due to distances to noise sensitive locations
SC 11/01	Lackagh Quarry	Phase 2: Lackagh Tunnel and potential for concrete batching plant, crushing and regrading of material.	100 – 200	Impacts can be well controlled through siting high noise activities away from noise sensitive boundaries, site orientation and use of quarry face for noise screening
SC 14/01	Twomileditch (N83 Tuam Road Junction)	Phase 2: N83 Tuam Road Junction and Parkmore Link Road - Rock Crushing Plant	40 – 50	Potential exceedance of construction noise criteria at closet boundaries. Boundary screening to west and site layout planning will be undertaken to locate crushing plant away from NSL boundaries.
SC 14/02	Twomileditch (N83 Tuam Road Junction)	Phase 2: N83 Tuam Road Junction and Parkmore Link Road	200	No significant impacts. Boundary screening and site layout where necessary following assessment prior to commencement
SC 14/03	Twomileditch (N83 Tuam Road Junction)	Phase 2: N83 Tuam Road Junction and Parkmore Link Road	250	No significant impacts. Boundary screening and site layout where necessary following assessment prior to commencement
SC 14/04	Galway Racecourse Tunnel Western Portal	Phase 2: Galway Racecourse Tunnel (western section)	240	No significant impacts. Boundary screening and site layout where necessary following assessment prior to commencement
SC 14/05	Galway Racecourse infield	Phase 1: Temporary stables construction Phase 3: Permanent stables construction Phase 4: Repurposing the temporary stableyard	250	No significant impacts. Boundary screening and site layout where necessary following assessment prior to commencement
SC 15/01	Coolagh / Briarhill	Phase 2: Galway Racecourse Tunnel (eastern section)	30	Potential exceedance of construction noise criteria at closet boundaries. Boundary screening to north and east and siting of noisy activities away from noise sensitive boundaries will be undertaken
SC 16/01	Coolagh	Phase 2: Coolagh Junction	90	Potential exceedance of construction noise criteria at closet boundaries Boundary screening to north and east and site layout where necessary following assessment prior to commencement

The majority of site compounds across the Project are back from NSLs and noise emissions from these areas can be largely controlled through the use of boundary screening and site layout planning, as required. The largest site compound will be located at Lackagh Quarry which will be in use for the full extent of the construction of the proposed N6 GCRR (Phase 2 of the Project). This compound will be the main portal for

the Lackagh Tunnel and will likely include a concrete batching plant, mobile rock crushing and rock grading equipment. All of the above have the potential to generate high levels of noise, however, given the large extent of the compound (9ha approximately), there is ample opportunity to sufficiently locate activities with high noise levels away from noise sensitive boundaries. In addition, the existing quarry profile will provide substantial screening to noise sensitive properties beyond.

Other site compounds where rock crushing activities are likely are well set back from noise sensitive locations and noise levels from this activity is not expected to generate noise levels in exceedance of the construction noise criteria once on-site control measures are included into the site design.

As per the 2018 EIAR, there is potential for rock crushing plant to be positioned within Site Compound SC 14/01 at the N83 Tuam Road Junction where noise sensitive properties are at distances of approximately 40m across the N83 Tuam Road. The location of rock processing equipment can be sited at distances further into the compound to reduce noise emission from this activity and the use of boundary screening along the western side of the compound will be required.

During Phase 1, 3 and 4, Site Compound SC 14/05 will be utilised within Galway Racecourse. The compound is set back approximately 250m from the closest NSLs and no significant noise impacts are likely to occur based on the distance to NSLs and the activities within the compound.

Overall, the potential impacts during the construction of the Project will be moderate to very significant and short term in the absence of noise mitigation. Prior to the set up of any compound, the proposed on-site activities and associated noise levels will be calculated and reviewed by the contractor to review the optimum site layout and requirement for boundary screening. Additional control measures will be implemented as required at specific working areas to suitably reduce noise impacts at noise sensitive locations. Further discussion on noise mitigation measures are discussed in Section 18.6.2.

Emergency Work

Emergency work may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.

18.5.3.2 Construction Traffic

In addition to direct impacts from the construction works including site compounds, there is also the potential for noise impacts from construction traffic along public roads.

A detailed analysis of construction traffic volumes has been conducted to determine the expected lorry movements required to transport the materials extracted and delivered to site which are set out in Chapter 7 of this updated EIAR and takes account of the updated traffic predictions on the road network. A total of 16 public roads has been identified as required haul routes where construction traffic will be permitted to travel along.

As Phases 1, 3, and 4 of the Project are in one localised area, namely Galway Racecourse and its surrounding lands, the added traffic volumes due to construction works of these phases will mainly impact on the surrounding local roads, including Racecourse Avenue (or Ballybrit Crescent), the Monivea Road, Parkmore Road, the R339, Bóthar na dTreabh, and the Tuam Road (N83), and the haul routes identified in Section 7.4.7.3 of Chapter 7 of this updated EIAR. During the construction works of Phase 2, the proposed N6 GCRR, construction traffic will travel on the approved haul routes as well as along the line of the proposed N6 GCRR as illustrated in Figure 7.001 and 7.002.

Traffic volumes for the base scenario are based on the 2031 Do Minimum flows projected along the local road network. These are AADT flows with percentage HGVs. The additional HGV and LGV flows per day associated with construction traffic along each road including construction staff vehicles, deliveries, demolition works, construction activities, delivery of goods and earthworks material haulage are added to the base traffic volumes.

In order to determine the potential noise impacts associated with additional construction traffic on the identified haul routes, a comparison between traffic noise levels during for the base (Do Minimum) scenario and the Do Something (base plus construction) scenario were determined.

Noise levels associated with 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:

$L_{Aeq,T} = L_{AX} + 10\log10(N) – 10\log10(T)$ 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 mean value of Sound Exposure Level for truck moving at low to moderate speeds is in the order of 82dB L_{AX} at a distance of 10 metres from the vehicle. The mean value of Sound Exposure Level for car or light good vehicle passing at low to moderate speeds is in the order of 68dB L_{AX} at a distance of 10 metres from the vehicle.

Noise levels associated with additional construction traffic volumes are calculated over a 12hr period, relating to the typical construction working day (i.e. 07:00 to 19:00hrs). The combined value represents the total noise level over a daily (24hr) period.

Table 18.8 presents a summary of the construction traffic noise assessment. Traffic noise levels at a distance of 10m from the haul roads is calculated for the base (Do-Minimum) scenario and the Do-Something (base plus construction) scenario. The increase in noise levels between both scenarios is also presented.

Reference to Table 18.18 overleaf confirms the increase in noise level along the majority of the haul routes is negligible (<1dB) due to the existing volume of traffic along these roads and the relatively low additional HGV and LGV traffic per day forecast. Reference to Table 18.8 defines an increase in traffic noise levels below 1 dB as imperceptible. The overall impact is determined to be negative, imperceptible and short-term.

The greatest increase in noise levels is calculated along Bóthar Nua in Zone 4 which is calculated as +4.3 dB above the Do-Minimum scenario. Reference to Table 18.6 defines an increase of this magnitude as Moderate. The calculated traffic noise level along this road is 58 dB $L_{Aeq,T}$ at 10m from the road edge. This level is below the construction noise threshold values for day, evening and weekend periods. Considering the above, the overall impact is deemed to be negative, slight to moderate and short-term.

Along Parkmore Link Road at Business Park Junction 2 in Zone 2, traffic noise levels are calculated to increase by +3.7 dB. Reference to Table 18.6 defines an increase of this magnitude as Moderate. The calculated traffic noise level along this road is 63 dB $L_{Aeq,T}$ at 10m from the road edge. The calculated level is below the construction noise threshold values for day, evening and weekend periods. Considering the above, the overall impact is deemed to be negative, slight to moderate and short-term.

Along the Bearna to Moycullen Road (L1321) in Zone 1, the calculated change in traffic noise during the construction phase is +1.3 dB. Reference to Table 18.6 defines an increase of this magnitude as Not Significant. The overall impact is determined to be negative, not significant and short-term.

Table 18.18 Construction Traffic Noise Assessment

Do Minimum		Do Something (Construction)		Calculated Change in Noise Levels, dB	EPA Significance of Effect
Total Vehicles (AADT)	Do Minimum Noise Level at 10m, dB	Additional Construction (AADT)	Cumulative Noise Level at 10m, dB		
18,126	63	132	64	+0.1	EPA Significance of Effect
2,794	53	132	54	+1.3	Not Significant
5,038	56	133	57	+1.0	Not Significant
21,838	65	265	65	+0.2	Imperceptible
16,356	63	265	63	+0.4	Imperceptible
8,319	61	60	61	+0.3	Imperceptible
18,342	64	60	64	+0.1	Imperceptible
35,528	68	325	68	+0.2	Imperceptible
2,080	54	111	58	+4.3	Moderate
11,962	64	58	65	+0.1	Imperceptible
22,289	66	58	66	+0.1	Imperceptible
37,129	68	552	68	+0.6	Imperceptible

Do Minimum		Do Something (Construction)		Calculated Change in Noise Levels, dB	EPA Significance of Effect
Total Vehicles (AADT)	Do Minimum Noise Level at 10m, dB	Additional Construction (AADT)	Cumulative Noise Level at 10m, dB		
31,523	67	542	68	+0.6	Imperceptible
3,567	60	233	63	+3.7	Moderate
46,579	69	650	70	+0.5	Imperceptible
33,853	69	696	69	0.6	Imperceptible

18.5.3.3 Vibration

The potential for elevated levels of vibration at sensitive locations during construction is typically associated with excavation works, rock-breaking and blasting operations. Depending on the method and equipment used, there is potential for some vibration relating to piling operations, demolition works and lorry movements on uneven road surfaces. The more significant of these relates to vibration from excavation and rock-breaking operations.

In terms of piling, low vibration methods involving bored or augured piles will be selected over and above percussive type piling, where ground conditions permit. This piling method significantly minimises the levels of both noise and vibration generated as it is a non-percussive piling technique.

For the purposes of this assessment, however, vibration levels associated with driven piles are assessed in order to determine potential worst case impacts. British Standard BS 5228- 2 (2009+A1:2014), includes measured magnitude of vibration associated with different piling types. Table 18.19 reproduces those associated with steel sheet piling.

Table 18.19 Vibration Magnitudes associated with Sheet Steel Piling

Soil Conditions	Pile Dimensions	Distance, m	PPV, mm/s
Very soft to soft (0 – 10m), soft to medium clay (10 – 20m)	U-shaped LX 16 sheet piles	4.8 – 24	4.3 – 0.5
(not provided)	U-shaped piles	7.1	0.3 – 0.7
Made ground 0 – 3m, loose and very dense sand and silt 3 – 17m, firm to stiff clay 17 – 25m	244mm diameter driven tubular steel piles	5 – 20	13.9 – 4.3
Made ground 0 – 3m, loose and very dense sand and silt 3 – 17m, firm to stiff clay 17 – 25m	275mm driven square piles	5 – 20	11.4 – 4.3

The vibration magnitudes outlined in Table 18.18, as per the 2018 EIAR, indicate that at distances beyond 20m, vibration magnitudes are significantly reduced to well below those associated with any form of cosmetic damage to buildings but would be perceptible to building occupants.

The closest sensitive buildings to scheduled piling works for retaining walls are 180m from the western approach to Lackagh Tunnel. Vibration magnitudes at this distance will be negligible due to propagation with distance and will not result in any perceptible vibration magnitudes within NSLs. It is also noted that secant piling will likely be used in this area which will result in lower vibration magnitudes compared to those presented above.

During rock breaking, 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
- 6 tonne hydraulic breaker on large Liebherr tracked excavator

Vibration measurements were conducted during various staged activities and at various distances.

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

Whilst these measurements relate to a solid concrete slab, the range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity. The vibration magnitudes associated with ground breaking works are orders of magnitude below limits values associated with any form or cosmetic or structural damage referred to in Table 18.4.

Vibration impacts during ground breaking activities using heavy breakers have the potential to generate negative, slight to moderate and temporary effects at to human receptors at distances of 10m from the activity. Beyond 50m from this type of activity, impacts are reduced to negative, not significant to slight and temporary.

Demolition of existing structures will involve careful deconstruction using controlled techniques. There may be a requirement for breaking ground as part of specific demolition procedures, depending on the structure. Vibration levels associated with this activity will be of similar or lower magnitude to rock breaking discussed above.

Referring to the vibration magnitudes above, vibration impacts due to ongoing construction works will be not significant to slight to moderate and temporary to short term.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 18.4.

18.5.3.4 Blasting

Ground investigations have indicated that blasting will be required at a number of locations along the route of the proposed N6 GCRR during Phase 2 of the Project, in proximity to access roads, stream diversions and attenuation ponds Blasting may be required as part of the rock excavation for Phase 1, which relates to the construction of the temporary stables.

The location of identified proposed and potential blast locations are illustrated in Figures 7.201 and 7.202. The extent of blasting will depend on the rock type and depth in the area and the depth of the cutting involved. For the majority of identified locations, a relatively shallow blast depth is required. There are a number of locations along the route of the proposed N6 GCRR where a cut depth of greater than 10m will be required as part of the construction of the proposed N6 GCRR.

Whilst drill and blast methods generate intermittent high noise levels when taking place, the time period over which impacts are experienced are significantly shorter compared to other extraction methods. For the proposed N6 GCRR where a significant portion of hard rock is required to be excavated, the use of drill and blast will enable extraction works to be undertaken at a significantly faster rate compared to traditional rock breaking techniques.

Blasting impacts relate to both ground vibration and air overpressure, the magnitude of which depends on a variety of factors.

Air Overpressure (AOP)

Air overpressure is energy transmitted from the blast site within the atmosphere in the form of pressure waves. As such a wave passes a given position, the pressure of the air at this point rises very rapidly to a value above the ambient pressure, and then falls more slowly to a value below, before returning to the ambient value after a series of oscillations. The maximum excess pressure in this wave is known as the peak air overpressure. This value is typically measured in terms of dB (L_{in}).

These pressure waves will consist of energy over a wide range of frequencies, some of which are audible and known as sound waves or noise, but most of the energy is inaudible at frequencies of less than 20Hz which is not heard by the human ear but is sensed as pressure.

The main sources of air overpressure from blasting relate to blast design and set up (e.g. detonating cord, stemming release and gas venting) and physical properties of the site (movement of rock and reflection of stress waves). The intensity of air overpressure levels at a receiver location is highly dependent on meteorological conditions which affect ambient air pressure including temperature, cloud cover, humidity, wind speed and direction etc. Due to the large variability in these conditions, it is not possible to reliably calculate AOP. The control of its intensity is therefore undertaken at source through careful blast design.

It is important to note that routine open-pit blasting operations regularly generate air overpressures up to a magnitude of 120dB (Lin), with levels in excess of 125dB (Lin) being relatively rare. Damage levels are rarely approached let alone exceeded. BS 5228-2 notes that there is no known evidence of structural damage to structures from excessive air overpressure levels from quarry blasting in the UK.

Ground Vibration

The level of vibration at a receiver location from a blast depends predominately on the distance from the blast, the maximum instantaneous charge (MIC), sequencing of charges and ground conditions between the blast area and the receiver location. Whilst it is possible to undertake indicative predictive calculations for ground vibrations from a blast site using information on the MIC, distance and ground factors, the most accurate methodology for determining vibration levels is through controlled trial blasts at specific sites and undertaking scaled distance regression analysis to determine maximum charge values in order to comply with set criteria. This is therefore undertaken by experienced contractors as part of the blast design (refer to Chapter 9, Soils and Geology) of this updated EIAR.

In the case of the proposed N6 GCRR, blast events will be clearly perceptible at the nearest sensitive receptors due to ground vibration and air overpressure levels, however the duration of the effects are intermittent. The overall impacts are therefore considered to be significant, momentary and localised. The closest sensitive properties to the identified likely blast sites are at distances of 30 to 50m. It is expected that these potential impacts can be appropriately mitigated through the implementation of best practice blasting control measures which are outlined in Section 18.6.2. Specific assessment of potential impacts of blasting on birds and other sensitive species are included in Chapter 8, Biodiversity of this updated EIAR.

18.5.3.5 Summary of Construction Phase Impacts

A summary of the key potential construction noise impacts without mitigation are summarised in Table 18.20.

Table 18.20 Construction Noise and Vibration Summary Pre-Mitigation

Construction Activity	Period over Which Criterion Applies (dB $L_{Aeq,T}$)	Predicted Impact (Pre-Mitigation)
Rock Breaking / Drilling / Rock Crushing / Impact Piling	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, significant to very significant at NSLs within 55m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, moderate to significant at NSLs between 55 and 105m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, slight to moderate NSLs at or beyond 110m. Duration is temporary to short term depending on area of work.
	Saturdays (07:00 – 16:30hrs)	Negative, profound at NSLs within 30m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, significant to very significant at NSLs between 55 and 105m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, moderate to significant at NSLs between 105 and 165m distance from the proposed works.
		Negative, slight to moderate at NSLs beyond 165m distance from the proposed works. Duration is temporary to short term depending on area of work.
Site Clearance, Utilities, Excavation & fill, Road Works, Structures	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, significant to very significant at NSLs within 20m distance from the proposed works. Duration is temporary to short term depending on area of work.

Construction Activity	Period over Which Criterion Applies (dB $L_{Aeq,T}$)	Predicted Impact (Pre-Mitigation)
		Negative, moderate to significant at NSLs between 25 and 40m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, slight to moderate NSLs at or beyond 40m. Duration is temporary to short term depending on area of work.
	Saturdays (07:00 – 16:30hrs)	Negative, significant to very significant at NSLs within 45m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, moderate to significant at NSLs between 45m and 75m distance from the proposed works. Duration is temporary to short term depending on area of work.
General site work	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, slight to moderate NSLs beyond 75m. Duration is temporary to short term depending on area of work.
	Saturdays (07:00 – 16:30hrs)	Negative, moderate to significant at NSLs within 35m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, slight to moderate NSLs beyond 35m distance from the proposed works. Duration is temporary to short term depending on area of work.
Construction Traffic	Construction traffic periods daytime	Negative, imperceptible to negative slight to moderate. Duration is temporary to short term depending on area of work.
Construction vibration from general road works and construction activities including bored piling	All Construction work periods	Negative, Imperceptible to Not Significant and Temporary.
Construction vibration during sheet piling	As required	Negative, Moderate to Significant and Temporary at occupied buildings within 20m.
Construction vibration from ground breaking activities within 10m of occupied residential buildings	Ground breaking during road works and utility diversion works	Negative, Slight to Moderate and Temporary.
Blasting AOP and PPV	Blasting daytime periods	Negative, Significant, Momentary

18.5.4 Potential Operational Effects

18.5.4.1 Operational Traffic Noise Levels

Noise impacts for the Project are predominantly related to the operation of proposed N6 GCRR (Phase 2 of the Project) as noise due to the operation of a road has the potential to significantly impact human beings and there are no significant impacts due to noise on human health associated with the operation of the racecourse stables.

Traffic Noise Impacts Across Project

Traffic noise levels have been calculated at the 309 properties (at 342 modelled receptor locations) along the length of the proposed N6 GCRR in accordance with the methodologies outlined in Section 18.2.5.

In line with the methodology outlined in Section 18.2.5, in order to evaluate the significance of noise impacts, the following approach has been undertaken.

- The predicted Do-Minimum noise levels are compared against the predicted Do-Something noise levels to determine the increase in noise levels during both the Year of Opening and the Design Year. At receptors where the predicted Do Minimum noise levels were at or below 45 dB $L_{den,}$ the measured baseline L_{den} noise level was reviewed to determine if the model was artificially low due to the absence of modelled roads in the vicinity and the measured value used, where appropriate. For all NSLs with a calculated Do Minimum value above 45 dB $L_{den,}$ the predicted Do Minimum value was used. This ensured a robust assessment relating to the relative change in noise levels was adopted.
- The significance rating is assigned for each NSLs based on the magnitude of change ratings from the DMRB short term period (Year of Opening) or long-term period (Design Year), the absolute noise level category as per Table 18.10.

Table 18.21 summarises the number of modelled properties categorised within each significance rating for the Year of Opening and the Design Year. The table excludes the seven assessment locations that will be demolished as part of the Project.

Table 18.21 Change in Noise Levels along the proposed N6 GCRR (Pre-Mitigation)

Short-Term Impacts – Year of Opening			Long-Term Impacts - Design Year		
Significance Rating	**No. of Assessed Properties**	**% of total**	**Significance Rating**	**No. of Assessed Properties**	**% of total**
Imperceptible / Positive	67	20	Imperceptible / Positive	53	16
Not Significant	32	10	Not Significant	37	11
Not Significant - Slight	19	6	Not Significant - Slight	58	17
Slight	61	18	Slight	38	11
Moderate	78	23	Moderate	74	22
Moderate - Significant	9	3	Moderate - Significant	9	3
Significant	49	15	Significant	46	14
Very Significant	20	6	Very Significant	20	6
Total		**335**			**335**

During the Year of Opening (2031), the assessment has concluded that 179 No. (53%) of the modelled receptors in proximity to the proposed N6 GCRR will experience an Imperceptible / Positive to Slight impact as a result of the Project in the absence of mitigation. A total of 78 No. (23%) of the modelled receptors will experience a Moderate impact as a result of the Project. A total of 78 No. (23%) of the modelled receptors will experience a moderate to significant to very significant impact in the absence of mitigation.

During the Design Year (2046), the assessment has concluded that 186 No. (56%) of the modelled receptors in proximity to the proposed N6 GCRR will experience an Imperceptible / Positive to Slight impact as a result of the Project in the absence of mitigation. A total of 74 No. (22%) of the modelled receptors will experience a Moderate impact as a result of the Project. A total of 75 No. (22%) of the modelled receptors will experience moderate to significant to very significant impact in the absence of mitigation.

To determine the specific requirement for noise mitigation across the proposed N6 GCRR, the calculated traffic noise level at each NSL has been compared against the three TII conditions for noise mitigation (referenced in Section 18.2.2.2).

- Each NSLs is assessed against 'Condition (a)' to determine if the calculated traffic noise level is above 60 dB $L_{den.}$
- The calculated Do Something must by at least 1 dB(A) above the calculated Do Minimum traffic noise level to comply with 'Condition (b)'. The calculated Do Minimum noise levels presented in Table 18.20 relate to traffic noise levels associated with modelled roads only
- The third condition determines if the Do Something traffic noise level is attributed directly from the proposed N6 GCRR, i.e. 'Condition (c)'. When considering the requirement for noise mitigation under Condition (c), traffic noise levels must be attributed to the physical proposed N6 GCRR in order for noise mitigation to be provided. In certain instances, traffic flows along the local road network are higher during the Do-Something scenario compared to the Do-Minimum scenario due to traffic volumes along these road links

All modelled locations with a calculated traffic noise level above 60 dB L_{den} during the Design Year (2046) are summarised in Table 18.22. The requirement for noise mitigation is assigned against each which has been a**ss**essed against the 3 conditions for noise mitigation for the Opening Year (2031) and Design Year (2046). The table includes any property to be acquired by Galway County Council for the Project but excludes those to be demolished. The significance rating at each NSLs is determined from the assessment matrix from Table 18.10.

Assessment locations labelled as 2024_1 to 2024_38 are NSLs that have been added to the updated model including newly constructed NSLs, those under construction at present or those granted but not yet constructed.

The full set of calculated traffic noise levels for all locations are included in Appendix A.18.3.

Table 18.22 Locations with Predicted Traffic Noise Level Greater than 60dB L_{den}

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
1	R336 West of Bearna West Roundabout	63	63	No	Not Significant	63	63	No	Not Significant
5	R336 West of Bearna West Roundabout	63	63	No	Imperceptible / Positive	63	64	No	Imperceptible / Positive
6	R336 West of Bearna West Roundabout	63	63	No	Imperceptible / Positive	63	64	No	Imperceptible / Positive
12	R336 East of Bearna West Roundabout	67	63	No	Imperceptible / Positive	67	64	No	Imperceptible / Positive
27	Na Foraí Maola Thiar (to be acquired)	41	61	Yes	Significant	41	61	Yes	Significant
30	R336 East of Bearna West Roundabout	66	63	No	Imperceptible / Positive	66	63	No	Imperceptible / Positive
51	Troscaigh Thoir - L1321 South	60	61	No	Moderate - Significant – Note 1	61	61	No	Not Significant – Note 1
63a	Cappagh Road North (rear)	56	62	Yes	Significant	57	63	Yes	Significant
63b	Cappagh Road North (side / front)	61	61	No	Not Significant	62	62	No	Not Significant
64a	Cappagh Road North (front)	58	59	No	Slight	60	61	No	Not Significant
65a	Cappagh Road North (front)	60	60	No	Not Significant	61	61	No	Not Significant
66a	Cappagh Road South (side / rear)	55	60	No	Moderate	56	61	Yes	Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
66b	Cappagh Road South (front)	62	64	Yes	Moderate - Significant	63	64	Yes	Not Significant
74a	Ballymoneen Road South	54	64	Yes	Significant	55	65	Yes	Very Significant
74b	Ballymoneen Road South	39	65	Yes	Very Significant	39	66	Yes	Very Significant
75a	Ballymoneen Road South	56	61	Yes	Significant	57	61	Yes	Moderate - Significant
76	Ballymoneen Road North	56	60	No	Moderate	57	61	Yes	Moderate - Significant
77	Ballymoneen Road South	57	61	No	Significant - Note 2	58	62	No	Moderate - Significant - Note 2
78	Ballymoneen Road South	58	62	Yes	Significant - Note 2	59	62	Yes	Moderate - Significant - Note 2
79	Ballymoneen Road North	60	64	Yes	Significant	61	63	No	Moderate - Significant -
80a	Ballymoneen Road North (front)	58	63	Yes	Significant	59	64	Yes	Moderate - Significant
80b	Ballymoneen Road North (rear)	50	61	Yes	Significant	50	62	Yes	Significant
83	Ballymoneen Road	60	64	No	Significant - Note 2	61	65	No	Significant - Note 2
86	Árd na Gaoithe - Ballymoneen	42	60	No	Moderate	43	61	Yes	Significant
96	Clybaun Road North	48	61	Yes	Significant	49	62	Yes	Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
105	Rahoon Road	62	61	No	Imperceptible / Positive	62	62	No	Imperceptible / Positive
106	Between Rahoon & Letteragh Road	42	61	Yes	Significant	43	62	Yes	Significant
107	Letteragh Road North	56	61	Yes	Significant	57	63	Yes	Significant
111	N59 Moycullen Road (Parknagapple)	63	63	No	Not Significant	63	64	No	Not Significant
117	Rosán Glas - Letteragh	61	59	No	Imperceptible / Positive	61	61	No	Imperceptible / Positive
120a	Letteragh Road South (front)	60	62	Yes	Moderate - Significant	61	63	Yes	Not Significant
121	Bushypark / N59 Moycullen Road	64	63	No	Imperceptible / Positive	65	63	No	Imperceptible / Positive
123	Bushypark / N59 Moycullen Road	66	64	No	Imperceptible / Positive	66	64	No	Imperceptible / Positive
128	Letteragh Road South	61	64	No	Significant - Note 2	62	65	No	Significant - Note 2
129	Letteragh Road South	56	60	No	Moderate	57	61	No	Moderate - Significant - Note 2
130	Letteragh Road South	57	61	No	Significant - Note 2	58	62	No	Moderate - Significant - Note 2
131	N59 Moycullen Road	62	62	No	Imperceptible / Positive	63	63	No	Imperceptible / Positive
136	Barnacranny	51	61	Yes	Significant	51	62	Yes	Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
138	The Heath	44	65	Yes	Very Significant	45	66	Yes	Very Significant
139	N59 Moycullen Road / Ard na Locha	62	63	Yes	Moderate - Significant	62	63	Yes	Not Significant
140	Barnacranny	50	67	Yes	Very Significant	50	68	Yes	Very Significant
141	N59 Moycullen Road / Chestnut Lane	63	63	No	Not Significant	63	63	No	Not Significant
142	N59 Moycullen Road / Ard na Locha	51	64	Yes	Significant	51	65	Yes	Very Significant
144a	Árd an Locha (to be acquired)	55	68	Yes	Very Significant	55	69	Yes	Very Significant
144b	Árd an Locha (to be acquired)	58	63	Yes	Significant	58	63	Yes	Moderate - Significant
145	The Heath	47	61	Yes	Significant	47	62	Yes	Significant
146a	Árd an Locha (side)	46	66	Yes	Very Significant	46	68	Yes	Very Significant
146b	Árd an Locha (rear)	51	68	Yes	Very Significant	51	69	Yes	Very Significant
147a	Árd an Locha (front)	60	65	Yes	Very Significant	60	66	Yes	Significant
147b	Árd an Locha / N59 Moycullen Road (side)	67	66	No	Imperceptible / Positive	68	67	No	Imperceptible / Positive

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
148a	N59 Moycullen Road / Aughnacurra (rear)	62	64	Yes	Moderate - Significant	62	65	Yes	Not Significant - Slight
148b	N59 Moycullen Road / Aughnacurra (side/front)	66	65	No	Imperceptible / Positive	66	65	No	Imperceptible / Positive
150	St. James National School, Upper Dangan	48	62	Yes	Significant	48	63	Yes	Significant
151a	Upper Dangan / N59 Moycullen Road (front)	60	66	Yes	Very Significant	61	67	Yes	Significant
151b	Upper Dangan / N59 Moycullen Road (side)	58	66	Yes	Very Significant	58	67	Yes	Significant
153	Aughnacurra (to be acquired)	57	67	Yes	Very Significant	57	68	Yes	Very Significant
154	Aughnacurra	52	64	Yes	Significant	52	65	Yes	Very Significant
155	Upper Dangan / N59 Moycullen Road	62	63	Yes	Moderate - Significant	62	64	Yes	Not Significant
156	Aughnacurra	45	63	Yes	Significant	46	64	Yes	Significant
157	N59 Moycullen Road	64	63	No	Imperceptible / Positive	65	63	No	Imperceptible / Positive
158	UoG	50	66	Yes	Very Significant	50	67	Yes	Very Significant
159	N59 Moycullen Road	69	66	No	Imperceptible / Positive	69	66	No	Imperceptible / Positive

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
160	UoG	47	67	Yes	Very Significant	47	68	Yes	Very Significant
161	N59 Moycullen Road	69	67	No	Imperceptible / Positive	70	67	No	Imperceptible / Positive
162	N59 Moycullen Road / UoG	60	61	No	Not Significant	60	61	No	Not Significant
163	Dangan House	44	60	No	Moderate	44	61	Yes	Significant
164	N59 Moycullen Road / Clifton Close	64	64	No	Imperceptible / Positive	65	64	No	Imperceptible / Positive
165	Menlo Castle	46	62	Yes	Significant	46	63	Yes	Significant
168a	Coolough Road (front)	40	62	Yes	Significant	40	63	Yes	Significant
168b	Coolough Road (rear)	43	62	Yes	Significant	43	63	Yes	Significant
170a	Menlough / Sean Bothar (front)	59	63	Yes	Significant	59	63	Yes	Moderate - Significant
170b	Menlough / Sean Bothar (rear)	51	62	Yes	Significant	51	63	Yes	Significant
172	N84 Headford Road / Ballinfoyle	64	64	No	Imperceptible / Positive	64	64	No	Imperceptible / Positive
173	Ballindooley Boithrin / N84 Junction	56	65	Yes	Very Significant	56	66	Yes	Significant
174a	N84 Headford Road Junction South	67	64	No	Imperceptible / Positive	67	64	No	Imperceptible / Positive

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
174b	N84 Headford Road Junction South	58	61	Yes	Significant	58	62	Yes	Moderate - Significant
176	N84 Headford Road Junction South	55	61	Yes	Significant	56	62	Yes	Significant
177a	N84 Headford Road Junction (front)	61	64	Yes	Significant	61	65	Yes	Significant
177b	N84 Headford Road Junction (rear)	64	65	Yes	Significant	64	65	Yes	Not Significant - Slight
178	Ballindooley Boithrin / N84 Junction	52	61	Yes	Significant	52	62	Yes	Significant
179	Ballindooley / N84 Headford Road	65	67	No	Significant - Note 1	65	67	No	Not Significant - Slight - Note 1
180	Ballindooley / N84 Headford Road	65	67	No	Significant - Note 1	66	67	No	Not Significant - Slight - Note 1
181	N84 Headford Road Junction	68	69	Yes	Significant	68	69	Yes	Not Significant - Slight
182	N84 Headford Road Junction	70	71	No	Not Significant - Slight	70	71	No	Not Significant - Slight
183	N84 Headford Road Junction	61	64	Yes	Significant	61	65	Yes	Significant
185	Ballindooley / N84 Headford Road	65	66	No	Significant - Note 1	65	66	No	Not Significant - Slight - Note 1
186	Ballindooley / N84 Headford Road	67	69	No	Significant - Note 1	67	69	No	Not Significant - Slight - Note 1
188	Bóthar an Chóiste	49	60	No	Moderate	49	61	Yes	Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
191	Castlegar	47	60	No	Moderate	47	61	Yes	Significant
192	Castlegar	48	64	Yes	Significant	48	65	Yes	Very Significant
193	Castlegar	48	60	No	Moderate	49	61	Yes	Significant
194	School Road North	50	63	Yes	Significant	51	64	Yes	Significant
195b	School Road (rear) (to be acquired)	53	65	Yes	Very Significant	53	66	Yes	Very Significant
196	School Road North	50	62	Yes	Significant	50	63	Yes	Significant
198a	Castlegar / School Road South - rear (to be acquired)	53	61	Yes	Significant	54	62	Yes	Significant
204	Castlegar / N83 Tuam Road	52	60	No	Moderate	53	61	Yes	Significant
205	N83 Tuam Road South	71	70	No	Imperceptible / Positive	72	71	No	Imperceptible / Positive
206	Castlegar / N83 Tuam Road	59	62	Yes	Moderate - Significant	60	63	Yes	Not Significant
207a	Castlegar / N83 Tuam Road South (front)	69	68	No	Imperceptible / Positive	70	69	No	Imperceptible / Positive
207b	Castlegar / N83 Tuam Road South (rear)	62	61	No	Imperceptible / Positive	63	62	No	Imperceptible / Positive
208	Castlegar / N83 Tuam Road	56	64	Yes	Significant	57	65	Yes	Significant
209	City North Park Link Road	59	60	No	Slight	59	61	Yes	Not Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
210	N6 Bóthar na dTreabh	75	74	No	Imperceptible / Positive	75	75	No	Imperceptible / Positive
212	N83 Tuam Road North (front)	56	61	Yes	Significant	56	62	Yes	Significant
212 R	N83 Tuam Road North (rear)	54	62	Yes	Significant	55	63	Yes	Significant
213a	N83 Tuam Road North / Ceapach na Boirne (front)	71	68	No	Imperceptible / Positive	72	68	No	Imperceptible / Positive
213b	N83 Tuam Road North / Ceapach na Boirne (rear)	64	64	No	Imperceptible / Positive	64	63	No	Imperceptible / Positive
214	N83 Tuam Road North / Ceapach na Boirne	71	67	No	Imperceptible / Positive	72	68	No	Imperceptible / Positive
215	N83 Tuam Road North / Ceapach na Boirne	68	65	No	Imperceptible / Positive	69	66	No	Imperceptible / Positive
216	N17 Tuam Road North	69	67	No	Imperceptible / Positive	69	68	No	Imperceptible / Positive
217	The Meadows / N6 Bóthar na dTreabh	71	72	No	Not Significant - Slight	72	73	No	Not Significant - Slight
219	N83 Tuam Road South	71	73	No	Significant - Note 1	71	73	No	Not Significant - Slight - Note 1
220	N83 Tuam Road North	67	66	No	Imperceptible / Positive	67	66	No	Imperceptible / Positive
223	N83 Tuam Road North	67	66	No	Imperceptible / Positive	68	67	No	Imperceptible / Positive

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
225	The Paddocks, N6 Bóthar na dTreabh	73	72	No	Imperceptible / Positive	73	72	No	Imperceptible / Positive
233	Ballybrit Crescent	60	60	No	Imperceptible / Positive	61	61	No	Imperceptible / Positive
234a	Ballybrit Crescent (front)	66	64	No	Imperceptible / Positive	67	65	No	Imperceptible / Positive
235	Ballybrit Crescent	57	65	Yes	Very Significant	57	66	Yes	Significant
236	Ballybrit Cresent	55	60	No	Moderate	56	61	Yes	Moderate - Significant
237	An Sean Bhaile	71	68	No	Imperceptible / Positive	71	69	No	Imperceptible / Positive
238	Monivea Road R339, Ballybrit Cresent Junction	66	63	No	Imperceptible / Positive	67	63	No	Imperceptible / Positive
240	An Sean Bhaile	71	65	No	Imperceptible / Positive	72	66	No	Imperceptible / Positive
244	Garran Iseal	70	68	No	Imperceptible / Positive	70	68	No	Imperceptible / Positive
247	Galway Clinic R446 Doughiska	64	63	No	Imperceptible / Positive	64	64	No	Imperceptible / Positive
251a	Menlough / Sean Bothar (front)	41	63	Yes	Significant	41	64	Yes	Significant

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
251b	Menlough / Sean Bothar (rear)	47	65	Yes	Very Significant	47	66	Yes	Very Significant
255a	Letteragh Road South (front)	62	64	Yes	Moderate - Significant	63	64	Yes	Not Significant
270	Coolagh	60	60	No	Imperceptible / Positive	61	61	No	Imperceptible / Positive
2024_9	Ballymoneen Road South - residential under construction	48	66	Yes	Very Significant – Note 3	48	67	Yes	Very Significant – Note 3
2024_10	Ballymoneen Road South - residential under construction	45	67	Yes	Very Significant - Note 3	45	68	Yes	Very Significant - Note 3
2024_23a	Menlough / Sean Bothar (front) - residential property	56	64	Yes	Significant	56	65	Yes	Significant
2024_23b	Menlough / Sean Bothar (rear) - residential property	40	64	Yes	Significant	40	65	Yes	Very Significant
2024_27	Ballymoneen Road South - residential under construction (apartment)	54	68	Yes	Very Significant - Note 3	55	68	Yes	Very Significant - Note 3
2024_28	Ballymoneen Road South - residential under construction (apartment)	46	67	Yes	Very Significant - Note 3	47	68	Yes	Very Significant - Note 3

Receiver Location Reference	Description	Opening Year 2031		Mitigation Required?	Significance Rating	Design Year 2046		Mitigation Required?	Significance Rating
		Predicted Noise Level				Predicted Noise Level			
		Do Minimum	Do Something			Do Minimum	Do Something		
		L_{den} (dB)	L_{den} (dB)			L_{den} (dB)	L_{den} (dB)		
2024_34a_C	Rahoon link apt. (new development) upper floor	58	61	Yes	Moderate – Significant - Note 3	60	62	Yes	Not Significant - Note 3
2024_38	Bóthar an Chóiste -residential property	49	60	No	Moderate	49	61	Yes	Significant

Note 1: Assessment locations marked with Note 1 do not meet the TII conditions for noise mitigation due to the proposed N6 GCRR traffic contribution being less than 1 dB(A). Increased traffic noise levels are as a result of traffic flow increases along the local road and are not significant in the long-term. The specific impacts at these locations are discussed below.

Note 2: Assessment locations marked with Note 2 do not meet the TII conditions for noise mitigation due to the proposed N6 GCRR traffic contribution being less than 1 dB(A). Increased traffic noise levels are as a result of traffic flow increases along the local road but result in residual significant impacts in the long term. The specific impacts at these locations are discussed below.

Note 3: Assessment locations marked with Note 3 are new residential developments that are either under construction or have been granted permission but are not yet constructed. The specific impacts at these locations are discussed below.

TII Conditions for Noise Mitigation During Opening Year 2031

On review of the modelled results, a total of 118 assessment locations are calculated above 60 dB L_{den}. This excludes properties which will be demolished as part of the proposed N6 GCRR but includes those that are to be acquired.

Sixty eight (68) of these properties satisfy the initial requirements for noise mitigation i.e. the predicted road traffic noise level is above 60dB L_{den} and noise levels are increased by 1dB or more as a direct result of the proposed N6 GCRR.

Two of these receptors (2024_23a and 2024_23b) relate to a newly built property along Sean Bothair Road and is an additional location since the 2018 EIAR.

Four of the modelled receptors (2024_9, 2024_10, 2024_27 and 2024_28) are residential houses and apartments under construction along Ballymoneen Road, south of the proposed N6 GCRR. The grant of planning for this residential development by An Bord Pleanala (ABP-304762-19) included a condition for the developer to provide noise mitigation measures within the development site such that noise levels are attenuated to acceptable levels in accordance with internationally accepted standards. Mitigation measures for this residential development are therefore outside the scope of this Project.

One receptor (2024_34a) relates to a permitted, but not yet constructed residential building off the Rahoon Link Road, to the east of the proposed N59 Link Road South.

TII Conditions for Noise Mitigation During Design Year 2046

On review of the modelled results, a total of 135 assessment locations are calculated above 60 dB L_{den}. This excludes properties which will be demolished as part of the proposed N6 GCRR but includes those that are to be acquired.

A total of 79 of the modelled locations satisfy the initial requirements for noise mitigation i.e. the predicted road traffic noise level is above 60dB L_{den} and noise levels are increased by 1dB or more as a direct result of the proposed N6 GCRR.

The same seven additional receptors discussed above for the Year of Opening are also included in the NSLs where the conditions for noise mitigation are met.

Noise mitigation will therefore be reviewed for the remaining locations based on the TII criteria and existing planning conditions for new developments.

Significant Effects Outside Assessment Boundary

During the Year of Opening, there are four modelled NSLs along the N84 Headford Road, north of the proposed N6 GCRR (179, 180, 185 and 186) where traffic noise levels are calculated to increase by 1 to 2 dB above the Do Minimum scenario.

The noise level range is categorised as high at these NSLs due to their proximity to the N84 road edge. During the Opening Year, the impact is categorised as Significant and is reduced to Not Significant to Slight in the Design Year. Given the small change in the prevailing traffic noise level at these locations and the reduced impacts between the opening and design years, mitigation is not proposed. This is in line with the TII guidelines where the contribution of the proposed N6 GCRR must be at least 1 dB(A).

There are 3 modelled NSLs along Ballymoneen Road, North and South of the proposed N6 GCRR (77, 78 and 83) and 2 NSLs along Letteragh Road, South of the proposed N6 GCRR (128 & 130) where traffic noise levels are calculated to increase by up to 4 dB above the Do Minimum scenario as a result of increased traffic flows along these roads.

During the Opening Year, the impact is categorised as Significant and during the Design Year, the impact is categorised as Moderate to Significant or Significant. Whilst these NSLs do not meet the TII conditions for noise mitigation as the increase is not attributed directly to the proposed N6 GCRR Road, given the significant effect over both assessment years, it is recommended that consideration is given to reducing traffic noise levels along these two roads as far as practicable.

Summary of Receptors Requiring Mitigation

Analysis of the modelled results indicates that during the Design Year of 2046, 79 assessment locations meet the initial three criteria for noise mitigation. These are distributed across the length of the proposed N6 GCRR including the mainline, link roads and along existing roads which will be upgraded as part of the proposed N6 GCRR.

Whilst the 78 properties identified satisfy the requirement for noise mitigation, the suitability and or practicality of noise mitigation for each location may not be possible or required by the Project at all locations. In addition, there are a further seven modelled locations that do not meet the TII conditions for mitigation but are predicted to experience a significant impact in the opening and design year and hence have been recommended for noise mitigation. Further discussion on the recommended mitigation measures for the operational phase are included in Section 18.6.3.

Traffic Noise Impacts Along Surrounding Road Network

The proposed N6 GCRR will result in a reduction in traffic volumes along the existing road network, particularly along routes traversing Galway City Centre.

It is possible to determine the approximate change in noise levels between the Do Minimum and Do Something scenarios using the traffic volumes calculated for the wider road network within Galway City. Using the same formulae described in Section 18.5.3.2, the reduction in traffic noise levels along the existing road network across Galway City is calculated and presented in Table 18.23.

Table 18.23 Calculated Reduction in Traffic Noise Levels along Existing Road Network - 2046

Road Link	Do Minimum		Do Something		Reduction in Traffic Noise Level, dB
	AADT	% HGV	AADT	% HGV	
N6 South of Briarhill	51991	4%	30207	4%	-2
N6 Near Ballybrit Business Park	51724	3%	41464	3%	-1
N6 Between N17 and R865	42433	2%	31487	2%	-2
N6 Between N84 and N17	36522	3%	26486	2%	-2
N6 East of Quincentenary Bridge	37385	4%	31889	3%	-2
N6 - on Quincentenary Bridge	65637	2%	43967	1%	-3
R338 at Westside Playing fields	23037	3%	16014	2%	-2
Western Distributor Road between Clybaun Road and R338	18703	1%	10651	0%	-4
Western Distributor Road between Clybaun Road and Ballymoneen Road	14339	1%	11668	0%	-2
R337 Kingston Road. Kingston	18105	1%	9986	0%	-3
R336. Salthill Road Upper. Galway Golf Course	17082	1%	14753	1%	-1
R336. Barna Road, Barna Woods	19148	1%	9083	1%	-3
R336. Barna Road, Barna. Creagan bus stop	14060	1%	6894	2%	-3
Boleybeg Road. Between Cappagh Road and Ballymoneen Road	6865	0%	4187	0%	-2
Rahoon Road. Between Clybaun Road and Bothar Stiofáin	8134	1%	7095	1%	-1

Road Link	Do Minimum		Do Something		Reduction in Traffic Noise Level, dB
	AADT	% HGV	AADT	% HGV	
N59. Thomas Hynes Road. Between Hazel Park and Cherry Park	8174	2%	7562	0%	-2
N59. Upper Newcastle Road. Between R338 and Corrib Village	14148	2%	10452	1%	-3
N59. Barnacranny. Between Chestnut Lane and Circular Road	19316	2%	17816	0%	-2
R338. Dublin Road. West of Junction with Coast Road	22577	3%	20963	3%	-1
R338. Dublin Road. Between Renmore Road and Michael Collins Road	27189	3%	22526	4%	-1
R336. Tuam Road. Mervue Business Park	24141	3%	17905	3%	-1
Wolfe Tone Bridge	26863	2%	19647	2%	-1
O'Briens Bridge	12947	1%	9517	1%	-2
N17. Tuam Road. North East of School Road	26446	4%	23371	3%	-1
Cappagh Road - North of N6 GCRR	6847	0%	4863	0%	-1
Cappagh Road - South of N6 GCRR	6847	0%	13158	1%	5
N84 South of N6 GCRR	12690	4%	17085	2%	-1
Letteragh Road North of N6 GCRR Link Road	7382	0%	1350	0%	-7
N6 North of Briarhill	56867	3%	39671	3%	-2
R339 East of Briarhill	34880	2%	26165	2%	-2
Ballybrit Crescent North of R339	30831	2%	19660	2%	-2
Ballybrit Crescent North of Briarhill Business Park	29678	2%	18829	2%	-2
School Road	4116	3%	1397	6%	-2
Ballybrit Industrial Estate Link to existing N6	5142	2%	9985	2%	3
Rahoon Rd east of N6 GCRR Link Road	11306	1%	10480	1%	-1
Western Distributor Road - East of Gort Na Bró	20771	2%	13372	1%	-3
R339 East of Parkmore	20678	1%	19611	1%	-1
Coast Road	18794	1%	17963	1%	-1
R864 Newcastle Road	19065	1%	15,113	1%	-1
R336 Bohermore	16069	3%	15439	3%	0

Referring to Table 18.23 the calculated reduction in traffic noise levels along the existing road network across Galway City is in the range of 1 to 7 dB. The greatest reduction in noise levels will be experienced along sections of the Letteragh Road North of the proposed GCRR, sections of the R336, R337, the N59 and Western Distributor Road with estimated traffic noise reductions ranging between 3 and 7 dB. There are extensive areas of high sensitive locations along and in proximity to these routes including high numbers of residential areas, educational buildings and hospitals which will therefore experience a moderate to major positive impact as a result of the proposed N6 GCRR. The roads with traffic noise level increases are modelled and discussed in the previous sections.

Referring the Draft Galway City NAP (2024 – 2028), the identified PIAs along the R336 Bohermore Road, N6 Bóthar na dTreabh and N6 Bóthar na dTreabh at Briarhill will experience no change or a reduction in noise levels of the order of 1 to 3 dB as a result of the Project and hence will achieve part of the Noise Action Plan objectives.

Operational Noise Summary

The proposed N6 GCRR will introduce traffic noise to areas which are not currently exposed to any significant level of road traffic, particularly at properties set back from existing local roads in rural settings. The character of the noise environment will be altered at properties where intermittent traffic forms part of the noise environment to a more continual source of noise as a result of the operational phase.

In the absence of mitigation, the majority of modelled NSLs will experience an impact that is categorised as slight or lower. Approximately 50% of the modelled NSLs will experience an impact of moderate or greater. Those with traffic noise levels above 60 dB L_{den} are those with the highest potential noise impacts and noise mitigation is therefore focused on these locations in accordance with the TII noise guidelines.

18.5.4.2 Operational Vibration

As a vehicle travels along a road, vibration can be generated in the road and subsequently propagate towards nearby buildings. Such vibration is generated by the interaction of a vehicle's wheels and the road surface and by direct transmission through the air of energy waves. Some of these waves arise as a function of the size, shape and speed of the vehicle, and others from pressure fluctuations due to engine, exhaust and other noises generated by the vehicle.

It has been found that ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Perceptible road traffic vibration can therefore be largely avoided by maintenance of the road surface.

18.5.4.3 Operational Maintenance

Once operational, the Project will be subject to the same maintenance programme as the existing road infrastructure. This will involve upgrade and/or replacement of road surfaces over the life span of the Project. These activities will occur along sections of the Project as required. Noise impacts associated with these activities will be of similar magnitude to those described in Section 18.5.3.1.

18.6 Mitigation Measures

18.6.1 Introduction

Mitigation measures for the construction and operational phases are set out below in order to reduce potential impacts as far as practicable to within the adopted design goals for noise and vibration.

18.6.2 Construction Phase

18.6.2.1 Noise

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

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use
- Any plant, such as generators or pumps that is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen
- During the course of the construction programme, the contractor will be required to manage the works to comply with the limits detailed in Table 18.2 using methods outlined in BS 5228-1 (2009+A1 2014).

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

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

Further comment is offered on these items in the following paragraphs and in Appendix A.18.2, however specific control measures relating to construction activities undertaken by the contractor will be set out within the construction noise and vibration management plan. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise monitoring. The contractor will be required to conduct construction noise predictions prior to works taking place and put in place the most appropriate noise control measures depending on the level of noise reduction required at any one location.

Selection of Quiet Plant

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

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

The contractor will evaluate the choice of piling, excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, 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 minimise potential disturbance.

The decision regarding the type of pile, excavation technique, rock breaking, crushing etc. to be used on a site will normally be governed by other engineering, environmental constraints. In these instances, it may not be possible for technical reasons to replace a noisy process by a quieter alternative (e.g. rotary bored piling over driven piles). Even if it is possible, the adoption of a quieter method may prolong the overall process

(e.g. manual rock breaking versus blasting); the net result being that the overall disturbance to the community will not necessarily be reduced.

General Comments on Noise Control at Source

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

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

The expression "*available techniques*" means *"those techniques developed on a scale which allows implementation…., under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced within the State, as long as they are reasonably accessible to the operator carrying on the activity".*

The term *"techniques*" includes *"both the technology used and the way in which the installation is designed, built, managed, maintained, operated and decommissioned".*

Thus, the concept of Best Available Techniques requires a degree of balance between the attainment of environmental benefits and the likely cost implications. In the identification of Best Available Techniques, regard will be had to a wide range of factors, however, emphasis will be given to *"practical suitability"* and the need *"to reduce an emission and its impact on the environment as a whole"*.

Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations, which have been reviewed and updated since the 2018 EIAR:

- For static plant such as compressors, generators, motors, pumps, the units will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation, as required, to ensure CNTs are not exceeded
- 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 cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant will be switched off when not in use and not left idling
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it is possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover
- For percussive tools such as pneumatic concrete breakers, rock drills and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed. Erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction
- Reverse alarms from mobile plant within large construction compounds (e.g. areas of extensive cutting), will be broadband to reduce tonal elements from this source
- 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 concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights and drop chutes/dump trucks are lined with resilient materials. This is an important consideration for site compounds where materials are loaded and unloaded. Site compounds in close proximity to noise sensitive areas (refer to Table 18.15) will incorporate a strict noise control policy relating to materials handling
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact
- Demountable enclosures can also be used to screen operatives using hand tools and may be moved around site as necessary
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures

Screening

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

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

BS 5228-1 (2009+A1 2014) 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. As an example, the use of a standard 2.4m high construction site hoarding will provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver. Annex B of BS 5228-1 (2009+A1:2014) (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials.

In addition, careful planning of the site layout will also be considered. Within site compounds, the placement of site buildings such as offices and stores between the site and sensitive locations can provide a good level of noise screening. Similarly, in some instances materials such as topsoil or aggregate along the route of the proposed N6 GCRR can provide a degree of noise screening if placed between the source and the receiver.

Installation of localised screens around the breakers, piling items or drill bits when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction.

Hours of Work

Construction activity will mostly take place during daytime hours Monday to Friday and Saturdays (refer Section 18.4.1.5). Depending on the noise emission levels experienced and associated noise impact, the contractor will be flexible and able to conduct certain works at hours which reflect periods when the neighbouring properties have lower sensitivities to noise.

It will be necessary to work overtime (including weekends) and night shifts at certain critical stages during the Project. Over the expected construction phase there will be up to 10 weeks of night time working along different sections of the proposed N6 GCRR primarily to facilitate bridge works over existing roads.

Consideration will be given to the scheduling of activities in a manner that reflects the location of the site and the nature of neighbouring properties. Each potentially noisy event/activity will be considered on its

individual merits and scheduled according to its noise level, proximity to sensitive locations and possible options for noise control. In situations where a particularly noisy activity is scheduled e.g. activities identified in Table 18.14 (rock breaking/crushing/impact piling etc.) or other activities of similar noise level, the use of other on-site activities will be scheduled to ensure control cumulative noise levels.

Liaison with the Public

On typical road construction sites, the major sources of noise are essentially mobile, and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling, excavation, breaking and other high noise or vibration activities works is usually short in relation to the length of construction work as a whole, and the amount of time spent working near to sensitive areas can represent only a part of the overall period. It is important, therefore, that clear forms of communication are established between the contractor and noise sensitive areas in proximity so that residents or building occupants are aware of the likely duration of activities likely to generate higher noise or vibration. Special areas of noise sensitivity where communication of scheduled works will be required include the adjacent schools and nursing homes where daytime concentration and resting is important. Key areas of communication will be required during blasting, breaking, and other elements of high noise activity with potential for durations likely to exceed ten or more days in any 15 consecutive days.

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.

Monitoring

During the construction phase noise monitoring will be undertaken at the nearest sensitive locations to ensure construction noise limits outlined in Table 18.2 are not exceeded. Noise monitoring will be conducted in accordance with the International Standard ISO 1996: Acoustics – Description, measurement and assessment of environmental noise Part 1 (2016) and Part 2 (2017). The selection of monitoring locations will be based on the nearest sensitive buildings to the working area which will progress along the length of the road construction.

It is recommended that noise control audits are conducted at regular intervals throughout the construction programme in conjunction with noise monitoring. The purpose of the audits will be to ensure that all appropriate steps are being taken to control construction noise emissions and to identify opportunities for improvement, where required.

18.6.2.2 Blasting and Air Overpressure

Air overpressure from a blast is difficult to control because of its variability, however, much can be done to reduce the effect and the control of the blast design at source.

In terms of blast design control, specific guidance will be obtained from the recommendations contained within BS 5228-2 (2009+A1:2014) in relation to blasting operations in addition to experienced blast control techniques used by the contractor. As per the 2018 EIAR, these will include some or all of the following:

- All blasting will be undertaken by professionally trained blast contractors
- Restriction of hours within which blasting can be conducted (09:00 – 18:00hrs)
- Trial blasts will be tested in less sensitive areas to assist in blast designs and identify potential zones of influence
- Explosive charges will be properly confined by a sufficient amount of stemming
- Blasting contractors will ensure that the minimum amount of primer cord is used, and that no primer cord is located above ground
- Profiling will be carried out after each blast in order to ensure the geometry of the rock face can be established, enabling the optimum burden and spacing to be applied for subsequent blasts

- The design, execution and completion of any blasting within 150metres of any existing structure shall require special considerations. This will include the use of pre and post condition structural surveys by a competent structural engineer
- Ground vibration and air over pressure (AOP) will be recorded simultaneously for each blast at the most sensitive locations, depending on the works area being blasted
- When blasting moves into a new area, an initial low level blast will be carried out (i.e. a low Maximum Instantaneous Charge (MIC)) and monitoring will be carried out simultaneously at a number of sensitive properties in different directions in order to generate specific scaled distance graphs
- The scaled distance graphs will be used to determine the optimum MIC for subsequent blasts area in order control vibration and AOP limits below the relevant limit values (as set out in Section 18.2.1) at the nearest sensitive buildings

In line with best practice mitigation measures from vibration sources, good communication and public relations are a key factor in reducing any startle effects to residents. In this instance, a Public Communications Strategy will be implemented by the contractor prior to the commencement of any blast works. In such cases, as per the 2018 EIAR, the following recommended mitigation measures are proposed:

- Relevant nearby residents will be notified before any work, and blasting starts (e.g. a minimum of 24-hour written notification)
- The firing of blasts will be undertaken, where possible, at similar times to reduce the 'startle' effect
- Ongoing circulars will be issued informing people of the progress of the blasting works
- The implementation of an onsite documented complaints procedure will be maintained by the contractor
- The use of independent monitoring will be undertaken by external bodies for verification of results

18.6.2.3 Vibration

The TII Guidelines recommend that in order to ensure that there is no potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in Table 18.4.

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

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

- A clear communication programme will be established to inform adjacent building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to exceed perceptible levels. The nature and duration of the works will be clearly set out in all communication circulars
- Alternative less intensive working methods and/or plant items shall be employed, where feasible
- Appropriate vibration isolation shall be applied to plant, where feasible
- Cut off trenches to isolate the vibration transmission path shall be installed where required
- In the case of impact piling or demolition works for instance, a reduction in the input energy per below shall be considered where required
- Monitoring will be undertaken at identified sensitive buildings, where proposed works have the potential to be at or exceed the vibration limit values

Property Condition Surveys

Property condition surveys will be offered for all buildings within 50m of the Assessment Boundary and those within 150m of proposed blasting works across the Project. Property condition surveys will also be carried out at buildings and structures considered appropriate relative to their proximity to the works. Such

property condition surveys shall be carried out by a Chartered Surveyor or Chartered Structural Engineer. Such property condition surveys, subject to the written agreement of relevant property owners, shall be carried out in two stages as the follows:

- the first stage shall consist of pre-construction condition surveys including photographic records which shall be carried out prior to the commencement of construction
- the second stage shall consist of post-construction condition surveys which shall include photographic records

A property condition survey will be carried out at the thatched cottage in Coolough Village, Menlough and at M&M Qualtech, Parkmore Business Park.

Disturbance of Particularly Vibration-Sensitive Equipment and Processes

The location of potentially vibration sensitive activities have been identified for manufacturing facilities within the Parkmore and Racecourse Business Parks. This location is in proximity to an area where blasting will take place as part of the proposed tunnel at Ballybrit (Galway Racecourse Tunnel). The most effective form of mitigation for this type of sensitive process is through on-going consultation with the property owners as the design and construction of the Project progresses. This will involve baseline vibration monitoring and the use of trial blasts using an initial low level charge with simultaneously vibration measurements undertaken at the building. This information will be used to determine acceptable vibration levels for the facility relating to the sensitivity of the operating equipment. The results of this trial assessment will then set appropriate agreed limits values at the facility in question which will be monitored during subsequent blasts or other excavation methodologies. Where no safe limit is determined, the timing and scheduling of blasts will be undertaken in consultation with the facility when no sensitive operations are taking place. Given the short time period over which an individual blast takes place (i.e. a number of seconds), this approach is deemed to be feasible.

M&M Qualtech will be included in the list of property owners to be consulted with as the design and construction of the Project progresses, in particular in respect of the dates of rock breaking and blasting and the detailed traffic management plan for their area. Vibration monitoring will be undertaken at their property in Parkmore.

The Contractor shall liaise with the operator for Twomileditch Quarry in relation to the blasting schedule for the proposed N6 GCRR and the blasting schedule for the quarry. The Contractor shall ensure that blasting between School Road and N84 does not take place at the same time (concurrently) as blasting in Twomileditch Quarry.

In considering the mitigation measures included ABP's Inspector concluded that they are comprehensive and robust and will adequately address potential construction impacts.

An Bord Pleanála's Inspector's Report dated 22 June 2021:

"Having considered the issues raised in the written and oral submissions, I conclude that noise and vibration emissions will arise during the construction phase and that this has the potential to impact upon sensitive residential receptors. However, I consider that the applicant has proposed a comprehensive and robust suite of mitigation measures, the majority of which are relatively standard for proposed road developments. I consider that these proposed mitigation measures will adequately address construction phase noise and vibration. However, I also consider that their success will be dependent on adequate monitoring and a pro-active communications/complaints system as outlined in the EIAR, CEMP and the SoEC."

18.6.3 Operational Phase

The following section details the mitigation measures deemed practicable to achieve the design goals previously defined in Section18.2.2.2.

The mitigation measures required to reduce traffic noise levels are specified based on the predicted noise levels for the Design Year of 2046. As discussed in Section 18.5.4.1, a total of 79 locations have been identified to trigger the three TII conditions for noise mitigation.

The difference in those triggering the requirement for mitigation between the 2018 EIAR and this updated EIAR relates to the inclusion of a LNRS as part of the design of the Project as it is now standard practice.

Four of the new assessment locations (2024_9, 2024_10, 2024_27 and 2024_28) are located to the south of the proposed N6 GCRR along Ballymoneen Road. The grant of planning for this residential development by An Bord Pleanala (ABP-304762-19) included a condition for the developer to provide noise mitigation measures within the development site such that noise levels are attenuated to acceptable levels in accordance with internationally accepted standards. Mitigation measures for this residential development are therefore outside the scope of this Project.

One of the new assessment locations (2024_34) is located along the junction of the Letteragh Road and the proposed N59 Link Road South. The grant of planning for this residential development by Galway City Council (23129) included a condition for the developer to provide boundary treatments to be agreed with the planning authority prior to the commencement of the development. Mitigation measures for this residential development are therefore outside the scope of this Project.

Options to reduce operational noise levels along the proposed N6 GCRR include the use of noise barriers to reduce noise levels along the propagation path between the source (proposed N6 GCRR) and the specific receivers (houses, schools, churches etc.). These screens may be constructed as earth bunds, proprietary noise barriers or a combination of both.

There are no new barriers proposed over those within the 2018 EIAR or the schedule of commitments submitted at the end of the oral hearing in 2020. The suite of barriers set out in the 2018 EIAR have been maintained within this updated EIAR.

There are two changes to previous detailed barriers as follows:

- An extension in height of noise barrier NB8/02 has been included as additional mitigation in vicinity of Upper Dangan. This has been increased from 2.5m to 3m
- An extension of noise barrier NB10/01 has been included as additional mitigation in vicinity of Coolagh Road. This has been extended west by 120m at a height of 2.5m (NB10/02)

Table 18.24 Likely Extent of Noise Screening

Receiver No.	Structure Name	Start Chainage	End Chainage	Height (m)	Location	Lateral Siting / Type
7 & 6	NB00/01	0+015	0+120	2	R336 West of Bearna West Roundabout	Westbound / Standard
8	NB00/02	0+000	0+100	2	R336 East of Bearna West Roundabout	Eastbound / Standard
27	NB01/01	1+030	1+145	2	Proposed N6 GCRR Mainline	Eastbound / Standard
40	NB01/02	1+520	1+735	2	Proposed N6 GCRR Mainline	Westbound / Standard
63a/63b	NB04/01	4+370	4+450	2.5	Proposed N6 GCRR Mainline	Eastbound / Standard
	NB04/02	0+095	0+130	2	Cappagh Road North of Cappagh Road Junction	Northbound / Standard
66a/66b	NB04/04	4+460	4+535	1.5	Proposed N6 GCRR Mainline	Westbound / Standard
	NB04/05	0+185	0+225	2.5	Cappagh Road South of Cappagh Road Junction	Southbound / Standard
	NB04/06	0+140	0+185	2.5	Cappagh Road South of Cappagh Road Junction	Southbound / Standard

Receiver No.	Structure Name	Start Chainage	End Chainage	Height (m)	Location	Lateral Siting / Type
74a/74b/75a	NB05/01	5+525	5+615	3.5	Proposed N6 GCRR Mainline	Westbound / Standard
	NB05/02	0+080	0+110	3	Ballymoneen Road south of Ballymoneen Road Junction	Northbound / Standard
	NB05/03	0+000	0+060	2.5	Ballymoneen Road south of Ballymoneen Road Junction	Northbound / Standard
80a/80b	NB05/04	5+660	5+750	2.5	Proposed N6 GCRR Mainline	Eastbound / Standard
	NB05/05	0+145	0+160	2	Ballymoneen Road north of Ballymoneen Road Junction	Southbound / Standard
	NB05/06	0+170	0+225	2	Ballymoneen Road north of Ballymoneen Road Junction	Southbound / Standard
86	NB05/07	5 +910	6+110	2	Proposed N6 GCRR Mainline	Westbound / Standard
96	NB06/01	6+400	6+555	2	Proposed N6 GCRR Mainline	Eastbound / Standard
106	NB06/02	6+870	7+100	2	Proposed N6 GCRR Mainline	Westbound / Standard
107	NB07/01	7+165	7+210	2.5	Proposed N6 GCRR Mainline	Eastbound / Standard
	NB07/02	0+000	0+250	2.5	N59 Letteragh Junction EB diverge	Eastbound / Standard
		7+210	7+260			
109/110	NB07/03	7+180	7+440	2	Proposed N6 GCRR Mainline	Westbound / Standard
120a/120b	NB07/04	1+415	1+470	2	N59 Link Road South	Southbound / Standard
	NB07/05	0+105	0+175	2	Letteragh Road L1323	Eastbound / Standard
255a	NB07/06	0+030	0+065	2	Letteragh Road L1323	Eastbound / Standard
	NB07/07	0+000	0+025	2	Letteragh Road L1323	Eastbound / Standard
136/137/145/146a/146b/149/150/151b/151a/155	NB08/01	0+060	0+000	2.5	N59 Letteragh Junction WB diverge	Westbound / Absorptive
		8+010	8+070			
	NB08/02	8+070	8+280	3	Proposed N6 GCRR Mainline	Westbound / Absorptive
	NB08/03	8+280	8+540	3	Proposed N6 GCRR Mainline	Westbound / Absorptive
140/142	NB08/04	8+100	8+230	3.5	Proposed N6 GCRR Mainline	Eastbound / Absorptive

Receiver No.	Structure Name	Start Chainage	End Chainage	Height (m)	Location	Lateral Siting / Type
	NB08/05	8+230	8+375	4	Proposed N6 GCRR Mainline	Eastbound / Absorptive
	NB08/06	8+375	8+405	3.5	Proposed N6 GCRR Mainline	Eastbound / Absorptive
148a/153/156/158	NB08/07	8+545	8+850	2.5	Proposed N6 GCRR Mainline	Eastbound / Reflective
	NB08/08	8+850	9+500	2	Proposed N6 GCRR Mainline	Eastbound / Reflective
151/155	NB08/09	8+540	8+760	2.5	Proposed N6 GCRR Mainline	Westbound / Reflective
158	NB08/10	8+760	8+790	2	Proposed N6 GCRR Mainline	Westbound / Reflective
158/160	NB08/11	8+850	9+500	2	Proposed N6 GCRR Mainline	Westbound / Reflective
144/147/148a	NB08/12	8+405	8+525	3	Proposed N6 GCRR Mainline	Eastbound / Absorptive
	NB08/13	8+525	8+545	2.5	Proposed N6 GCRR Mainline	Eastbound / Reflective
158	NB08/14	8+800	8+850	2	Proposed N6 GCRR Mainline	Westbound / Reflective
168	NB09/01	9+990	10+100	1.5	Proposed N6 GCRR Mainline	Eastbound / Reflective
170/251a/251b	NB10/01	10+420	10+780	3	Proposed N6 GCRR Mainline	Westbound / Reflective
	NB10/02	10+300	10+420	2.5	Proposed N6 GCRR Mainline	Westbound / Reflective
173/177/178	NB11/01	11+910	12+120	3.5	Proposed N6 GCRR Mainline	Eastbound / Reflective
174a	NB11/02	11+980	12+120	2.5	Proposed N6 GCRR Mainline	Westbound / Reflective
183	NB12/01	12+140	12+350	3	Proposed N6 GCRR Mainline	Eastbound / Absorptive
174a/174b/176	NB12/02	0+180	0+350	2	N84 Headford Road Junction WB diverge	Westbound/ Reflective
177a/177b	NB12/03	0+050	0+080	2	N84 Headford Road	Northbound/ Reflective
173/177a	NB12/04	0+090	0+150	2	N84 Headford Road	Northbound/ Reflective
191/192/193 (2024_38 & 189)	NB12/05	12+550	13+020	2.5	Proposed N6 GCRR Mainline	Westbound / Absorptive

Receiver No.	Structure Name	Start Chainage	End Chainage	Height (m)	Location	Lateral Siting / Type
194/195/196	NB12/06	12+870	13+050	3.5	Proposed N6 GCRR Mainline	Eastbound / Absorptive
174a/174b/176	NB12/07	12+140	12+350	2.5	Proposed N6 GCRR Mainline	Westbound / Absorptive
192/193/198a	NB13/01	13+020	13+165	3	Proposed N6 GCRR Mainline	Westbound / Absorptive
194/195/196	NB13/02	13+050	13+120	3	Proposed N6 GCRR Mainline	Eastbound / Absorptive
197	NB13/03	13+160	13+370	2	Proposed N6 GCRR Mainline	Eastbound / Reflective
203/204/206/208	NB13/04	13+360	13+640	3	Proposed N6 GCRR Mainline	Westbound / Reflective
	NB13/05	13+590	13+935	3.5	Proposed N6 GCRR Mainline	Westbound / Absorptive
	NB13/06	0+240	0+000	3	N83 Tuam Road Junction WB merge	Westbound / Reflective
		13+640	13+840			
212/213b	NB13/07	13+620	13+960	3.5	Proposed N6 GCRR Mainline	Eastbound / Absorptive
235 - 236	NB15/01	15+200	15+720	2.5	Proposed N6 GCRR Mainline	Eastbound / Reflective

In addition to the physical barriers proposed, it is recommended that the following sections of road, outside of the Assessment Boundary are surfaced with a LNRS to reduce potential significant impacts in the opening and design years:

- Ballymoneen Road: South of the proposed N6 GCRR to Western Distributor Road Junction
- Ballymoneen Road: North of the proposed N6 GCRR to Rahoon Road Junction
- Letteragh Road/Circular Road: South of the proposed N6 GCRR to Seamus Quirke Road

This proposed approach aligns with the Draft Galway City and Galway County NAPs which identifies the use of resurfacing roads with a LNRS (10mm SMA) areas with identified significant effects.

The proposed noise mitigation set out above have been designed to reduce traffic noise levels at or below the traffic noise design goal of 60dB $L_{den,}$ where relevant.

The mitigation measures associated with the physical noise screening has been assessed to provide the most suitable available noise mitigation at the nearest sensitive locations. Discussion on the residual impacts taking account of the proposed mitigation measures are outlined in Section 18.7.2.

18.7 Residual Impacts

18.7.1 Introduction

The residual impacts associated with the construction and operational phase are considered taking account of the proposed mitigation measures. These are discussed in the following sections.

18.7.2 Construction Phase

During the construction of the Project noise levels at properties closest to working areas will be increased. Given the linear nature of the works, noise emissions related to construction works will be of temporary to short term impact at any one area as the works progress along the length of the Project. The most appropriate noise mitigation measures for each work area will be determined taking account of the various control measures included within Section 18.6.2, Appendix A.18.2 and the CEMP in Appendix A.7.5. The various mitigation measures will be selected in order to control construction noise levels to within the limit values included in Table 18.2.

The residual construction noise and vibration impacts are discussed in this section, taking account the mitigation measures and assumed noise reduction. BS 5228-1 states that:

"If the site noise level exceeds the appropriate category value [the CNT], then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect."

A conservative reduction of 10 dB has been applied to construction noise sources to account for the level of noise reduction available by applying by the various noise mitigation measured outlined in the sections above. Taking account of this assumed reduction (through screening, noise control at source, choice of quieter plant items etc) the potential residual noise levels are discussed in Table 18.24.

Table 18.25 Construction Noise and Vibration Summary Post Mitigation

Construction Activity	Period over which Criterion Applies (dB LAeq,T)	Predicted Impact (Post Mitigation and Monitoring)
Rock Breaking / Drilling / Rock Crushing / Impact Piling	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, significant to very significant at NSLs up to 35m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, slight to moderate at NSLs between 35 and 185m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, not significant at NSLs at beyond 185m.
	Saturdays (07:00 – 16:30hrs)	Negative, significant to very significant at NSLs within 30m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, moderate to significant at NSLs between 35 and 55 m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, slight to moderate at NSLs between 60 and 185m distance from the proposed works.
		Negative, not significant at NSLs beyond 190m distance from the proposed works.
Site Clearance, Utilities, Excavation & fill, Road Works, Structures	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, slight to moderate NSLs within 105m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, not significant at NSLs beyond 110m distance from the proposed works.
	Saturdays (07:00 – 16:30hrs)	Negative, moderate to significant at NSLs within 20m distance from the proposed works. Duration is temporary to short term depending on area of work.

Construction Activity	Period over which Criterion Applies (dB LAeq,T)	Predicted Impact (Post Mitigation and Monitoring)
		Negative, slight to moderate at NSLs between 25m and 105m distance from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, not significant NSLs beyond 110m.
General site work	Monday to Friday: Daytime (07:00 – 19:00hrs)	Negative, slight to moderate at NSLs within 30m from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, not significant NSLs beyond 30m.
	Saturdays (07:00 – 16:30hrs)	Negative, slight to moderate at NSLs within 30m from the proposed works. Duration is temporary to short term depending on area of work.
		Negative, not significant NSLs beyond 30m.
Construction Traffic	Construction traffic periods daytime	Negative, imperceptible to negative slight to moderate. Duration is temporary to short term depending on area of work.
Construction vibration from general road works and construction activities including bored piling	All Construction work periods	Negative, Imperceptible to Not Significant and Temporary.
Construction vibration during sheet piling	As required	Negative, Moderate and Temporary at occupied buildings within 20m.
Construction vibration from ground breaking activities within 10m of occupied residential buildings	Ground breaking during road works and utility diversion works	Negative, Slight and Temporary.
Blasting AOP and PPV	Blasting daytime periods	Negative, Significant, Momentary

Once the various mitigation measures are put in place, noise impacts associated with the construction phase will be of negative, not significant and temporary impact to negative, significant and temporary to short term impact. Highest noise impacts will remain within areas of major earth work excavation areas, particularly in areas where sections of hard rock are to be excavated.

As noted within the earlier section, the use of drill and blast methods will likely be chosen in these areas. Whilst high noise levels are associated with an individual blast, the effects are momentary, and the blast designs will be strictly controlled to ensure the AOP and PPV levels are within the specified limit values. The use of this form of rock breaking will expedite the level of rock extraction in any one location and hence reducing overall exposure times and overall impacts. This approach also reduces the requirement for any significant periods of mechanical breaking in an excavation area. The use of crushing plant will be located in compounds areas set back from NSLs as far as practicable. All areas where major earthworks occur and materials handling will be strictly controlled through the use of control of noise at source, siting within compounds set back from NSLs, localised screening, scheduling of works to ensure noise limit values at the closest sensitive properties are controlled.

With reference to the significant effects identified above, as per DMRB Noise and Vibration (UKHA 2020) in cases of moderate to major magnitude of impacts, the duration of works determines the overall significance rating. As part of the mitigation measures, the durations advised in the DMRB Noise and Vibration (UKHA 2020) will be followed, where feasible, to reduce overall significance effects (i.e.

scheduling works to occur for periods of less than ten days/nights over 15 consecutive day/night periods and less than 40 days over six consecutive months where significant effects are identified). Where the CNL and duration of works is considered in line with the DMRB Noise and Vibration (UKHA 2020) the Construction Phase residual noise levels are not significant.

The assessment has indicated that the use of standard construction activities can operate within the recommended vibration limits for standard residential and other light-framed buildings. With the adoption of best practice methodologies for the control of vibration from blasting, potential vibration impacts at the most sensitive premises can be adequately mitigated to within acceptable levels for human response.

In considering the potential impacts during construction ABP's Inspector in their report dated 22 June 2021 noted:

"I have considered all of the written and oral submissions made in relation to noise and vibration matters, in addition to those specifically identified in this section of the report. I consider that noise and vibration impacts will arise during the construction phase, including from blasting operations, and that this has the potential to impact upon residential and other sensitive receptors. However, I am satisfied that these potential impacts would be avoided, managed and mitigated by the measures which form part of the proposed scheme, the proposed mitigation and monitoring measures, through suitable conditions and noting the relatively short-term duration of the construction phase and the linear nature of the proposed development."

18.7.3 Operational Phase

18.7.3.1 Residual Noise Level

The residual impacts associated with the Project have been assessed for each modelled location. A full set of calculated residual noise levels for all assessment locations are included in Appendix A.18.3.

With the inclusion of the noise mitigation measures, noise levels are at or below the TII operational noise design goal of 60dB L_{den} at the majority of assessment locations (properties, schools, churches etc.) or have been reduced to within or below the pre-existing noise level.

In line with the methodology outlined in Section 18.2.5., the significance of noise impacts are categorised and summarised in Table 18.26.

Table 18.26 Significance of effects with Mitigation

Short-Term Impacts – Year of Opening			Long-Term Impacts - Design Year		
Significance Rating	No of assessed properties	% of total	Significance Rating	No of assessed properties	% of total
Imperceptible / Positive	87	26	Imperceptible / Positive	69	21
Not Significant	33	10	Not Significant	42	13
Not Significant - Slight	20	6	Not Significant - Slight	72	21
Slight	88	26	Slight	49	15
Moderate	88	26	Moderate	90	27
Moderate - Significant	7	2	Moderate - Significant	5	1
Significant	8	2	Significant	4	1
Very Significant Note 1	4	1	Very Significant Note 1	4	1

Short-Term Impacts – Year of Opening			Long-Term Impacts - Design Year		
Significance Rating	No of assessed properties	% of total	Significance Rating	No of assessed properties	% of total
Total		**335**	**Total**		**335**

Note 1: Relates to new residential development where developer led mitigation is not included within this assessment. Residual effects will be lower with specific mitigation included, to be confirmed by development.

Opening Year

During the Year of Opening (2031), the assessment has concluded that 228 No (68%) of the modelled receptors in proximity to the proposed N6 GCRR will experience an Imperceptible/Positive to Slight impact as a result of the Project with mitigation.

A total of 88 (26%) of the modelled receptors will experience a Moderate impact as a result of the Project. All calculated NSLs with a rating of Moderate or below has a calculated traffic noise level of 60 dB L_{den} or less.

A total of 19 (6%) of the modelled receptors will experience an impact of moderate to significant or greater with mitigation. The specific assessment locations with residual noise impacts in these significance ranges are discussed below.

Modelled properties with Very Significant residual impacts (4 No.) are those where mitigation has not been included as part of this Project but will be incorporated as part of the development itself and hence this rating in an unmitigated one for these properties and will be lower once specific development led mitigation is incorporated.

The overall balance of residual effects are determined to be moderate or less across the Project with a small number of localised residual moderate to significant effects in the short-term opening year period.

Design Year

During the Year of Opening (2046), the assessment has concluded that 232 No. (69%) of the modelled receptors in proximity to the proposed N6 GCRR will experience an Imperceptible/Positive to Slight impact as a result of the Project with mitigation.

A total of 90 No. (27%) of the modelled receptors will experience a Moderate impact as a result of the Project. All calculated NSLs with a rating of Moderate or below has a calculated traffic noise level of 60 dB L_{den} or less.

A total of 13 No. (4%) of the modelled receptors will experience an impact of moderate to significant or greater with mitigation. The specific assessment locations with residual noise impacts in these significance ranges are discussed below.

As per the opening year, modelled properties with Very Significant residual impacts (4 No.) are those where mitigation has not been included as part of this Project but will be incorporated as part of the development itself and hence this rating in an unmitigated one for these properties.

The overall balance of residual effects are determined to be moderate or less across the Project with a small number of localised residual moderate to significant effects in the long-term design year period.

Table 18.27 overleaf presents the calculated residual noise levels for those locations where the conditions for mitigation were identified and proposed for the Project. Calculated residual noise levels for all assessment locations are set out in Appendix A.18.3.

Table 18.27 Calculated Residual Noise Levels for Locations Requiring Noise Mitigation

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
27	Na Foraí Maola Thiar (to be acquired)	41	58	Moderate	41	58	Moderate	Below Design Goal
51	Troscaigh Thoir - L1321 South	60	61	Moderate - Significant	61	61	Not Significant - Slight	Increase above Do Minimum less than 1dB. Not significant
63a	Cappagh Road North (rear)	56	59	Moderate	57	60	Slight	Achieves Design Goal
66a	Cappagh Road South (side / rear)	55	57	Slight	56	57	Not Significant - Slight	Below Design Goal
66b	Cappagh Road South (front)	62	59	Imperceptible / Positive	63	60	Imperceptible / Positive	Achieves Design Goal
74a	Ballymoneen Road South	54	59	Moderate	55	60	Moderate	Achieves Design Goal
74b	Ballymoneen Road South	39	59	Moderate	39	59	Moderate	Below Design Goal
75a	Ballymoneen Road South	56	58	Slight	57	58	Not Significant - Slight	Below Design Goal
76	Ballymoneen Road North	56	60	Moderate	57	61	Significant	1 dB above Design Goal, governed by traffic on Ballymoneen Road. Includes LNRS. Residual long-term noise level categorised as significant due to increase above Do Minimum levels. Residual noise level in line with similar locations across the Project
77	Ballymoneen Road South	57	59	Slight	58	59	Not Significant - Slight	Below Design Goal

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
78	Ballymoneen Road South	58	60	Slight	59	60	Not Significant - Slight	Achieves Design Goal
79	Ballymoneen Road North	60	62	Moderate - Significant	61	63	Not Significant - Slight	2 – 3 dB above Do Minimum level, governed by traffic on Ballymoneen Road. Includes LNRS. Residual noise level in line with similar locations across the Project
80a	Ballymoneen Road North (front)	58	61	Moderate - Significant	59	62	Moderate - Significant	2 – 3 dB above Do Minimum level, governed by traffic on Ballymoneen Road. Includes LNRS. (property derelict)
80b	Ballymoneen Road North (rear)	50	58	Moderate	50	59	Moderate	Below Design Goal
83	Ballymoneen Road	60	61	Moderate - Significant	61	63	Not Significant - Slight	2 – 3 dB above Do Minimum level, governed by traffic on Ballymoneen Road. Includes LNRS. Residual noise level in line with similar locations across the Project
86	Árd na Gaoithe - Ballymoneen	42	57	Moderate	43	58	Moderate	Below Design Goal
96	Clybaun Road North	48	57	Moderate	49	58	Moderate	Below Design Goal
106	Between Rahoon & Letteragh Road	42	59	Moderate	43	60	Moderate	Achieves Design Goal
107	Letteragh Road North	56	57	Slight	57	58	Not Significant - Slight	Below Design Goal

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
120a	Letteragh Road South (front)	60	56	Imperceptible / Positive	61	57	Imperceptible / Positive	Below Design Goal
128	Letteragh Road South	61	62	Moderate - Significant	62	63	Not Significant - Slight	1 dB above Do Minimum level, not significant in long term. LRNS to local road. Residual noise level in line with similar locations across the Project
129	Letteragh Road South	56	58	Slight	57	59	Not Significant - Slight	Below Design Goal
130	Letteragh Road South	57	58	Slight	58	59	Not Significant - Slight	Below Design Goal
136	Barnacranny	51	58	Moderate	51	59	Moderate	Below Design Goal
138	The Heath	44	59	Moderate	45	60	Moderate	Achieves Design Goal
139	N59 Moycullen Road/ Ard na Locha	62	61	Imperceptible / Positive	62	62	Not Significant - Slight	Equivalent or less than Do Minimum
140	Barnacranny	50	61	Significant	50	62	Significant	2 dB above Design Goal & significant increase above Do Minimum. Substantial mitigation in place at this location
142	N59 Moycullen Road/ Ard na Locha	51	58	Moderate	51	59	Moderate	Below Design Goal
144a	Árd an Locha (to be acquired)	55	58	Moderate	55	59	Slight	Below Design Goal
144b	Árd an Locha (to be acquired)	58	58	Not Significant	58	59	Not Significant - Slight	Below Design Goal
145	The Heath	47	57	Moderate	47	58	Moderate	Below Design Goal

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
146a	Árd an Locha (side)	46	57	Moderate	46	58	Moderate	Below Design Goal
146b	Árd an Locha (rear)	51	59	Moderate	51	60	Moderate	Achieves Design Goal
147a	Árd an Locha (front)	60	60	Imperceptible / Positive	60	60	Not Significant - Slight	Achieves Design Goal
148a	N59 Moycullen Road / Aughnacurra (rear)	62	61	Imperceptible / Positive	62	61	Imperceptible / Positive	Below Do Minimum value
150	St. James National School, Upper Dangan	48	56	Moderate	48	57	Moderate	Below Design Goal
151a	Upper Dangan / N59 Moycullen Road (front)	60	61	Moderate - Significant	61	62	Not Significant - Slight	1 dB above Do Minimum. Substantial mitigation in place. Residual noise level in line with similar locations across the Project
151b	Upper Dangan / N59 Moycullen Road (side)	58	60	Slight	58	61	Moderate - Significant	1 dB above Design Goal. Substantial mitigation in place. Residual noise level in line with similar locations across the Project
153	Aughnacurra (to be acquired)	57	60	Moderate	57	61	Moderate - Significant	1 dB above Design Goal. Substantial mitigation in place. Residual noise level in line with similar locations across the Project Property to be acquired
154	Aughnacurra	52	57	Moderate	52	58	Moderate	Below Design Goal

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
155	Upper Dangan / N59 Moycullen Road	62	61	Imperceptible / Positive	62	62	Not Significant - Slight	Equivalent or less than Do Minimum
156	Aughnacurra	45	57	Moderate	46	58	Moderate	Below Design Goal
158	UoG	50	59	Moderate	50	60	Moderate	Achieves Design Goal
160	UoG	47	57	Moderate	47	58	Moderate	Below Design Goal
163	Dangan House	44	56	Moderate	44	57	Moderate	Below Design Goal
165	Menlo Castle	46	56	Moderate	46	57	Moderate	Below Design Goal
168a	Coolough Road (front)	40	59	Slight	40	60	Not Significant - Slight	Achieves Design Goal
168b	Coolough Road (rear)	43	59	Slight	43	60	Not Significant - Slight	Achieves Design Goal
170a	Menlough / Sean Bothar (front)	59	60	Not Significant	59	60	Not Significant	Achieves Design Goal
170b	Menlough / Sean Bothar (rear)	51	56	Moderate	51	57	Moderate	Below Design Goal
173	Ballindooley Boithrin / N84 Junction	56	60	Moderate	56	61	Significant	1 dB above Design Goal. Substantial mitigation in place. Residual noise level in line with similar locations across the Project
174b	N84 Headford Road Junction South	58	57	Imperceptible / Positive	58	58	Not Significant - Slight	Below Design Goal
176	N84 Headford Road Junction South	55	57	Slight	56	58	Slight	Below Design Goal

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
177a	N84 Headford Road Junction (front)	61	61	Imperceptible / Positive	61	62	Not Significant - Slight	Increase above Do Minimum less than 1dB. Not significant
177b	N84 Headford Road Junction (rear)	64	63	Imperceptible / Positive	64	64	Not Significant - Slight	Equivalent or less than Do Minimum
178	Ballindooley Boithrin / N84 Junction	52	57	Moderate	52	58	Moderate	Below Design Goal
179	Ballindooley / N84 Headford Road	65	67	Significant	65	67	Not Significant - Slight	Increase above Do Minimum less than 2dB – influenced by traffic on N84
180	Ballindooley / N84 Headford Road	65	67	Significant	66	67	Not Significant - Slight	≤1 dB increase above Do Minimum– influenced by traffic on N84
181	N84 Headford Road Junction	68	69	Significant	68	69	Not Significant - Slight	≤1 dB increase above Do Minimum– influenced by traffic on N84
183	N84 Headford Road Junction	61	62	Not Significant	61	62	Not Significant - Slight	≤1 dB increase above Do Minimum– influenced by traffic on N84
185	Ballindooley / N84 Headford Road	65	66	Significant	65	66	Not Significant - Slight	≤1 dB increase above Do Minimum– influenced by traffic on N84
186	Ballindooley / N84 Headford Road	67	69	Significant	67	69	Not Significant - Slight	Increase above Do Minimum less than 2dB - local traffic

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
188	Bóthar an Chóiste	49	59	Moderate	49	60	Moderate	Achieves Design Goal
191	Castlegar	47	55	Moderate	47	56	Moderate	Below Design Goal
192	Castlegar	48	57	Moderate	48	58	Moderate	Below Design Goal
193	Castlegar	48	55	Moderate	49	56	Moderate	Below Design Goal
194	School Road North	50	59	Moderate	51	60	Moderate	Achieves Design Goal
195b	School Road (rear) (to be acquired)	53	61	Significant	53	62	Significant	2dB above Design Goal. Property to be acquired. Substantial mitigation in place. Residual noise level in line with similar locations across the Project
196	School Road North	50	58	Moderate	50	59	Moderate	Below Design Goal
198a	Castlegar / School Road South - rear (to be acquired)	53	59	Moderate	54	60	Moderate	Achieves Design Goal
204	Castlegar / N83 Tuam Road	52	57	Moderate	53	58	Moderate	Below Design Goal
206	Castlegar / N83 Tuam Road	59	60	Not Significant	60	61	Not Significant - Slight	Substantial mitigation in place Increase above Do Minimum less than 1dB. 1 dB above Design Goal in Design Year, not significant in short or long term
208	Castlegar / N83 Tuam Road	56	60	Moderate	57	61	Moderate - Significant	Substantial mitigation in place. 1 dB above Design Goal in Design Year.

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
								Residual impact due to increase above Do Minimum level
209	City North Park Link Road	59	59	Not Significant	59	60	Not Significant - Slight	Achieves Design Goal
212	N83 Tuam Road North (front)	56	59	Moderate	56	60	Slight	Achieves Design Goal
212 R	N83 Tuam Road North (rear)	54	59	Moderate	55	60	Moderate	Achieves Design Goal
235	Balybrit Crescent	57	58	Slight	57	59	Not Significant - Slight	Below Design Goal
236	Ballybrit Cresent	55	56	Not Significant	56	57	Not Significant - Slight	Below Design Goal
251a	Menlough / Sean Bothar (front)	41	57	Moderate	41	58	Moderate	Below Design Goal
251b	Menlough / Sean Bothar (rear)	47	58	Moderate	47	59	Moderate	Below Design Goal
255a	Letteragh Road South (front)	62	57	Imperceptible / Positive	63	58	Imperceptible / Positive	Below Design Goal
2024_9	Ballymoneen Road South - residential under construction	48	67	Very Significant	48	68	Very Significant	Unmitigated noise levels. Mitigation to be progressed as part of residential development planning conditions outside of project scope
2024_10	Ballymoneen Road South - residential under construction	45	67	Very Significant	45	68	Very Significant	Unmitigated noise levels. Mitigation to be progressed as part of residential development planning conditions outside of project scope

Receiver Location Reference	Description	Opening Year 2031		Significance Rating	Design Year 2046		Significance Rating	Comment
		Predicted Noise Level			Predicted Noise Level			
		Do-Minimum	Do-Something		Do-Minimum	Do-Something		
		(dB) L_{den}	(dB) L_{den}		(dB) L_{den}	(dB) L_{den}		
2024_23a	Menlough / Sean Bothar (front) - residential property	56	58	Slight	56	59	Not Significant	Below Design Goal
2024_23b	Menlough / Sean Bothar (rear) - residential property	40	56	Moderate	40	57	Moderate	Below Design Goal
2024_27	Ballymoneen Road South - residential under construction (apartment)	54	68	Very Significant	55	69	Very Significant	Unmitigated noise levels. Mitigation to be progressed as part of residential development planning conditions outside of project scope
2024_28	Ballymoneen Road South - residential under construction (apartment)	46	67	Very Significant	47	68	Very Significant	Unmitigated noise levels. Mitigation to be progressed as part of residential development planning conditions outside of project scope
2024_34a_C	Rahoon link apartment (new development)	58	61	Moderate - Significant	60	62	Moderate - Significant	Unmitigated noise levels. Mitigation to be progressed as part of residential development planning conditions outside of project scope
2024_38	Bóthar an Chóiste -residential property	49	59	Moderate	49	60	Moderate	Achieves Design Goal

The results of the assessment have indicated that along the length of the proposed N6 GCRR and the proposed development at Galway Racecourse, traffic noise levels at or below 60dB L_{den} can be achieved, and/or the Do-Something noise levels can be reduced to the equivalent Do-Minimum traffic noise levels at the majority of locations with the recommended mitigation measures in place.

There are a number of properties where a residual noise level is calculated as a direct result of the Project along the proposed N6 GCRR. These are discussed below:

- Assessment Locations R140, R151 and R153 within Upper Dangan, Ard na Locha and Aughnacurra have residual calculated levels between 1 and 2 dB above the design goal. There is substantial noise mitigation in this area through the use of high noise barriers.
- Assessment Locations R173, R177, R181 and R183 in the vicinity of the N84 Headford Road Junction have residual calculated levels between 1 and 2 dB above the design goal or the Do Minimum traffic noise level. There is substantial noise mitigation in this area through the use high noise barriers.
- Assessment Location R195b, along school road, north of the proposed N6 GCRR has a residual calculated level 2 dB above the design goal. There is substantial noise mitigation in this area through the use of high noise barriers and this property will be acquired as part of the Project.
- Assessment Location R208 in the vicinity of the N83 Tuam Road Junction has residual calculated levels 1 dB above the design goal which are influenced by both the N83 and the proposed N6 GCRR. There is substantial noise mitigation in this area through the use of high noise barriers.
- Assessment Locations 2024_9, 2024_10, 2024_27 and 2024_28 represent a new residential development south of Ballymoneen Road and the current significance rating of 'very significant' relates to an unmitigated scenario. As per the developments grant of permission, noise mitigation measures are to be incorporated within the development site such that noise levels are attenuated to acceptable levels in accordance with internationally accepted standards. In this instance, residual mitigated noise levels at these properties are required to be further mitigated and residual effects should be reduced to moderate.

The 2004 TII noise guidance document notes the following with respect to achievement of the noise design goal:

> *"The Authority accepts that it may not always be sustainable to provide adequate mitigation in order to achieve the design goal. Therefore, a structured approach should be taken in order to ameliorate as far as practicable."*

The 2014 noise guidance document notes that:

> *"in some cases the attainment of the design goal may not be possible by sustainable means".*

This guidance document also notes that caution should be exercised specifying substantial screening where small benefits (<3dB) are only achieved, given a change of 3dB(A) is the smallest change that would give a reliable difference in public response. Specifically, the TII 2014 document goes on to note that:

> *"It may be unsustainable to increase barrier dimensions significantly where the result would be a reduction of 1dB or less, as such a reduction would be close to imperceptible in a laboratory situation and would not result in a difference in public response in the real world environment."*

In this instance, the extent of screening deemed feasible to achieve the target design goal at the relevant properties has been assessed, taking into account a level of proportionality with respect to changes in noise levels. The assessment concluded that whist these exceedances are above the TII noise design goal, reducing traffic noise levels to at or below 60dB L_{den} at these properties will require substantial additional barrier lengths and heights over and above those in place in order to achieve an insignificant change to the overall noise level at a property.

There are instances where a residual noise level of 1 to 2dB above the Do Minimum traffic noise level remains at NSLs that are not directly impacted by the proposed N6 GCRR itself. These locations primarily relate to properties which remain dominated by traffic along the local road network which falls outside the fenceline of the proposed N6 GCRR.

- Residual noise levels at locations R76, R80a, R83 along the Ballymoneen Road remain dominated by traffic along this road. Residual noise levels are reduced to within 1 to 2 dB above the Do Minimum scenario with the inclusion of a LNRS along this road. It is noted that the residential property R80a is a derelict building.
- Residual noise levels at location R128 along Letteragh Road South remain dominated by traffic along this road. Residual noise levels are reduced to within 1 dB above the Do Minimum scenario with the inclusion of a LNRS along this road.
- Residual noise levels at locations R179, R180, R185 and R186 along the N84 Headford Road North of the proposed N6 GCRR remain dominated by traffic along this road. Residual noise levels are reduced to within 2 dB above the Do Minimum scenario.
- Assessment Location 2024_34a, represents a new residential development off Letteragh Road and along the proposed N59 Link Road South (ABP: 318465-23). The residual noise level relates to upper level of building at the junction of the Letteragh Road and the proposed N59 Link Road South and is influenced primarily by traffic along the Letteragh Road. The application of LNRS to Letteragh Road has been included in the mitigation proposals for the Project.

Comment on Schools Along the Proposed N6 GCRR

There are two schools located in proximity to the proposed N6 GCRR, St. James' National School in Bushypark and Castlegar School off School Road. Both schools have been assessed in terms of their noise impacts. Calculated noise levels at St James' National School are 57dB L_{den} during the design year taking account of noise mitigation in this area. This represents a minor increase above the pre-existing noise environment and is an acceptable external noise levels for school buildings.

Calculated noise levels at Castlegar school are made along the southern façade and rear facades facing the proposed N6 GCRR including a new building to the north. Three assessment locations are modelled across the school buildings. Taking account of the screening provided by the extensive cutting in this area, the proposed low noise road surface and noise barrier, residual noise levels are calculated in the range of 52 to 58dB $L_{den.}$ Taking account of baseline noise levels measured at the school and adjacent properties along School Road, this represents a minor change in the noise environment and is an acceptable external noise levels for school buildings.

In considering the potential impacts during operation ABP's Inspector in their report dated 22 June 2021 noted:

"During the operational phase, the majority of noise sensitive receptors will be in compliance with the design goal set out in the TII Guidelines – which I consider to be the appropriate guidelines to utilise in this instance – once noise mitigation measures are incorporated, such as noise barriers and the low noise road surface. There will also be positive impacts on a large number of receptors on the existing road network, due to reductions in traffic volumes on existing roads. A limited number of properties will, however, experience a residual noise impact marginally in excess of the TII Design Goal. Noting the provisions of the TII Guidelines for such a scenario, and also noting the need to balance the provision and scale of noise barriers against other consideration, such as visual impact, I am satisfied that the proposed development would not have any unacceptable direct, indirect or cumulative noise and vibration impacts."

A new development was granted permission in December 2024 (Planning Ref: 23141) for a school, PE / Multipurpose Hall and external ball courts within Dangan to the southeast of the proposed N6 GCRR alignment. The school buildings are located within the southeastern portion of the site furthest from the proposed N6 GCRR and screened by the PE/ Multipurpose hall buildings. During the planning process for the school the design of the proposed N6, including its elevation was shared with the applicant. As such the school had full cognisance of the proposed N6 GCRR during their design to mitigate accordingly. This development is included in the cumulative assessment list of projects in Section 18.8 below.

18.8 Cumulative Impacts

This section of the chapter presents the assessment carried out to examine whether the Project along with any other projects or plans could cumulatively result in a likely significant noise and/or vibration effects.

The identification of potential projects for the assessment of cumulative impacts has considered statutory city and county development plans and associated planning registers, local area plans, Galway Transport Strategy etc., with projects identified according to the methodology laid out in Chapter 21 of this updated EIAR. Thereafter, planned and committed projects have been scoped for assessment in this chapter based on relative proximity and potential noise and vibration connection between developments.

The identification of projects for the long list considered the following sources:

- An Bord Pleanála (ABP) website (http://www.pleanala.ie/index.htm) – for details of Strategic Infrastructure Developments (SIDs), Strategic Housing Developments (SHDs) and permissions made on appeal
- Local authorities (Galway City Council and Galway County Council) for up-to-date planning applications and local development plan designations

The types of projects considered:

- Local Planning Applications – those projects for which planning permission is applied for through the local planning authorities themselves and were identified from local authority planning application lists
- Strategic Housing Developments (SHDs) – housing developments of a certain type and scale (e.g., 100 or more houses or student accommodation units) where applications were lodged directly with An Bord Pleanála
- Large Scale Residential Developments (LRDs) – housing developments of a certain type and scale (e.g., 100 or more houses or student accommodation units comprising 200 bed spaces or more) for which planning permission is applied for through the local planning authorities
- Strategic Infrastructure Development (SIDs) - major infrastructure developments by local authorities and others for which applications are lodged directly with An Bord Pleanála

A five-year timeframe was deemed the most appropriate period for planning searches, as permissions granted more than five years ago would generally be constructed, partially constructed, or are under construction when the planning registers were viewed.

This list was then screened for developments within 300m of the Project for those with potential for cumulative noise impacts. Proposed developments beyond this distance will not contribute any significant construction noise impacts at NSLs in the vicinity of the Project due to distance attenuation and the calculated construction noise levels at this distance.

After reviewing the proposed developments within this buffer zone, a total of 50 proposed developments were assessed for potential cumulative noise impacts. Appendix A.18.4 presents the cumulative assessment undertaken for all the proposed developments within 300m of the Project whilst Table 18.28 presents the assessment of the proposed development likely to have a cumulative noise and vibration impact with the Project.

18.8.1 Cumulative Operational Phase Noise Effects

Cumulative traffic noise impacts for the opening and design year of the Project have been assessed at each of the receptor locations considered as part of this assessment. During the Do-Minimum scenario, road traffic flows along the existing road network have been modelled and the cumulative traffic noise level calculated. For the modelled Do-Something scenarios, road traffic along the existing road network coupled with traffic along the proposed N6 GCRR are combined to obtain a cumulative traffic noise level. The assessment takes account of any alignment alterations to the existing roads and junction and the re-distribution of traffic along the existing road network as a result of the proposed N6 GCRR. Operational traffic modelled for the assessment years of the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential and planned development.

In this regard the cumulative residual road traffic noise impacts are incorporated into the calculated operational noise levels set out in Appendix A.18.3.

Out of the projects brought forward for assessment, none were deemed to have potential cumulative operational impacts with the Project.

18.8.2 Cumulative Construction Phase Noise Impacts

Whilst works associated with the Project will be the dominant noise and vibration source at any one location in its vicinity, a review of potential cumulative construction noise impacts was undertaken assuming all proposed developments would be under construction at the same time as the Project.

Out of the projects brought forward for assessment, a total of 12 were deemed to have potential cumulative construction impacts with the Project should they be under construction at the same time. Table 18.28 presents a summary of the cumulative noise assessment undertaken for noise for these locations.

There is no potential cumulative vibration impact from any of the proposed developments within the screened 300m assessment zone or beyond due to the nature of the proposed developments.

Table 18.28 List of Potential Cumulative effects on Noise and Vibration

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
2460056	Galway City Council	Housing development of 20 no. units at Letteragh Road, Galway.	Letteragh Road Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the proposed development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
2360177	Galway City Council	Industrial (Car Park)	Ballybrit Business Park Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
				groundworks associated with higher construction noise levels. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary.
23157	Galway City Council	Residential 2 no. 3-storey duplex buildings;	Clybaun Road and Mincloon Cross Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and foundation works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house and apartment superstructure works and no significant construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
21430	Galway City Council	Residential Amendments to previously granted Planning Permission Ref: 14/248 (Bord Pleanala Ref: Pl 61.245292) extended under granted planning permission ref: 20/327 and previously amended under planning permission re	Mincloon, Clybaun Road & Mincloon Cross Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
				impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
20327	Galway City Council	Residential 58 residential units	Mincloon, Clybaun Road and Mincloon Cross, Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
23129	Galway City Council	Large-Scale Residential Development on a site located to the South of the Letteragh Road (L1323)	South of the Letteragh Road (L1323) Rahoon Letteragh Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
				into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
23141	Galway City Council	School, PE Hall/ Multi-Purpose Hall, Special Needs Unit, five external Ball Courts, 79 car parking space	Dangan Lower	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the low noise sources from the development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
21108	Galway City Council	Residential Amendments to previously granted planning permission ref: 14/248 (Bord Pleanala Ref: PL 61.245292). Extended under granted planning permission ref:20/327 and previously amended under planning permission re	Mincloon Clybaun Road & Moncloon Cross Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
				impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
314295	ABP	170 no. residential units and creche		The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and foundation works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house and apartment superstructure works and no significant construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
2460270	Galway City Council	LRD 1. Demolition of 2 no. existing dwellings 2. Construction of 156 no. residential units	Ballymoneen Road (L5024), Keeraun and Ballynahown East, Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant cumulative construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary to short-term. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project are assessed as part of the EIAR has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
2460394	Galway City Council	Residential	Letteragh Road, Letteragh, Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and ground works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house building works and no significant construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project are assessed as part of the EIAR has included for significant population growth in Galway City in line with NPF

Application Ref. No.	Planning Authority	Type of Development	Address	Likely Significant Cumulative Impacts
				forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.
2452	Galway City Council	Residential 33 apartments, 2 retail units and 1 medical unit	Clybaun Road, Knocknacarra Galway	The proposed development is adjacent to the Project and as such there is potential for cumulative construction noise impacts at commonly affected properties should both projects be under construction at the same time. Potential cumulative impacts associated with the development is likely to be limited to early stage site establishment and foundation works associated with higher construction noise levels. Lower noise levels and impacts are associated with the house and apartment superstructure works and no significant construction impacts are anticipated during this phase. Noise limits, mitigation and monitoring measures will be incorporated into the Project to control noise levels during this short-term phase. The overall residual cumulative impact with mitigation is expected to be negative, slight to moderate and temporary. There are no likely significant cumulative impacts of the Project in combination with the proposed development at operation stage due to the insignificant noise sources from the residential development beyond its site boundary. Operational traffic associated with the Project are assessed as part of the EIAR has included for significant population growth in Galway City in line with NPF forecasts to include additional residential development. The resultant noise impacts as assessed are not predicted to result in additional likely significant direct, indirect cumulative traffic noise impacts of the Project in combination with this proposed development on noise and vibration.

18.9 Summary

An assessment relating to the potential noise and vibration impacts of the Project has been determined for both the construction phase and the operational phase.

The key changes to the chapter since the 2018 EIAR involve:

- Reviewing and updating elements of the chapter to address points raised from the Brief of Evidence presented to An Bord Pleanala (ABP) at the oral hearing in 2020 and from the ABP Inspector's Report dated June 2021
- Update to the assessment of significance of effects having regard to the EPA 2022 EIAR guidelines, Design Manual for Roads and Bridges (DMRB) Sustainability & Environmental Appraisal LA 111 Noise and Vibration, Revision 2. (UKHE 2020), WHO European Noise Guidelines (2018), the Galway City Council Draft Noise Action Plan 2024 – 2028 and the Galway County Council Draft Noise Action Plan 2024 – 2028
- Updated operational traffic modelling based on the most up to date traffic forecasts for the revised opening and design years of the Project

- Update of Appendices 18.1 and 18.2 and Figures 18.1.1 to 18.1.15 to take account of additional noise monitoring and noise modelling results

During the construction phase, as per the 2018 EIAR, the assessment has determined that noise impacts will be negative moderate short-term and, in some instances, negative significant and momentary to short-term depending on the activities involved. The use of best practice noise control measures, hours of operation, scheduling of works within appropriate time periods, strict construction noise limits and noise monitoring during this phase will ensure impacts are controlled to within the adopted criteria. Similarly, vibration impacts during the construction phase will be well controlled through the use of low impact equipment and adherence to strict limit values which will be subject to monitoring at the nearest sensitive buildings.

The construction phase design and associated impacts of the Project are the same as the 2018 EIAR. The main difference is the description of the effects to align with the most up to date standards and guidelines for describing their effects.

During the operational phase, as per the 2018 EIAR, noise levels will be increased at the majority of noise sensitive locations immediately adjacent to the proposed N6 GCRR. As per ABPs inspectors report, the use of the 60 dB L_{den} was found to be the most appropriate design criteria for the proposed N6 GCRR upon consideration of the WHO 2018 Noise Guidelines and the TII Guidelines discussed during the oral hearing in 202. Taking account the updated Draft Galway City and Galway County Noise Action Plans, this design criteria for noise mitigation remains unchanged since the 2018 EIAR. Whilst noise levels of varying increases and impact magnitudes are calculated at the assessment locations, the incorporation of a low noise road surface as part of the design and the use of extensive noise barriers as part of the mitigation along the proposed roadside boundary will reduce noise levels to within the design goal of 60dB L_{den} or to the pre-existing Do-Minimum noise levels at the majority of noise sensitive locations.

Residual noise levels at a small number of locations will remain above the 60 dB L_{den} design goal or will be increased by 1 to 2 dB above the Do-Minimum where traffic noise levels are already above this value.

The overall balance of residual effects are determined to be moderate or less across the Project with a small number of localised residual moderate to significant effects in the short and long-term assessment periods.

Overall, noise levels will be increased at properties along the route of the proposed N6 GCRR once operational and a change in the noise environment will occur. The proposed N6 GCRR, however, has been designed to reduce operational noise levels to within national design guidelines through the incorporation of detailed noise mitigation measures. The number of properties along its route is relatively low compared to those within the city centre which are currently exposed to significantly higher noise levels from passing road traffic as determined from the TII Strategic Noise mapping and discussed within the Draft Galway City and Galway County NAPs (2024 – 2028). The reduction in traffic volumes traversing the city centre will result in a moderate to major positive noise impact to noise sensitive properties along the existing road network and hence will achieve part of the Noise Action Plan objectives.

The operation of the temporary and permeant stables and associated infrastructure will not increase the traffic or capacity of Galway Racecourse, and therefore the likely impacts of noise and vibration when the racecourse resumes normal operation, post construction, will not be altered and operational noise impacts will be negligible.

18.10 References

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

British Standard Institute. (BSI) British Standard (BS) 5228-1:2009 +A1 2014 *Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise*.

BS 5228-2:2009+A1:2014 *Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration*

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

BS 6472-1: 2008 *Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting*

BS 6472-2: 2008 *Guide to evaluation of human exposure to vibration in buildings, Part 2 Blasting Induced Vibration*

Environmental Protection Agency. (EPA) *Environmental Management in the Extraction Industry* (2006)

United Kingdom Highways England (now National Highways) (UKHE) *Design Manual for Roads and Bridges (DMRB) Sustainability & Environmental Appraisal LA 111 Noise and Vibration, Revision 2*. (UKHE 2020)

Galway City Council. *Draft Noise Action Plan 2024 – 2028*

Galway County Council. *Draft Noise Action Plan 2024 – 2028,* (hereafter referred to as Draft Galway Co.Co. NAP)

S.I. No. 663/2021 – European Communities (Environmental Noise) (Amendment) Regulations 2021

S.I. No. 241/2006 - European Communities *Noise Emission by Equipment for Use Outdoors (Amendment) Regulations 2006*

ISO 1996-1:2016 Acoustics - *Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures*

ISO 1996-2:2017 - *Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels*

Transport Infrastructure Ireland. (TII) (previously National Roads Authority (NRA)) 2004 *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA 2004

TII. (NRA) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (NRA 2014)

The UK Department of Transport. *Calculation of Road Traffic Noise* (hereafter referred to as the CRTN) (UK Department of Transport 1998)

World Health Organization. (WHO) *Environmental Noise Guidelines for the European Region* (2018)