Chapter 12 Noise and Vibration

12.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) outlines the assessment of the potential noise and vibration impacts associated with the N5 Ballaghaderreen to Scramoge Proposed Road Development.

12.2 Methodology

For new national roads in Ireland, it is standard practice to adopt the guidance contained within the TII/NRA document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004).

Supplementary guidance on the application of Guidelines has also been published by TII/NRA in the form of the *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (NRA, 2014). Where relevant and applicable, the content of this best practice guidance has been incorporated into this assessment.

National guidance in respect of the preparation of EIAR has been obtained from the Environmental Protection Agency's *Advice Notes on Current Practice in the Preparation of EIS* (2003). In addition, the draft *Advice Notes for Preparing Environmental Impact Statements (*September 2015) was considered.

12.2.1 Construction Phase

As per TII/NRA guidance, noise levels associated with the construction phase of a road project may be calculated in accordance with guidance set out in *BS 5228-1:*2009+*A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

The TII/NRA guidance document specifies noise levels that it typically deems acceptable in terms of construction noise. These limits are set out in Table 12.1.

Table 12.1 Maximum Permissible Noise Levels at the Facade of Dwellings During Construction

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
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 relevant local authority.

In the case that works are required on Saturday evenings (16:30 to 19:00hrs), works will be required not to exceed noise levels of 60dB $L_{Aeq(1hr)}$ and 65dB L_{Amax} at the Facade of Dwellings.

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

Table 12.2 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)**
8 mm/s	12.5 mm/s	20 mm/s

Whilst the levels of vibration outlined in Table 12.2 are deemed to be appropriate for soundly constructed buildings, it may be appropriate to adopt lower limits on vibration in the case of sensitive buildings of high intrinsic or archaeological value that are not in poor state of repair. Limits outlined in German Standard *DIN 4150-3 (1999-02) Structural Vibration - Effects of Vibration on Structures* may be appropriate for use in such instances.

In addition, the TII/NRA Guidelines suggest that human tolerance for daytime blasting and piling, two of the primary sources of construction vibration, limits vibration levels to a peak particle velocity (ppv) of 12mm/s and 2.5mm/s respectively.

12.2.2 Operational Phase

In regards to operational noise levels, the TII/NRA document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004) specifies that it is considered appropriate to set a design goal of 60dB L_{den} (free field residential façade criterion). Noise mitigation measures are deemed necessary whenever all of the following three conditions are satisfied:

a) The combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed development 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 development in place; and,

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

These conditions will ensure that mitigation measures arising out of this process are only based upon the degree of impact of the proposed road development under consideration.

This design goal is applicable to new national road schemes and is to be applied to receptors in respect of both the year of opening and the design year, typically 15 years after projected year of opening. In this case, an opening year of 2020 and a design year of 2035 have been assessed.

Due to very low levels of vibration generated by road traffic on well-maintained and smooth road surfaces, ground borne vibration from this development is unlikely to cause perceptible levels of vibration to building occupants. Similarly, the operational phase is not expected to generate any form of cosmetic damage to buildings located in proximity to the alignment. As such, the impacts of operational vibration have not been addressed further in this chapter.

12.3 Description of Existing Environment

An extensive programme of surveying was conducted in order to quantify the existing noise environment in the vicinity of noise sensitive locations that may be affected by the proposed road development.

The surveying was completed in accordance with relevant guidance and standards including:

- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (NRA, 2004).
- *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (NRA, 2014)
- *ISO 1996-2:2017 Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Sound Pressure Levels*

The surveying programme encompassed attended surveys at 85 no. locations and unattended surveys at 22 no. locations. The survey methodology and summary of results are presented and discussed in the following sections.

A survey of vibration along the proposed route corridor was not undertaken, as levels associated with existing roads would not be expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

12.3.1 Survey Methodology

The first stage is to assess and quantify the existing noise environment in the vicinity of sensitive receptors that may be affected by the proposed development. In the case of a road development, the selected noise-sensitive locations are those in closest proximity to the proposed road. Both the construction and operational phases of the proposed road development should be reviewed when selecting appropriate measurement locations.

Unattended Measurements

The continuous measurements were conducted using a Brüel & Kjær Type 3592 Environmental Kit, with either Brüel & Kjær Type 2238 or 2250 Sound Level Meters.

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.

Unmanned continuous measurements were conducted over at least 24-hour periods at twenty two locations. L_{den} values are derived directly from the measured data.

Attended Measurements

The short-term measurements were performed using Brüel & Kjær Type 2238, 2250 or 2260 Sound Level Meters. Short-term 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 NRA Guidance document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004).

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 Ireland for the purposes of assessing traffic noise.

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.
  - $L_{den} = 0.86 \times L_{A10(18hr)} + 9.86\ dB$

Survey Locations

The location reference and a description of each survey position are given in Table 12.3 and shown on Figure 12.1 of Volume 3 of this EIAR.

Table 12.3 Details of Attended Survey Locations

Survey Location Ref	Coordinates (Decimal Degrees Minutes Seconds)	
	Latitude	Longitude
ASL001	53.88539	-8.4678
ASL002	53.88429	-8.46243
ASL003	53.88046	-8.46265
ASL004	53.88149	-8.46047
ASL005	53.88186	-8.44927
ASL006	53.8821	-8.45139
ASL007	53.8794	-8.45067
ASL008	53.88069	-8.44414
ASL009	53.8802	-8.44082
ASL010	53.87062	-8.43104
ASL011	53.86017	-8.3998
ASL012	53.85484	-8.3937
ASL013	53.85149	-8.39009
ASL014	53.84961	-8.38348
ASL015	53.84992	-8.37923
ASL016	53.84764	-8.37795

Survey Location Ref	Coordinates (Decimal Degrees Minutes Seconds)	
	Latitude	Longitude
ASL017	53.84619	-8.37753
ASL018	53.83723	-8.38199
ASL019	53.83405	-8.3752
ASL020	53.83852	-8.3602
ASL021	53.84253	-8.34604
ASL022	53.84235	-8.33403
ASL023	53.84666	-8.32251
ASL024	53.83812	-8.31963
ASL025	53.83824	-8.28593
ASL026	53.83623	-8.28117
ASL027	53.83557	-8.26934
ASL028	53.835268	-8.26363
ASL029	53.83504	-8.26032
ASL030	53.83531	-8.25655
ASL031	53.83176	-8.25144
ASL032	53.83511	-8.244077
ASL033	53.83558	-8.23089
ASL034	53.83777	-8.22007
ASL035	53.828513	-8.223419
ASL036	53.827442	-8.223751
ASL037	53.82834	-8.19248
ASL038	53.827444	-8.184533
ASL039	53.83666	-8.185333
ASL040	53.82705	-8.17139
ASL041	53.82746	-8.16662
ASL042	53.83031	-8.16216
ASL043	53.83157	-8.15928
ASL044	53.82981	-8.14712
ASL045	53.82363	-8.14808
ASL046	53.82278	-8.14868
ASL047	53.81572	-8.13926
ASL048	53.81424	-8.13327
ASL049	53.81193	-8.12874
ASL050	53.79838	-8.11708
ASL051	53.7908	-8.10913
ASL052	53.78589	-8.10679
ASL053	53.78598	-8.10191
ASL054	53.786178	-8.098449
ASL055	53.79082	-8.09235
ASL056	53.79145	-8.08964
ASL057	53.7832	-8.10249
ASL058	53.78705	-8.08742

Survey Location Ref	Coordinates (Decimal Degrees Minutes Seconds)	
	Latitude	Longitude
ASL059	53.78348	-8.09004
ASL060	53.7801	-8.06716
ASL061	53.77083	-8.070142
ASL062	53.7651	-8.0734
ASL063	53.76589	-8.06168
ASL064	53.76588	-8.0564
ASL065	53.76776	-8.05109
ASL066	53.82767	-8.36344
ASL067	53.82048	-8.35003
ASL068	53.81361	-8.33655
ASL069	53.80588	-8.30466
ASL070	53.80009	-8.29703
ASL071	53.78396	-8.26243
ASL072	53.77973	-8.25584
ASL073	53.77761	-8.251652
ASL074	53.77276	-8.23087
ASL075	53.78652	-8.21556
ASL076	53.76652	-8.20228
ASL077	53.76597	-8.17407
ASL078	53.76784	-8.16687
ASL079	53.77235	-8.14566
ASL080	53.77425	-8.1277
ASL081	53.7742	-8.11564
ASL082	53.77668	-8.10687
ASL083	53.77627	-8.10357
ASL084	53.77145	-8.10271
ASL085	53.76742	-8.09766

Table 12.4 Details of Unattended Survey Locations

Survey Location Ref	Coordinates (Decimal Degrees Minutes Seconds)	
	Latitude	Latitude
USL001	53.883251	-8.458309
USL002	53.872769	-8.426517
USL003	53.865771	-8.416779
USL004	53.84818	-8.38852
USL005	53.836471	-8.319447
USL006	53.83636	-8.28855
USL007	53.83589	-8.275013
USL008	53.83508	-8.24837
USL009	53.82567	-8.22503
USL010	53.82477	-8.19452
USL011	53.831179	-8.159246

Survey Location Ref	Coordinates (Decimal Degrees Minutes Seconds)	
	Latitude	Latitude
USL012	53.820805	-8.145135
USL013	53.808106	-8.127047
USL014	53.79798	-8.11338
USL015	53.787865	-8.09507
USL016	53.78811	-8.090018
USL017	53.770357	-8.103293
USL018	53.77536	-8.07181
USL019	53.768101	-8.062424
USL020	53.81116	-8.32428
USL021	53.789639	-8.272393
USL022	53.768639	-8.16274

Survey Periods

Attended measurement survey periods were completed over the following periods:

- 11 Aug 2015 to 14 Aug 2015;
- 18 Aug 2015 to 21 Aug 2015;
- 24 Aug 2015 to 25 Aug 2015;
- 01 Sep 2015 to 04 Sep 2015, and;
- 07 Sep 2015 to 10 Sep 2015

Unattended 24-hour monitoring was conducted over the following periods:

- USL001 - 14:00hrs on 08 Sep 2015 to 21:00hrs on 09 Sep 2015;
- USL002 - 11:00hrs on 13 Aug 2015 to 15:00hrs on 14 Aug 2015;
- USL003 - 13:00hrs on 08 Sep 2015 to 21:00hrs on 09 Sep 2015;
- USL004 - 13:00hrs on 08 Sep 2015 to 20:00hrs on 09 Sep 2015;
- USL005 - 10:00hrs on 12 Aug 2015 to 11:00hrs on 13 Aug 2015;
- USL006 - 12:00hrs on 12 Aug 2015 to 13:00hrs on 13 Aug 2015;
- USL007 - 19:00hrs on 09 Sep 2015 to 08:00hrs on 11 Sep 2015;
- USL008 - 10:00hrs on 20 Aug 2015 to 13:00hrs on 21 Aug 2015;
- USL009 - 19:00hrs on 09 Sep 2015 to 08:00hrs on 11 Sep 2015;
- USL010 - 10:00hrs on 11 Aug 2015 to 10:00hrs on 12 Aug 2015;
- USL011 - 11:00hrs on 11 Aug 2015 to 11:00hrs on 12 Aug 2015;
- USL012 - 10:00hrs on 13 Aug 2015 to 14:00hrs on 14 Aug 2015;
- USL013 - 11:00hrs on 03 Sep 2015 to 12:00hrs on 04 Sep 2015;
- USL014 - 11:00hrs on 03 Sep 2015 to 12:00hrs on 04 Sep 2015;
- USL015 - 11:00hrs on 20 Aug 2015 to 13:00hrs on 21 Aug 2015;
- USL016 - 11:00hrs on 03 Sep 2015 to 12:00hrs on 04 Sep 2015;
- USL017 - 12:00hrs on 08 Sep 2015 to 20:00hrs on 09 Sep 2015;
- USL018 - 11:00hrs on 08 Sep 2015 to 12:00hrs on 09 Sep 2015;
- USL019 - 11:00hrs on 08 Sep 2015 to 18:00hrs on 09 Sep 2015;

- USL020 - 10:00hrs on 03 Sep 2015 to 11:00hrs on 04 Sep 2015;
- USL021 - 10:00hrs on 18 Aug 2015 to 18:00hrs on 19 Aug 2015, and;
- USL022 - 10:00hrs on 18 Aug 2015 to 17:00hrs on 19 Aug 2015.

Personnel and Instrumentation

Enfonic Ltd. conducted all noise surveys associated with the project.

Procedure

Shortened 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.

In all cases, measurements were performance free-field at least 3m from any reflecting wall or structure.

For 24-hour monitoring, sample periods were 1-hour long. The results were saved to the instrument memory for later analysis. Where required, a 4m tripod was used to obtain representative noise levels at first floor level of the receptor.

Summary of Survey Results

The results of the baseline unattended results have been presented in Table 12.5 whilst a summary of the attended results is presented in Table 12.6.

Table 12.5 Summary of Baseline Unattended Survey Results

Survey Location Reference	Measured Noise Levels (dB re.$2x10^{-5}$Pa)			
	L_{Day} (07:00 to 19:00hrs)	$L_{Evening}$ (19:00 to 23:00hrs)	L_{Night} (23:00 to 07:00hrs)	L_{den}
USL001	62	59	55	64
USL002	48	43	37	48
USL003	53	50	42	53
USL004	65	62	58	66
USL005	46	42	39	47
USL006	49	47	38	49
USL007	54	50	43	54
USL008	59	56	46	58
USL009	60	57	52	61
USL010	57	41	31	55
USL011	50	47	40	50
USL012	52	49	44	53
USL013	44	39	32	43
USL014	44	41	41	48
USL015	50	50	42	52
USL016	41	37	32	42
USL017	55	54	52	59
USL018	41	43	36	45
USL019	54	52	47	56

Survey Location Reference	Measured Noise Levels (dB re.2x10^{-5}Pa)			
	L_{Day} (07:00 to 19:00hrs)	$L_{Evening}$ (19:00 to 23:00hrs)	L_{Night} (23:00 to 07:00hrs)	L_{den}
USL020	62	59	55	63
USL021	65	62	58	67
USL022	62	60	58	65

Table 12.6 Summary of Baseline Attended Survey Results[1]

Survey Location Reference	L_{den}	Survey Location Reference	L_{den}	Survey Location Reference	L_{den}	Survey Location Reference	L_{den}
ASL001	80	ASL025	46	ASL049	60	ASL073	73
ASL002	80	ASL026	56	ASL050	55	ASL074	77
ASL003	49	ASL027	62	ASL051	64	ASL075	79
ASL004	46	ASL028	55	ASL052	58	ASL076	78
ASL005	82	ASL029	57	ASL053	49	ASL077	78
ASL006	82	ASL030	58	ASL054	64	ASL078	78
ASL007	52	ASL031	52	ASL055	57	ASL079	73
ASL008	82	ASL031	59	ASL056	48	ASL080	78
ASL009	83	ASL032	55	ASL057	64	ASL081	76
ASL010	48	ASL034	65	ASL058	39	ASL082	68
ASL011	76	ASL035	68	ASL059	51	ASL083	72
ASL012	78	ASL036	71	ASL060	42	ASL084	64
ASL013	77	ASL037	38	ASL061	40	ASL085	78
ASL014	49	ASL038	40	ASL062	80		
ASL015	48	ASL039	40	ASL063	73		
ASL016	42	ASL040	41	ASL064	65		
ASL017	44	ASL041	42	ASL065	62		
ASL018	74	ASL042	40	ASL066	77		
ASL019	77	ASL043	63	ASL067	77		
ASL020	43	ASL044	52	ASL068	79		
ASL021	45	ASL045	57	ASL069	77		
ASL022	47	ASL046	56	ASL070	79		
ASL023	42	ASL047	58	ASL071	59		
ASL024	49	ASL048	47	ASL072	72		

[1] In certain instances, due to the proximity of the receptor to the roadside and the lack of any suitable proxy survey location, the sound level meter had to be placed in close proximity to the road. For approximately twenty nine of the locations surveyed, the actual L_{den} value at the receptors will be considerably lower than that outlined above.

12.3.2 Discussion of Baseline Environment

The baseline environment in the vicinity of the proposed road development has been characterised through an extensive programme of noise surveying. The noise climate was observed to vary considerably across the proposed road development although for the most part, the baseline environment can be regarded as typical of rural locations in close proximity to local or regional roads.

The primary land use across the extent of the proposed road development is agricultural and includes a mixture of pastureland and forestry. The majority of noise sensitive receptors in the vicinity of the proposed road are comprised of residential dwellings although a small number of a number of religious, educational and medical receptors are also located along the proposed route.

For all attended locations the measured ambient noise levels ranged from 36 to 81dB L_{Aeq} whilst the calculated L_{den} ranged from 38 to 83dB.

For the unattended locations the measured ambient noise levels ranged from 41 to 65dB $L_{day,}$ 37 to 62dB $L_{evening}$ and 31 to 58dB L_{night}. The calculated L_{den} value for the unattended survey locations ranged from 42 to 67dB.

Noise levels at receptors in the vicinity of the offline sections of the proposed road development ranged from 40 to 59dB L_{den} with an average of 51dB L_{den} whilst receptors in the vicinity of the existing N5 ranged from 60 to 83dB L_{den} with an average of 79dB L_{den}. The higher values being measured at locations along the road edge.

In the majority of cases, for both the attended and unattended survey locations, the ambient noise levels were influenced primarily by road traffic noise although other sources of noise such as birdsong, wind generated noise, agricultural activity and barking dogs were also contributory sources.

12.4 Description of Likely Impacts

12.4.1 Construction Phase

Noise

A variety of items of plant will be in use during the construction works. These will include breakers, excavators, dump trucks, and generators in addition to general road surfacing and levelling equipment. They key phases of works will involve ground breaking, earthworks and earthworks haulage, drainage works, construction of attenuation ponds and surfacing works, construction of bridges and overpasses as well as noise associated with the movement of machinery and materials within and to and from the construction compounds. Blasting of bedrock will also be required on certain sections of the proposed road development. Due to the nature of the activities undertaken on a road construction site, there is potential for generation of high levels of noise at nearby noise sensitive properties.

As per TII/NRA guidance noise levels associated with construction may be calculated in accordance with the methodology set out in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. However, it is often not possible to conduct detailed prediction calculations

for the construction phase of a project in support of the EIAR. This is due to the fact that the programme for construction works has not been established in detail.

BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise sets out typical noise levels for items of construction plant. Tables 12.7 to 12.11 set out assumed plant items during the key phases of construction with the associated source reference from BS 5228-1:2009+A1:2014. The closest properties to the proposed alignment are at distances of approximately 50m. Construction noise calculations have been conducted at distances of 50 to 150m from the works for different work phases, representing the nearest properties to the works.

The calculations assume that plant items are operating for 66%[2] of the time and that all plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario.

Table 12.7 Indicative Construction Noise Calculations During Site Preparation

Site Clearance & Preparation (BS 5228 Ref)	Calculated $L_{Aeq,\,T}$ at Distance From Road (m)			
	50m	80m	100m	150m
Wheeled loader (C2.26)	63	59	57	54
Tracked excavator (loading dump truck) (C1.10)	69	65	63	60
Dozer (C.2.10)	64	60	58	55
Dump Truck (C2.30)	63	59	57	54
Combined L_{Aeq}	72	68	66	62

Table 12.8 Indicative Construction Noise Calculations During Excavation and Fill Works

Excavation and Fill Works (BS 5228 Ref)	Calculated $L_{Aeq,\,T}$ at Distance From Road (m)			
	50m	80m	100m	150m
Tracked excavator (loading dump truck) (C1-10)	69	65	63	60
Articulated dump truck (dumping rubble) (C1-11)	64	60	58	55
Wheeled loader (C2-26)	63	59	57	54
Dozer (C.2.10)	64	60	58	55
Dump Truck Tipping fill (C2.30)	63	59	57	54
Combined L_{Aeq}	73	68	66	63

[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.

Table 12.9 Indicative Construction Noise Calculations During Road Works

Road Works (BS 5228 Ref)	Calculated $L_{Aeq, T}$ at Distance From Road (m)			
	50m	80m	100m	150m
Tracked excavator (C2.21)	55	51	49	46
Dump Truck (C2.30)	63	59	57	54
Vibration rollers (C5.20)	59	55	53	50
Asphalt Paver & Tipping Lorry (C.5.31)	61	57	55	52
Diesel Generator (C4.76)	45	41	39	36
Road Rollers (C5.19)	64	60	58	55
Combined L_{Aeq}	*69*	*65*	*63*	*59*

Table 12.10 Indicative Construction Noise Calculations During Bridge and Underpass Construction

Structures (BS 5228 Ref)	Calculated $L_{Aeq, T}$ at Distance Rrom Foad (m)			
	50m	80m	100m	150m
Lorry mounted concrete pump (D.6.16)	62	58	56	53
Poker vibrators (D.6.20)	63	59	57	54
Compressor (D.6.19)	56	52	50	47
Tracked crane (D.6.18)	65	61	59	56
Combined L_{Aeq}	*69*	*65*	*63*	*59*

Table 12.11 Indicative Construction Noise for Construction Compound Activities

Compound Activities (BS 5228 Ref)	Calculated $L_{Aeq, T}$ at Distance From Road (m)			
	50m	80m	100m	150m
Tracked excavator (C2.21)	55	51	49	46
Dump Truck (C2.30)	63	59	57	54
Angle Grinder (C4.93)	64	60	58	55
Diesel Generator (C4.76)	45	41	39	36
Wheeled loader (C2-26)	63	59	57	54
Combined L_{Aeq}	*69*	*64*	*63*	*59*

The reference values outlined in Tables 12.5 to 12.11 indicate that at distances of up to 50m from the works, there is potential for the construction noise limit of 70dB L_{Aeq} to be exceeded from Monday through Friday (07:00 to 19:00hrs), depending on the number and type of equipment occurring at any one time. The calculations would also indicate that at distances of up to 80m from the works, there is potential for the construction noise limit of 65dB L_{Aeq} to be exceeded on Saturdays (between 08:00 and 16:30hrs), depending on the number and type of equipment occurring at any one time.

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. In this instance, where construction works are planned within 80m of noise sensitive properties, a schedule

of noise mitigation measures will be required to ensure noise levels are minimised. Further details are set out in Section 12.5.1.

In addition to direct impacts from the construction works including site compounds, there is also the potential for additional impact as a result of additional construction road traffic on the main road network. Tables 12.12 to 12.14 outline the impact of this additional construction traffic in respect of the overall annual average daily traffic volumes expected.

Table 12.12 Construction Traffic Noise Calculations - Year 1

Section of Mainline / Existing Road	AADT (Do-Min 2035)	HGV's (Do-Min 2035)	Additional AADT HGV on Road Network	Increase in HGV AADT (%)	Increase in AADT (%)	Change in Noise Level (dB) based on HGV Traffic
Section A – Existing N5 Portaghard (Node 2)	7274	749	1	0.2%	0.0%	<1dB
Section B – Existing N5 through Bellanagare (Node 7)	6070	722	13	1.8%	0.2%	<1dB
Section B – R369 (Node 10)	1037	45	13	29.7%	1.3%	<1dB
Section C – R369 South of Elphin (Node 19)	1758	107	16	14.6%	0.9%	<1dB
Section D – Existing N5 through Strokestown (Node 28)	6426	855	1	0.2%	0.0%	<1dB

Table 12.13 Construction Traffic Noise Calculations - Year 2

Section of Mainline / Existing Road	AADT (Do-Min 2035)	HGV's (Do-Min 2035)	Additional AADT HGV on Road Network	Increase in HGV AADT (%)	Increase in AADT (%)	Change in Noise Level (dB) based on HGV Traffic
Section A – Existing N5 Portaghard (Node 2)	7274	10.3%	749	1	0.2%	0.0%
Section B – Existing N5 through Bellanagare (Node 7)	6070	11.9%	722	17	2.3%	0.3%
Section B – R369 (Node 10)	1037	4.3%	45	17	37.7%	1.6%
Section C – R369 South of Elphin (Node 19)	1758	6.1%	107	20	19.0%	1.2%

Section of Mainline / Existing Road	AADT (Do-Min 2035)	HGV's (Do-Min 2035)	Additional AADT HGV on Road Network	Increase in HGV AADT (%)	Increase in AADT (%)	Change in Noise Level (dB) based on HGV Traffic
Section D – Existing N5 through Strokestown (Node 28)	6426	13.3%	855	1	0.1%	0.0%

Table 12.14 Construction Traffic Noise Calculations - Year 3

Section of Mainline / Existing Road	AADT (Do-Min 2035)	HGV's (Do-Min 2035)	Additional AADT HGV on Road Network	Increase in HGV AADT (%)	Increase in AADT (%)	Change in Noise Level (dB) based on HGV Traffic
Section A – Existing N5 Portaghard (Node 2)	7274	10.3%	749	1	1.1%	0.1%
Section B – Existing N5 through Bellanagare (Node 7)	6070	11.9%	722	3	3.3%	0.5%
Section B – R369 (Node 10)	1037	4.3%	45	3	3.3%	7.4%
Section C – R369 South of Elphin (Node 19)	1758	6.1%	107	2	2.5%	2.3%
Section D – Existing N5 through Strokestown (Node 28)	6426	13.3%	855	1	1.0%	0.1%

Vibration

The potential for elevated levels of vibration at neighbouring sensitive locations during construction is typically limited to excavation works, rock-breaking, blasting operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from excavation and rock-breaking operations.

The specific excavation and rock breaking method will be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings and structures.

The proximity of a small number receptors to the proposed road development is such that construction vibration levels may be perceptible. Similar vibration control measures will be implemented to ensure that these levels do not reach levels that would be sufficient to result in human discomfort.

Blasting

Ground Investigations have indicated that blasting will be required at a number of locations along the route, most notably through the Cregga area. When assessing

the impact of blasting the appropriate parameters used are both air overpressure and Peak Particle Velocity (mm/s).

The Irish EPA Guidance *Environmental Management in the extraction industry* sets acceptable limits for air overpressure as 125dB (Lin) Peak Value and PPV as 12mm/s. In addition, the EPA recommends blasting is only carried out during 09:00 – 18:00 Monday to Friday. Blasting outside these hours shall be restricted for emergency or safety reasons only. Residents will be notified in advance of all proposed blasting schedules. Detailed Mitigation Measures are included in Section 12.5.

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 can be measured in terms of pounds per square inch or, more usually, in terms of dB (Lin).

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.

Air overpressure is transmitted through the atmosphere in a similar manner to sound waves. Thus, meteorological conditions, such as wind speed and direction, temperature, cloud cover and humidity will affect the intensity of the air overpressure value experienced at a distance from the blast site.

Maximum recommended levels in residential properties vary according to instrument response. These levels are detailed in Table 12.15 below.

Table 12.15 Recommended Maximum Levels in Terms of Instrument Response

Instrument Response	Maximum Level dB(Lin)
0.1Hz High Pass	134
2.0Hz High Pass	133
5.0 or 6.0Hz High Pass	129
C – Slow	105

Routine open-pit blasting operations in the UK regularly generate air overpressures up to a magnitude of 120dB (Lin) (measured with a 2.0Hz High Pass system), with levels in excess of 125dB (Lin) being relatively rare. Damage levels are rarely approached let alone exceeded.

In the case of the proposed road development, there is a potential for negative impacts to arise at the nearest noise sensitive receptors due to the blast vibration and air overpressure. These impacts will be appropriately mitigated through the implementation of best practice blasting best practices as outlined further in Section 12.5.1.

12.4.2 Operational Phase

Noise Model

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

Brüel & Kjær Type 7810 Predictor

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, Brüel & Kjær Type 7810 Predictor, calculates traffic noise levels in accordance with the UK's Department of Transport, Calculation of Road Traffic Noise (CRTN) 1988 and NRA guidance. The calculation module of Predictor allows the calculation of L_{den} by converting predicted L_{A10} values using the "end corrections" derived by the UK Transport Research Laboratory (TRL) and subsequently verified and adopted by the TII/NRA.

Brüel & Kjær type 7810 predictor is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. 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; and,
- 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 using Predictor in accordance with the CRTN and with application of the relevant conversion factors as detailed in the TII/NRA guidance. The CRTN method of predicting noise from a road development consists of the following five elements:

- Divide the road development into segments so that the variation of noise within this segment is small;
- Calculate the basic noise level at a reference distance of 10m 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; and,
- Combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road development.

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/NRA guidance.

Model Inputs

The noise model was prepared using the following data:

- Road alignments, topographical data and background ordnance survey mapping, and;
- "High" growth expanded Annual Average Daily Traffic (AADT), % Heavy Goods Vehicles and speed limits were provided for all existing and proposed roads within the proposed road development for the opening year 2020 and design year 2035. Data was provided for the Do Nothing and Do Something scenarios. (See Table 5.4 in Chapter 5 for traffic figures used in the modelling exercise)

A standard road surface type, such as hot rolled asphalt (HRA), has been assumed for all roads.

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 road development in question, it was decided that the most appropriate mechanism for calibration would be to compare the output of a Predictor model scenario, using the AADT traffic flows for the existing road network in 2015, with the measured L_{den} values at the unattended survey locations in the vicinity of the existing national and regional road network. The reason for choosing those survey locations along the existing national and regional road network for the purposes of calibration, is to ensure that the noise environment was dominated by road traffic noise during the survey period.

The results of the calibration are presented in Table 12.16. The differences between the measured and predicted results are in the range of 1 to 2 dB(A), which demonstrates a strong correlation and confirms that the model is correctly interpreting the input data.

Table 12.16 Model Calibration

Survey Location	Incident to road	Measured L_{den}, dB	Model Predicted L_{den}, dB	Variation (dB)
USL001	Existing N5	63	64	0.2
USL004	Existing N5	67	66	0.4
USL007	R369	54	54	0.3
USL008	R369	57	58	1.7
USL009	N61	60	61	0.7
USL011	R368	52	50	1.9
USL012	R368	52	53	0.6
USL020	Existing N5	62	63	1.2
USL021	Existing N5	65	67	2.1
USL022	Existing N5	63	65	2.0

Receiver Locations

Free-field traffic noise levels have been predicted at a number of properties in the vicinity of proposed and existing roads[3].

A total of three hundred and seventy four (374 No.) receiver locations have been considered in the assessment. For certain properties, receiver locations have been positioned at two or more locations around the building to assess noise levels associated with existing road traffic from the N5 or other regional roads and from the proposed future alignment. The properties were selected on the basis of proximity to the existing and proposed road. All receptors within 400m of the centreline of the proposed N5 road have been modelled, whilst Receptors along the section of the N61 at Shankill and the Strokestown Link Road have also been considered.

In certain cases, outside of the 400m, where a group of properties is present, the closest receptor to the road has been selected to determine the worst case noise levels at that group of properties. All properties experiencing an increase in proximity to the realigned road have been considered as per best practice.

The locations of all receptors are shown on Figures 12.1 to 12.26 in Volume 3. The predicted relevant noise levels have been presented in Table 12.21.

Predicted Noise Levels

Four scenarios have been considered as follows:

- Year 2020 – Do Nothing (i.e. proposed development is not built);
- Year 2020 – Do Something (i.e. proposed development in place);
- Year 2035 – Do Nothing; and,
- Year 2035 – Do something.

The results of the modelled scenarios are summarised below.

Model Results

The results of the modelled scenarios indicate that a positive or neutral noise impact will be experienced at the majority of properties along the existing N5 as a result of traffic being diverted onto the proposed road alignment. There are a small number of properties in close proximity to the new road alignment which are predicted to experience an increase in traffic noise levels and are above the relevant traffic noise design goal of 60dB L_{den}. The results of the assessment and the requirement for noise mitigation are summarised for the opening and design years below.

Model Results - Year 2020

The combined expected maximum traffic noise level from the proposed development together with other traffic in the vicinity (i.e. Do Something scenario) is greater than 60dB L_{den} at 31 no. receptor positions along the proposed road development.

On review of the modelled results, predicted traffic noise levels at 26 no. of these locations will either experience a decrease in noise levels as a result of traffic being diverted from the existing N5 to the new road alignment or experience a neutral noise

[3] All receivers have been modelled at heights of 1.5 and 4.0m above ground which corresponds approximately to ground and first floor windows respectively. The relevant result for the worst case highest window has been presented in each case.

impact (i.e. noise levels will not increase by more than 1dB as a result of the proposed road development). In this instance, whilst traffic noise levels at these properties will remain above the 60dB L_{den} guidance level, the noise impact to these properties arising from the proposed road development will be neutral to positive.

As the "Do Something" noise level at the remaining 5 no. receptors is above 60dB L_{den} and is increased by 1dB or more as a direct result of the proposed road development, mitigation is deemed to be required at these locations based on the TII/NRA criteria for noise mitigation measures.

Year 2035

The combined expected maximum traffic noise level from the proposed development together with other traffic in the vicinity (i.e. Do Something scenario) is greater than 60dB L_{den} at 44 no. receptor positions along the proposed road development.

On review of the modelled results, predicted traffic noise level at 34 no. of these locations will either experience a decrease in noise levels as a result of traffic being diverted from the existing N5 to the new road alignment or experience a neutral noise impact (i.e. noise levels will not increase by more than 1dB as a result of the proposed road development). In this instance, whilst traffic noise levels at these properties will remain above the 60dB L_{den} guidance level, the noise impact to these properties arising from the proposed road development will be neutral to positive.

As the "Do Something" noise level at the remaining 10 no. receptors is above 60dB L_{den} and is increased by 1dB or more as a direct result of the proposed road development, mitigation is deemed to be required at these locations based on the TII/NRA criteria for noise mitigation measures.

Summary of Receptors Requiring Mitigation

Receptors which meet the TII/NRA criteria for requiring mitigation, are presented in Table 12.17 for reference.

Table 12.17 Predicted Noise Levels at Receptors Requiring Mitigation

Receiver Location Reference	Opening Year 2020		Mitigation Required?	Design Year 2035		Mitigation Required?
	Predicted Noise Level L_{den} (dB)			Predicted Noise Level L_{den} (dB)		
	Do Minimum	Do Something		Do Minimum	Do Something	
A02-005_B	49	61	**Yes**	49	61	**Yes**
A02-007_A	52	61	**Yes**	52	62	**Yes**
A02-020_B	56	64	**Yes**	57	65	**Yes**
A02-021_B	55	60	No	56	61	**Yes**
B24-008_A	61	63	**Yes**	62	64	**Yes**
C33-005_A	36	60	No	37	61	**Yes**

Receiver Location Reference	Opening Year 2020		Mitigation Required?	Design Year 2035		Mitigation Required?
	Predicted Noise Level L_{den} (dB)			Predicted Noise Level L_{den} (dB)		
	Do Minimum	Do Something		Do Minimum	Do Something	
C35-001_B	52	60	No	53	61	**Yes**
C35-002_B	58	60	No	58	61	**Yes**
D52-007_A	48	60	No	49	61	**Yes**
D53-013_A	60	61	**Yes**	61	62	**Yes**

12.4.3 Comment on the Noise Level Changes Along the Existing Route

As a result of the proposed road development, traffic volumes along the existing N5 are expected to reduce significantly. This will result in a decrease in the traffic noise levels at properties located along the existing roads where traffic is diverted onto the new N5 alignment. Noise sensitive properties along the existing N5 are typically clustered at villages and town centres, along the road with one off rural housing typically encountered between built-up areas. In this instance, the majority of noise sensitive properties are typically within 50m of the road centreline.

In order to quantify the likely reduction in road traffic noise, noise levels have been modelled at a selection of representative noise sensitive locations along sections of the N5 and local roads where traffic decreases of the order of 25% or greater are calculated. The section of the roads referred to in the table below, are taken from the modelled links of the traffic impact assessment.

Table 12.18 below presents a summary of the calculated reduction in traffic noise levels between the Do Nothing and Do Something scenarios for the year 2035 along the existing N5 and part of the R368. The approximate number of noise sensitive buildings (residences, hotels, schools, churches etc.) within 50m of each road section are also included.

Table 12.18 Noise Reductions Along the Existing N5

Road Link (Ref to Figure 5.1 of EIAR)	Approximate no of Properties Within 50m	Modelled Receptor Locations	Reduction in Traffic Noise Levels, dB L_{den}
Link 2 N5: Dungar to Frenchpark	12	NR-01, NR-02	-9 to -20
Link 6 N5: Frenchpark to Ballaghcullia	37	NR-03 B11-002_B B12-003 - 7B	-2 to -24
Link 7 N5: Ballaghcullia to Bellanagare	16	NR-03 B12-008 - 9_B	-5 to -7
Link 8 N5: Bellanagare to Gortnagoyne	40	NR-05, NR-06	-7

Road Link (Ref to Figure 5.1 of EIAR)	Approximate no of Properties Within 50m	Modelled Receptor Locations	Reduction in Traffic Noise Levels, dB L_{den}
Link 11 N5: Gortnagoyne to Rathcroghan Crossroads	36	NR-07 to NR-010	-7
Link 12 N5: Rathcroghan Crossroads to Grange	24	NR-11 to NR-13	-6 to -9
Link 13 N5:Grange to Tulsk Crossroads	9	NR-14	-4
Link 20 N5: Tulsk Cross roads to Clooncullaan (Simpsons Crossroads)	33	NR-15 to NR-16	-8 to -9
Link 21 N5: Clooncullaan to Battlehill	30	NR-17 to NR-21	-7 to -9
Link 22 N5: Battlehill to Strokestown (Bridge St)	58	NR-22	-4
Link 26 R368 Strokestown - Elphin St	80	NR-23 to NR-24	-1
Link 27 R368 Strokestown Bridge Street to R368 junction	18	NR-25	-6
Link 28 N5: R368 junction to Scramoge	22	NR-26 to NR-28	-6 to -7

The results of the assessment indicate that approximately 50 properties along the existing N5 between Dungar and Ballaghcullia will experience a significant reduction in noise levels (of the order of 20dB L_{den}) as a result of traffic volume and speed reductions along the existing road.

For the remaining sections of the N5 between Ballaghcullia and Strokestown, approximately 250 noise sensitive properties will experience noise level reductions typically of the order of 4 to 9dB L_{den}, depending on the distance from the road, traffic volume changes and speed reductions.

Along the R368, approximately 80 noise sensitive properties will experience traffic noise reductions of the order of 1dB L_{den} along Elphin Road within Strokestown.

To the south of Strokestown along the existing N5, approximately 40 noise sensitive properties will experience a noise level reduction of the order of 6 to 7dB $L_{den.}$

Overall, reductions in traffic noise levels of this order are expected to have a largely positive impact on the noise exposure of residents along the existing N5 and sections of the R368 Road.

12.5 Mitigation Measures

12.5.1 Construction Phase

Noise

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

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps that is required to operate 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 12.1 using methods outlined in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise* "Noise and Vibration Control on Construction and open sites", Annex B.

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. 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, the following recommended mitigation measures are proposed;

- Residents within 200m of any locations for blasting 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.

Further guidance will be obtained from the recommendations contained within *BS5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration* in relation to blasting operations. 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.
- The design, execution and completion of any blasting within 150m 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 12.4.1) at the nearest sensitive buildings;
- Blasting contractors will ensure that the minimum amount of primer cord is used, and that no primer cord is located above ground.

Vibration

The TII/NRA 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 12.2.

It may be concluded that the construction of the proposed road development is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or even cosmetic damage.

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:

- 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, and;
- In the case of impact piling or demolition works for instance, a reduction in the input energy per blow shall be considered where required.

Specific vibration mitigation will be required for works in proximity to Urney Church. At the outset, it is important that the selection of appropriate construction techniques are selected to minimise the level of vibration generated. In this context, it would be recommended rotary bored piling methods are utilised for sections of the proposed

road development closest proximity to the church. This method of piling generates the lowest levels of vibration typically.

In regard to inspection and vibration monitoring, a thorough engineering inspection of the structure shall be undertaken immediately prior to construction. Additionally, a programme of monitoring should be implemented to ensure that condition limits are not exceeded and that all the relevant recommendations are met.

Working Hours

Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 16:30hrs on Saturdays. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority.

Emergency Work

The emergency work referred to above 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.

Property Condition Surveys

Property condition surveys will be offered for all buildings within 50m of the development boundary and those within 150m of proposed blasting works along the proposed road development. 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 project commencement,
- the second stage shall consist of post-construction condition surveys which shall include photographic records.

12.5.2 Operational Phase

The results of the modelling exercise show that noise mitigation shall be required for 10 no. properties along the proposed route.

The following section details the mitigation measures deemed practicable to achieve the design goals previously defined in Section 12.2. For the purposes of this assessment a standard Hot Rolled Asphalt (HRA) road surface has been assumed for all roads.

The mitigation measures will be specified based on the predicted noise levels for the design year of 2035.

The mitigation measures detailed here may be constructed as earth bunds, proprietary noise barriers or a combination of both. The mitigation requirements for the proposed road development will be further progressed during the detailed design and construction phase of the project, should approval be granted, taking into account the available construction techniques and technologies at the time of development. It is possible, for example that the vertical alignment may change

during the final construction design which in turn could reduce or increase the requirements for noise mitigation. Any changes to the road design likely to result in the increase of noise at any noise sensitive receptor would require an updated noise assessment to ensure that the NRA design goals, as discussed in Section 12.2, are complied with at all noise sensitive receivers. For this proposed road development indicative noise mitigation measures have been derived in consultation with the road engineers.

In order to meet the noise thresholds set out in the TII/NRA EACG, the proposed mitigation shall be provided in the form of acoustic barriers and/or earth bunds. In certain instances, it may be necessary to utilise a bund mounted acoustic barrier, however the required attenuation will be provided in so far as the barrier achieves the required height relative to the proposed road and receptor.

Details of the proposed mitigation measures are outlined in Table 12.19.

Table 12.19 Proposed Acoustic Barriers

Barrier Ref.	Incident to	Road Link	Chainage Start (m)	Chainage End (m)	Height (m)	Alignment/ Notes
NB-001	A02-005	N5	2+245	2+315	2	North
NB-002	A02-007	N5	2+225	2+290	2.5	South
		Side road	0+000	0+050		East
NB-003	A02-020/ A02-021	N5	2+865	2+890	3	South
		Side road	0+000	0+020		West
NB-004	A02-020/ A02-021	N5	2+900	3+000	3	South
		Side Road	0+000	0+045		East
NB-005	B24-008_B	N61	0+005	0+060	1	East
		Side Road	0+000	0+015		South
NB-006	C33-005_A	N5	33+400	33+500	1	North
NB-007	C35-001_B	N5	35+020	35+080	1	North (absorptive)
NB-008	C35-002_B	N5	35+045	35+095	1	South (absorptive)
NB-009	D52-007_A	N5	52+730	52+790	1.5	South
NB-010	D53-013_A	N5	53+640	53+710	1.5	South

The extent and location of these barriers are shown in Figures 12.2 to 12.26 in Volume 3 of this EIAR. The visual impact of the proposed barriers has been assessed in the landscape impact assessment conducted as part of this EIAR (See Chapter 11).

The predicted post mitigation noise levels at receptors requiring mitigation has been presented in Table 12.20.

In relation to receptor B24-008, it is important to note that that the proposed barrier is sufficient to reduce the variation in noise levels between the Do Minimum and Do Something Scenarios to equal to or less than 1dB, as such no further mitigation is

required at this location. At all other locations, the proposed road development is dominant and as such, the TII/NRA design goal of 60dB L_{den} is required to be achieved at all receptors.

Table 12.20 Predicted Post Mitigation Noise Levels at Receptors Requiring Mitigation

Receiver Location Reference	Design Year 2035 L_{den} (dB)		
	Unmitigated		Mitigated
	Do Minimum	Do Something	Do Something
A02-005_B	49	61	60
A02-007_A	52	62	60
A02-020_B	57	65	60
A02-021_B	56	61	60
B24-008_A	62	64	62
C33-005_A	37	61	60
C35-001_B	53	61	60
C35-002_B	58	61	60
D52-007_A	49	61	60
D53-013_A	61	62	61

It may also be prudent to consider if the benefit of the barriers in terms of noise reduction is proportionate to the potential visual intrusion and associated costs of such measures.

The most recent guidance from the TII/NRA in relation to Noise and Vibration has been published in the form of the *Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (March 2014*). The TII/NRA GPG presents a discussion on the issue of "proportionality" and acknowledges that *"in some cases the attainment of the design goal may not be possible by sustainable means".*

Reference to Tables 12.19 and 12.20 demonstrates that whilst the proposed mitigation measures meet the TII/NRA design goal, in a number of cases, the reduction in noise level achieved is of order of 1dB. The TII/NRA GPG also outlines the following:

> *In terms of a material increase in noise level, it is noted that the Guidelines require a 1dB increase in the relevant noise level as one condition for local mitigation and they also define 1dB is the smallest difference that can be detected in a controlled laboratory situation. A significant decrease in barrier dimensions which would result in an increase of 1dB or less, may be reasonable. Conversely, it may be unsustainable to increase barrier dimensions significantly where the result would be a reduction of 1 dB 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 the context of the proposed mitigation measures, the above comments must be considered in the context of other issues relating to potential visual impacts and costs.

Mitigation Measures - General

The design and the environmental mitigation measures may be further refined during the detailed design stage, including the incorporation of mitigation measures contained in such approval as may be granted by An Bord Pleanála.

The detailed design will seek to develop the design in a manner such that there is no material change in terms of significant adverse effect on the environment. Opportunities may be identified to further reduce the significance of adverse effect/impact and, in some cases, to improve the residual effect/impact.

12.6 Residual Impacts

12.6.1 Construction Phase

During the construction phase of the project there is potential for some temporary moderate to significant impact on nearby residential and business properties due to noise emissions from certain construction activities. The application of binding noise limits and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to a minimum.

12.6.2 Operational Phase

During the course of the assessment, it was shown that the predicted noise levels at nine receptors exceeded the specified TII/NRA Noise Mitigation Criteria. In this instance, mitigation measures have been specified. Once such measures are implemented, it was shown that all locations comply with the adopted criterion.

Properties along the existing N5 will experience a significant reduction in noise levels (of the order of 4 - 20dB L_{den}) depending on the distance from the road, traffic volume changes and speed reductions. The Candidate UNESCO World Heritage Site of the Rathcroghan Archaeological complex will also benefit from the removal of traffic and the visitor experience will be significantly improved with noise reductions of the order of 6-9 dBL_{den}.

It may be concluded that the project complies with the appropriate guidance in relation to noise, hence the associated impact is considered acceptable.

Table 12.21 Predicted Noise Levels for Years 2020 and 2035 for Do Minimum and Do Something Scenarios (Without Mitigation)

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
A01-001_B	71	55	No	No	Yes	No	72	56	No	No	Yes	No
A01-002_B	69	56	No	No	Yes	No	70	57	No	No	Yes	No
A01-003_B	67	57	No	No	Yes	No	67	58	No	No	Yes	No
A01-004_B	71	64	Yes	No	Yes	No	72	65	Yes	No	Yes	No
A01-005_B	54	51	No	No	Yes	No	55	51	No	No	Yes	No
A01-006_B	55	53	No	No	Yes	No	56	54	No	No	Yes	No
A01-007_B	54	52	No	No	Yes	No	55	53	No	No	Yes	No
A01-008_B	54	52	No	No	Yes	No	55	53	No	No	Yes	No
A01-009_B	53	52	No	No	Yes	No	54	53	No	No	Yes	No
A01-010_B	52	51	No	No	Yes	No	53	52	No	No	Yes	No
A01-011_B	52	51	No	No	Yes	No	53	52	No	No	Yes	No
A01-012_B	60	58	No	No	Yes	No	60	59	No	No	Yes	No
A01-013_B	68	61	Yes	No	Yes	No	69	61	Yes	No	Yes	No
A01-014_B	58	62	Yes	Yes	Yes	**Note A**	59	62	Yes	Yes	Yes	**Note A**
A01-014b_B	69	55	No	No	Yes	No	70	56	No	No	Yes	No
A01-015_B	53	60	No	Yes	Yes	No	54	61	Yes	Yes	Yes	**Note A**
A01-015b_B	69	50	No	No	Yes	No	70	52	No	No	Yes	No
A01-016_B	53	60	No	Yes	Yes	No	54	61	Yes	Yes	Yes	**Note A**
A01-016b_B	64	51	No	No	Yes	No	65	53	No	No	Yes	No
A02-001_B	69	56	No	No	Yes	No	70	57	No	No	Yes	No
A02-002_B	70	56	No	No	Yes	No	71	57	No	No	Yes	No
A02-003_B	60	57	No	No	Yes	No	60	58	No	No	Yes	No
A02-003b_B	72	52	No	No	Yes	No	73	53	No	No	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
A02-004_B	55	58	No	Yes	Yes	No	56	58	No	Yes	Yes	No
A02-004b_B	68	53	No	No	Yes	No	69	54	No	No	Yes	No
A02-005_B	49	61	Yes	Yes	Yes	No	49	61	Yes	Yes	Yes	**Yes**
A02-005b_B	58	55	No	No	Yes	No	59	56	No	No	Yes	No
A02-006_B	54	70	Yes	Yes	Yes	**Note B**	55	71	Yes	Yes	Yes	**Note B**
A02-007_A	52	61	Yes	Yes	Yes	No	52	62	Yes	Yes	Yes	**Yes**
A02-008_B	51	55	No	Yes	Yes	No	52	56	No	Yes	Yes	No
A02-009_B	51	55	No	Yes	Yes	No	51	55	No	Yes	Yes	No
A02-010_B	50	54	No	Yes	Yes	No	51	54	No	Yes	Yes	No
A02-011_B	52	56	No	Yes	Yes	No	52	57	No	Yes	Yes	No
A02-013_B	63	57	No	No	Yes	No	64	58	No	No	Yes	No
A02-014_B	57	57	No	No	Yes	No	58	58	No	No	Yes	No
A02-014b_B	68	51	No	No	Yes	No	69	52	No	No	Yes	No
A02-015_B	61	58	No	No	Yes	No	62	59	No	No	Yes	No
A02-015b_B	71	47	No	No	Yes	No	72	48	No	No	Yes	No
A02-016_B	62	57	No	No	Yes	No	63	58	No	No	Yes	No
A02-017_B	64	55	No	No	Yes	No	65	56	No	No	Yes	No
A02-018_B	73	57	No	No	Yes	No	74	58	No	No	Yes	No
A02-019_B	50	63	Yes	Yes	Yes	**Note B**	51	63	Yes	Yes	Yes	**Note B**
A02-020_B	56	64	Yes	Yes	Yes	**Yes**	57	65	Yes	Yes	Yes	**Yes**
A02-021_B	55	60	No	Yes	Yes	No	56	61	Yes	Yes	Yes	**Yes**
A02-022_B	53	57	No	Yes	Yes	No	54	58	No	Yes	Yes	No
A02-023_B	53	56	No	Yes	Yes	No	53	57	No	Yes	Yes	No
A02-024_B	50	53	No	Yes	Yes	No	51	54	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
A02-025_B	51	53	No	Yes	Yes	No	52	54	No	Yes	Yes	No
A02-026_B	51	52	No	Yes	Yes	No	52	53	No	Yes	Yes	No
A02-027_B	52	52	No	No	Yes	No	52	53	No	No	Yes	No
A02-028_B	51	51	No	No	Yes	No	52	52	No	No	Yes	No
A02-029_B	51	51	No	No	Yes	No	52	52	No	No	Yes	No
A02-030_B	48	51	No	Yes	Yes	No	49	52	No	Yes	Yes	No
A02-031_B	48	51	No	Yes	Yes	No	49	52	No	Yes	Yes	No
A03-001_B	56	58	No	Yes	Yes	No	57	59	No	Yes	Yes	No
A03-001b_B	67	52	No	No	Yes	No	68	53	No	No	Yes	No
A03-002_B	57	58	No	Yes	Yes	No	58	59	No	NoYes	Yes	No
A03-002b_B	68	54	No	No	Yes	No	69	55	No	No	Yes	No
A03-003_B	68	56	No	No	Yes	No	69	57	No	No	Yes	No
A03-004_B	67	56	No	No	Yes	No	68	57	No	No	Yes	No
A03-005_B	70	52	No	No	Yes	No	71	53	No	No	Yes	No
A03-006_B	60	53	No	No	Yes	No	60	54	No	No	Yes	No
A03-007_B	70	55	No	No	Yes	No	71	56	No	No	Yes	No
A03-008_B	71	55	No	No	Yes	No	72	56	No	No	Yes	No
A03-009_B	68	55	No	No	Yes	No	69	56	No	No	Yes	No
A04-001_B	60	52	No	No	Yes	No	61	53	No	No	Yes	No
A04-002_B	58	53	No	No	Yes	No	59	53	No	No	Yes	No
A04-003_B	68	54	No	No	Yes	No	69	55	No	No	Yes	No
A04-004_B	52	57	No	Yes	Yes	No	52	58	No	Yes	Yes	No
A04-004b_B	58	53	No	No	Yes	No	59	54	No	No	Yes	No
A04-005_B	54	58	No	Yes	Yes	No	54	59	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
A04-006_B	52	55	No	Yes	Yes	No	52	56	No	Yes	Yes	No
A04-007_B	52	55	No	Yes	Yes	No	53	56	No	Yes	Yes	No
A05-001_B	55	58	No	Yes	Yes	No	55	59	No	Yes	Yes	No
A05-001b_B	52	55	No	Yes	Yes	No	52	55	No	Yes	Yes	No
A05-002_B	57	60	No	Yes	No	No	58	61	Yes	Yes	No	No
B10-001_B	58	61	Yes	Yes	No	No	58	62	Yes	Yes	No	No
B10-002_B	48	51	No	Yes	Yes	No	49	52	No	Yes	Yes	No
B10-003_B	50	53	No	Yes	Yes	No	50	54	No	Yes	Yes	No
B10-004_B	47	58	No	Yes	Yes	No	48	59	No	Yes	Yes	No
B10-005_B	46	52	No	Yes	Yes	No	47	53	No	Yes	Yes	No
B10-006_B	46	51	No	Yes	Yes	No	46	52	No	Yes	Yes	No
B11-001_B	47	51	No	Yes	Yes	No	47	52	No	Yes	Yes	No
B11-002_B	52	50	No	No	Yes	No	53	51	No	No	Yes	No
B12-001_B	48	56	No	Yes	Yes	No	48	57	No	Yes	Yes	No
B12-002_B	52	53	No	Yes	Yes	No	53	54	No	Yes	Yes	No
B12-003_B	68	52	No	No	Yes	No	68	53	No	No	Yes	No
B12-004_B	65	54	No	No	Yes	No	66	55	No	No	Yes	No
B12-005_B	65	55	No	No	Yes	No	66	56	No	No	Yes	No
B12-006_B	69	52	No	No	Yes	No	70	53	No	No	Yes	No
B12-007_B	67	56	No	No	Yes	No	67	57	No	No	Yes	No
B12-008_B	66	58	No	No	Yes	No	67	59	No	No	Yes	No
B12-009_B	67	58	No	No	Yes	No	68	58	No	No	Yes	No
B12-010_B	54	51	No	No	Yes	No	54	52	No	No	Yes	No
B13-002_B	49	52	No	Yes	Yes	No	50	53	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
B13-002_B	48	50	No	Yes	Yes	No	49	51	No	Yes	Yes	No
B13-003_B	47	49	No	Yes	Yes	No	48	49	No	Yes	Yes	No
B13-004_B	47	48	No	Yes	Yes	No	47	49	No	Yes	Yes	No
B13-005_B	45	47	No	Yes	Yes	No	45	48	No	Yes	Yes	No
B13-006_B	44	45	No	Yes	Yes	No	44	46	No	Yes	Yes	No
B13-007_B	46	48	No	Yes	Yes	No	46	48	No	Yes	Yes	No
B13-008_B	46	47	No	Yes	Yes	No	47	48	No	Yes	Yes	No
B13-009_B	47	49	No	Yes	Yes	No	48	50	No	Yes	Yes	No
B13-010_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
B13-011_B	45	50	No	Yes	Yes	No	45	51	No	Yes	Yes	No
B13-012_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
B13-013_B	46	55	No	Yes	Yes	No	47	56	No	Yes	Yes	No
B14-001_B	40	51	No	Yes	Yes	No	41	52	No	Yes	Yes	No
B14-002_B	40	52	No	Yes	Yes	No	41	53	No	Yes	Yes	No
B14-003_B	42	51	No	Yes	Yes	No	42	52	No	Yes	Yes	No
B15-001_B	40	52	No	Yes	Yes	No	41	53	No	Yes	Yes	No
B15-002_B	41	50	No	Yes	Yes	No	42	51	No	Yes	Yes	No
B15-003_B	42	51	No	Yes	Yes	No	42	52	No	Yes	Yes	No
B15-004_B	41	48	No	Yes	Yes	No	41	49	No	Yes	Yes	No
B15-005_B	42	52	No	Yes	Yes	No	43	53	No	Yes	Yes	No
B15-006_B	42	55	No	Yes	Yes	No	43	56	No	Yes	Yes	No
B15-007_B	41	50	No	Yes	Yes	No	42	50	No	Yes	Yes	No
B16-001_B	40	49	No	Yes	Yes	No	41	49	No	Yes	Yes	No
B16-002_B	40	49	No	Yes	Yes	No	41	50	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
B16-003_B	38	49	No	Yes	Yes	No	39	50	No	Yes	Yes	No
B16-004_B	39	50	No	Yes	Yes	No	40	51	No	Yes	Yes	No
B16-005_B	38	49	No	Yes	Yes	No	39	50	No	Yes	Yes	No
B17-001_B	48	53	No	Yes	Yes	No	48	54	No	Yes	Yes	No
B17-002_B	45	55	No	Yes	Yes	No	46	56	No	Yes	Yes	No
B17-003_B	55	54	No	No	Yes	No	56	55	No	No	Yes	No
B17-003_B	43	57	No	Yes	Yes	No	44	57	No	Yes	Yes	No
B17-004_B	43	55	No	Yes	Yes	No	44	56	No	Yes	Yes	No
B17-005_B	41	50	No	Yes	Yes	No	42	51	No	Yes	Yes	No
B17-006_B	38	48	No	Yes	Yes	No	38	49	No	Yes	Yes	No
B17-007_B	40	50	No	Yes	Yes	No	40	51	No	Yes	Yes	No
B19-001_B	44	47	No	Yes	Yes	No	45	48	No	Yes	Yes	No
B19-002_B	46	48	No	Yes	Yes	No	46	49	No	Yes	Yes	No
B19-003_B	48	48	No	No	Yes	No	49	49	No	No	Yes	No
B19-004_B	49	49	No	No	Yes	No	50	50	No	No	Yes	No
B19-005_B	53	50	No	No	Yes	No	53	51	No	No	Yes	No
B19-006_B	55	52	No	No	Yes	No	56	53	No	No	Yes	No
B19-007_B	55	70	Yes	Yes	Yes	**Note C**	56	71	Yes	Yes	Yes	**Note C**
B19-008_B	48	50	No	Yes	Yes	No	49	51	No	Yes	Yes	No
B19-009_B	44	46	No	Yes	Yes	No	45	47	No	Yes	Yes	No
B19-010_B	41	46	No	Yes	Yes	No	41	46	No	Yes	Yes	No
B20-001_B	56	51	No	No	Yes	No	57	52	No	No	Yes	No
B20-002_B	58	51	No	No	Yes	No	59	52	No	No	Yes	No
B20-003_B	57	54	No	No	Yes	No	58	55	No	No	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
B20-003_B	56	53	No	No	Yes	No	57	54	No	No	Yes	No
B20-005_B	57	54	No	No	Yes	No	58	55	No	No	Yes	No
B20-006_B	57	54	No	No	Yes	No	58	55	No	No	Yes	No
B20-007_B	57	54	No	No	Yes	No	57	55	No	No	Yes	No
B21-001_B	57	53	No	No	Yes	No	58	54	No	No	Yes	No
B21-002_B	49	54	No	Yes	Yes	No	49	54	No	Yes	Yes	No
B21-003_B	48	57	No	Yes	Yes	No	49	58	No	Yes	Yes	No
B21-004_B	56	53	No	No	Yes	No	57	54	No	No	Yes	No
B21-005_B	56	56	No	No	Yes	No	56	56	No	No	Yes	No
B22-001_B	49	53	No	Yes	Yes	No	49	54	No	Yes	Yes	No
B22-002_B	51	52	No	Yes	Yes	No	51	53	No	Yes	Yes	No
B22-003_B	47	51	No	Yes	Yes	No	48	52	No	Yes	Yes	No
B22-004_B	47	50	No	Yes	Yes	No	48	51	No	Yes	Yes	No
B22-005_B	46	49	No	Yes	Yes	No	47	50	No	Yes	Yes	No
B22-006_B	42	51	No	Yes	Yes	No	43	52	No	Yes	Yes	No
B23-001_B	53	53	No	No	No	No	54	54	No	No	No	No
B24-002_B	63	57	No	No	Yes	No	64	58	No	No	Yes	No
B24-003_B	61	59	No	No	No	No	62	59	No	No	No	No
B24-004_B	62	61	Yes	No	No	No	62	61	Yes	No	No	No
B24-005_B	63	63	Yes	No	No	No	64	64	Yes	No	No	No
B24-006_B	63	62	Yes	No	No	No	63	63	Yes	No	No	No
B24-007_B	61	55	No	No	Yes	No	62	56	No	No	Yes	No
B24-008_A	61	63	Yes	Yes	Yes	**Yes**	62	64	Yes	Yes	Yes	**Yes**
B24-009_B	52	53	No	Yes	Yes	No	52	53	No	No	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
B24-010_B	58	57	No	No	Yes	No	59	57	No	No	Yes	No
B24-011_B	64	59	No	No	Yes	No	64	60	No	No	Yes	No
B24-012_B	56	57	No	Yes	No	No	57	58	No	Yes	No	No
B24-013_B	63	64	Yes	Yes	No	No	63	65	Yes	Yes	No	No
B24-014_B	58	56	No	No	No	No	59	57	No	No	No	No
B24-015_B	58	55	No	No	No	No	59	56	No	No	No	No
B24-016_B	58	56	No	No	No	No	59	57	No	No	No	No
B24-017_B	60	57	No	No	No	No	60	58	No	No	No	No
B24-018_B	58	56	No	No	No	No	59	57	No	No	No	No
B24-019_B	59	57	No	No	No	No	59	58	No	No	No	No
B24-020_B	59	57	No	No	No	No	59	57	No	No	No	No
B24-021_B	50	51	No	Yes	Yes	No	51	52	No	Yes	Yes	No
B24-022_B	49	50	No	Yes	Yes	No	50	51	No	Yes	Yes	No
B24-023_B	49	50	No	Yes	Yes	No	49	51	No	Yes	Yes	No
B24-024_B	48	50	No	Yes	Yes	No	49	50	No	Yes	Yes	No
B24-025_B	46	48	No	Yes	Yes	No	47	49	No	Yes	Yes	No
C30-001_B	45	55	No	Yes	Yes	No	45	56	No	Yes	Yes	No
C31-001_B	38	53	No	Yes	Yes	No	39	54	No	Yes	Yes	No
C31-002_B	37	52	No	Yes	Yes	No	38	53	No	Yes	Yes	No
C32-001_B	35	49	No	Yes	Yes	No	36	50	No	Yes	Yes	No
C32-002_B	35	50	No	Yes	Yes	No	36	51	No	Yes	Yes	No
C32-003_B	32	49	No	Yes	Yes	No	33	50	No	Yes	Yes	No
C32-004_B	34	50	No	Yes	Yes	No	35	50	No	Yes	Yes	No
C32-005_B	34	49	No	Yes	Yes	No	35	50	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
C32-006_B	33	48	No	Yes	Yes	No	34	49	No	Yes	Yes	No
C32-007_B	39	47	No	Yes	Yes	No	40	48	No	Yes	Yes	No
C32-008_B	30	48	No	Yes	Yes	No	31	48	No	Yes	Yes	No
C32-009_B	31	49	No	Yes	Yes	No	31	50	No	Yes	Yes	No
C33-001_B	32	49	No	Yes	Yes	No	32	50	No	Yes	Yes	No
C33-002_B	32	52	No	Yes	Yes	No	33	53	No	Yes	Yes	No
C33-003_A	32	57	No	Yes	Yes	No	33	58	No	Yes	Yes	No
C33-004_B	34	59	No	Yes	Yes	No	35	60	No	Yes	Yes	No
C33-005_A	36	60	No	Yes	Yes	No	37	61	Yes	Yes	Yes	**Yes**
C33-006_A	33	56	No	Yes	Yes	No	34	56	No	Yes	Yes	No
C33-007_B	36	56	No	Yes	Yes	No	37	57	No	Yes	Yes	No
C33-008_B	37	56	No	Yes	Yes	No	38	57	No	Yes	Yes	No
C34-001_B	43	50	No	Yes	Yes	No	44	50	No	Yes	Yes	No
C34-002_B	55	53	No	No	No	No	55	53	No	No	No	No
C34-003_B	53	52	No	No	Yes	No	54	53	No	No	Yes	No
C34-004_B	55	53	No	No	Yes	No	55	54	No	No	Yes	No
C34-006_B	51	51	No	No	Yes	No	52	52	No	No	Yes	No
C34-006_B	54	52	No	No	Yes	No	54	53	No	No	Yes	No
C34-007_B	61	58	No	No	No	No	62	59	No	No	No	No
C34-008_B	47	52	No	Yes	Yes	No	48	53	No	Yes	Yes	No
C34-009_B	43	49	No	Yes	Yes	No	44	50	No	Yes	Yes	No
C34-010_B	43	47	No	Yes	Yes	No	43	48	No	Yes	Yes	No
C35-001_B	52	60	No	Yes	Yes	No	53	61	Yes	Yes	Yes	**Yes**
C35-002_B	58	60	No	Yes	Yes	No	58	61	Yes	Yes	Yes	**Yes**

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
C35-003_B	52	56	No	Yes	Yes	No	52	57	No	Yes	Yes	No
C35-004_B	49	51	No	Yes	Yes	No	49	52	No	Yes	Yes	No
C35-005_B	50	53	No	Yes	Yes	No	50	54	No	Yes	Yes	No
C35-006_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
C35-007_B	45	49	No	Yes	Yes	No	45	50	No	Yes	Yes	No
C35-008_B	60	56	No	No	Yes	No	60	57	No	No	Yes	No
C35-009_B	43	48	No	Yes	Yes	No	43	49	No	Yes	Yes	No
C35-010_B	44	47	No	Yes	Yes	No	44	48	No	Yes	Yes	No
C35-011_B	59	53	No	No	No	No	59	54	No	No	Yes	No
C35-012_B	43	46	No	Yes	Yes	No	43	47	No	Yes	Yes	No
C35-013_B	47	46	No	No	Yes	No	47	47	No	No	Yes	No
C36-001_B	41	45	No	Yes	Yes	No	42	46	No	Yes	Yes	No
C36-002_B	44	49	No	Yes	Yes	No	44	50	No	Yes	Yes	No
C36-003_B	58	54	No	No	Yes	No	58	55	No	No	Yes	No
C36-004_B	47	49	No	Yes	Yes	No	48	50	No	Yes	Yes	No
C37-001_B	55	53	No	No	Yes	No	56	53	No	No	Yes	No
C37-002_B	47	49	No	Yes	Yes	No	48	50	No	Yes	Yes	No
C37-003_B	56	53	No	No	Yes	No	57	53	No	No	Yes	No
C37-004_B	49	50	No	Yes	Yes	No	49	51	No	Yes	Yes	No
C38-001_B	55	53	No	No	Yes	No	56	54	No	No	Yes	No
C38-002_B	54	51	No	No	Yes	No	55	51	No	No	Yes	No
C38-003_B	60	54	No	No	No	No	61	54	No	No	Yes	No
C38-004_B	60	54	No	No	Yes	No	61	54	No	No	Yes	No
C38-005_B	42	47	No	Yes	Yes	No	43	48	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
C38-005b_B	57	53	No	No	No	No	58	53	No	No	No	No
C38-006_B	36	49	No	Yes	Yes	No	36	50	No	Yes	Yes	No
C39-001_B	40	50	No	Yes	Yes	No	40	51	No	Yes	Yes	No
C39-001b_B	47	46	No	No	Yes	No	48	46	No	No	Yes	No
C39-002_B	44	47	No	Yes	Yes	No	45	48	No	Yes	Yes	No
C39-002b_B	58	53	No	No	No	No	59	53	No	No	No	No
C39-003_B	52	50	No	No	Yes	No	53	51	No	No	Yes	No
C39-004_B	57	52	No	No	No	No	58	52	No	No	No	No
C39-005_B	58	54	No	No	No	No	59	54	No	No	Yes	No
C39-006_B	60	52	No	No	No	No	61	52	No	No	No	No
C39-007_B	53	51	No	No	Yes	No	54	51	No	No	Yes	No
C39-008_B	44	48	No	Yes	Yes	No	44	49	No	Yes	Yes	No
C39-009_B	39	48	No	Yes	Yes	No	40	49	No	Yes	Yes	No
C39-011_B	42	52	No	Yes	Yes	No	43	53	No	Yes	Yes	No
C40-001_B	39	52	No	Yes	Yes	No	40	53	No	Yes	Yes	No
C40-002_B	56	51	No	No	Yes	No	56	52	No	No	Yes	No
C40-003_B	54	50	No	No	Yes	No	55	51	No	No	Yes	No
C40-004_B	51	49	No	No	Yes	No	52	50	No	No	Yes	No
C40-005_B	51	50	No	No	Yes	No	52	51	No	No	Yes	No
C40-006_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
C40-007_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
C40-008_B	44	49	No	Yes	Yes	No	45	50	No	Yes	Yes	No
C40-009_B	46	47	No	Yes	Yes	No	47	48	No	Yes	Yes	No
C40-010_B	50	46	No	No	Yes	No	50	47	No	No	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
C40-011_B	50	47	No	No	Yes	No	50	48	No	No	Yes	No
C40-012_B	50	47	No	No	Yes	No	51	47	No	No	Yes	No
C40-013_B	51	48	No	No	Yes	No	52	48	No	No	Yes	No
C40-014_B	54	51	No	No	Yes	No	55	51	No	No	Yes	No
C40-015_B	61	45	No	No	Yes	No	62	46	No	No	Yes	No
C40-016_B	62	45	No	No	Yes	No	63	46	No	No	Yes	No
C40-017_A	49	56	No	Yes	Yes	No	50	57	No	Yes	Yes	No
C40-018_B	53	57	No	Yes	Yes	No	54	58	No	Yes	Yes	No
C40-019_B	58	60	No	Yes	No	No	59	61	Yes	Yes	No	No
C40-020_B	59	60	No	Yes	No	No	60	61	Yes	Yes	No	No
C40-021_B	61	62	Yes	Yes	No	No	61	62	Yes	No	No	No
C40-022_B	49	53	No	Yes	Yes	No	50	54	No	Yes	Yes	No
C40-023_B	46	50	No	Yes	Yes	No	47	50	No	Yes	Yes	No
C40-024_B	44	50	No	Yes	Yes	No	45	51	No	Yes	Yes	No
D50-001_B	51	55	No	Yes	Yes	No	52	56	No	Yes	Yes	No
D50-002_B	55	56	No	Yes	Yes	No	56	57	No	Yes	Yes	No
D50-003_B	53	51	No	No	Yes	No	54	52	No	No	Yes	No
D50-003b_B	63	50	No	No	Yes	No	64	51	No	No	Yes	No
D50-004_B	58	50	No	No	Yes	No	59	51	No	No	Yes	No
D50-007_B	43	53	No	Yes	Yes	No	44	54	No	Yes	Yes	No
D50-008_B	47	48	No	Yes	Yes	No	48	49	No	Yes	Yes	No
D50-008_B	43	53	No	Yes	Yes	No	43	54	No	Yes	Yes	No
D50-009_B	48	48	No	No	Yes	No	49	49	No	No	Yes	No
D50-009_B	44	53	No	Yes	Yes	No	45	54	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
D50-010_B	46	47	No	Yes	Yes	No	47	48	No	Yes	Yes	No
D50-011_B	44	49	No	Yes	Yes	No	45	50	No	Yes	Yes	No
D50-012_B	45	49	No	Yes	Yes	No	46	50	No	Yes	Yes	No
D50-013_B	45	50	No	Yes	Yes	No	46	50	No	Yes	Yes	No
D50-014_B	47	47	No	No	Yes	No	48	48	No	No	Yes	No
D50-015_A	45	47	No	Yes	Yes	No	46	47	No	Yes	Yes	No
D50-016_A	43	49	No	Yes	Yes	No	44	50	No	Yes	Yes	No
D50-017_B	43	52	No	Yes	Yes	No	44	53	No	Yes	Yes	No
D50-018_B	43	50	No	Yes	Yes	No	43	51	No	Yes	Yes	No
D50-019_B	43	51	No	Yes	Yes	No	44	52	No	Yes	Yes	No
D50-020_B	43	51	No	Yes	Yes	No	44	52	No	Yes	Yes	No
D50-021_B	42	53	No	Yes	Yes	No	43	54	No	Yes	Yes	No
D50-022_B	42	54	No	Yes	Yes	No	43	55	No	Yes	Yes	No
D50-023_B	41	56	No	Yes	Yes	No	42	57	No	Yes	Yes	No
D50-024_B	39	52	No	Yes	Yes	No	40	53	No	Yes	Yes	No
D50-025_B	65	49	No	No	No	No	66	50	No	No	No	No
D50-026_B	65	50	No	No	No	No	66	50	No	No	No	No
D50-027_B	65	51	No	No	No	No	66	52	No	No	No	No
D50-028_B	65	51	No	No	No	No	66	52	No	No	No	No
D50-029_B	57	51	No	No	No	No	57	52	No	No	No	No
D50-030_B	66	64	Yes	No	No	No	66	65	Yes	No	No	No
D50-031_B	61	46	No	No	No	No	62	47	No	No	No	No
D50-032_B	61	42	No	No	Yes	No	62	43	No	No	Yes	No
D50-033_B	61	52	No	No	No	No	61	52	No	No	No	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
D50-034_B	52	40	No	No	Yes	No	53	40	No	No	Yes	No
D50-035_B	52	41	No	No	Yes	No	53	42	No	No	Yes	No
D50-036_B	60	52	No	No	No	No	60	53	No	No	No	No
D50-037_B	49	41	No	No	Yes	No	50	42	No	No	Yes	No
D50-038_B	58	53	No	No	No	No	59	54	No	No	No	No
D50-039_B	49	42	No	No	Yes	No	50	43	No	No	Yes	No
D50-040_B	49	40	No	No	Yes	No	50	40	No	No	Yes	No
D50-041_B	54	39	No	No	Yes	No	54	40	No	No	Yes	No
D50-042_B	52	44	No	No	Yes	No	53	45	No	No	Yes	No
D50-043_B	49	41	No	No	Yes	No	49	42	No	No	Yes	No
D51-001_B	44	53	No	Yes	Yes	No	44	53	No	Yes	Yes	No
D51-002_B	43	52	No	Yes	Yes	No	44	53	No	Yes	Yes	No
D52-001_B	45	57	No	Yes	Yes	No	46	58	No	Yes	Yes	No
D52-002_B	44	54	No	Yes	Yes	No	45	55	No	Yes	Yes	No
D52-003_B	45	56	No	Yes	Yes	No	46	57	No	Yes	Yes	No
D52-004_B	47	55	No	Yes	Yes	No	47	56	No	Yes	Yes	No
D52-005_B	48	56	No	Yes	Yes	No	49	57	No	Yes	Yes	No
D52-006_B	48	53	No	Yes	Yes	No	49	54	No	Yes	Yes	No
D52-007_A	48	60	No	Yes	Yes	No	49	61	Yes	Yes	Yes	**Yes**
D53-001_B	48	59	No	Yes	Yes	No	49	60	No	Yes	Yes	No
D53-002_A	51	59	No	Yes	Yes	No	52	60	No	Yes	Yes	No
D53-003_B	53	55	No	Yes	Yes	No	54	56	No	Yes	Yes	No
D53-004_B	52	54	No	Yes	Yes	No	53	55	No	Yes	Yes	No
D53-005_B	52	53	No	Yes	Yes	No	53	54	No	Yes	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
D53-006_B	52	53	No	Yes	Yes	No	53	54	No	Yes	Yes	No
D53-007_B	51	51	No	No	Yes	No	52	52	No	No	Yes	No
D53-008_B	50	50	No	No	Yes	No	51	51	No	No	Yes	No
D53-009_B	50	50	No	No	Yes	No	51	51	No	No	Yes	No
D53-010_B	57	62	Yes	Yes	Yes	**Note A**	58	62	Yes	Yes	Yes	**Note A**
D53-010b_B	65	59	No	No	No	No	66	60	No	No	No	No
D53-011_B	61	57	No	No	Yes	No	62	58	No	No	Yes	No
D53-012_B	59	56	No	No	Yes	No	60	57	No	No	Yes	No
D53-013_A	60	61	Yes	Yes	Yes	**Yes**	61	62	Yes	Yes	Yes	**Yes**
D53-014_A	59	59	No	No	Yes	No	60	60	No	No	Yes	No
D54-001_B	50	50	No	No	Yes	No	51	51	No	No	Yes	No
D54-002_B	50	50	No	No	Yes	No	51	51	No	No	Yes	No
D54-003_B	47	33	No	No	Yes	No	48	34	No	No	Yes	No
GOLF CLUB_B	47	52	No	Yes	Yes	No	48	53	No	Yes	Yes	No
NR-01_B	60	51	No	No	Yes	No	61	52	No	No	Yes	No
NR-01b_B	71	47	No	No	Yes	No	72	48	No	No	Yes	No
NR-02_B	71	51	No	No	Yes	No	72	52	No	No	Yes	No
NR-03_B	72	48	No	No	Yes	No	73	51	No	No	Yes	No
NR-04_B	69	62	Yes	No	No	No	70	63	Yes	No	No	No
NR-05_B	71	64	Yes	No	No	No	72	65	Yes	No	No	No
NR-06_B	67	61	Yes	No	No	No	68	61	Yes	No	No	No
NR-07_B	68	60	No	No	No	No	69	61	Yes	No	No	No
NR-08_B	62	56	No	No	No	No	63	57	No	No	No	No
NR-09_B	66	60	No	No	Yes	No	67	60	No	No	Yes	No

Receiver Location Reference	Opening Year 2020		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?	Design Year 2035		NRA Condition for Noise Mitigation Satisfied?			Mitigation Required?
	Predicted Noise Level						Predicted Noise Level					
	Do Minimum	Do Something					Do Minimum	Do Something				
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)	
NR-10_B	66	59	No	No	Yes	No	67	60	No	No	Yes	No
NR-11_B	70	61	Yes	No	Yes	No	71	62	Yes	No	Yes	No
NR-12_B	66	59	No	No	Yes	No	67	60	No	No	Yes	No
NR-13_B	71	62	Yes	No	Yes	No	72	63	Yes	No	Yes	No
NR-14_B	68	64	Yes	No	Yes	No	69	65	Yes	No	Yes	No
NR-15_B	67	58	No	No	Yes	No	68	60	No	No	Yes	No
NR-16_B	68	58	No	No	Yes	No	69	60	No	No	Yes	No
NR-17_B	65	59	No	No	Yes	No	66	60	No	No	Yes	No
NR-18_B	69	61	Yes	No	Yes	No	70	62	Yes	No	Yes	No
NR-19_B	70	61	Yes	No	Yes	No	72	63	Yes	No	Yes	No
NR-20_B	67	59	No	No	Yes	No	69	61	Yes	No	Yes	No
NR-21_B	69	61	Yes	No	Yes	No	70	62	Yes	No	Yes	No
NR-22_B	66	62	Yes	No	No	No	67	63	Yes	No	No	No
NR-23_B	66	65	Yes	No	No	No	67	66	Yes	No	No	No
NR-24_B	67	66	Yes	No	No	No	68	67	Yes	No	No	No
NR-25_B	69	64	Yes	No	No	No	71	65	Yes	No	No	No
NR-26_B	69	62	Yes	No	No	No	70	64	Yes	No	No	No
NR-27_B	68	60	No	No	No	No	69	62	Yes	No	No	No
NR-28_B	69	61	Yes	No	No	No	70	63	Yes	No	No	No

Note A In these cases, the receptor is located in close proximity to the existing N5. In the Do Something scenario, whilst the proposed road development increases noise levels on one façade, the façade facing the existing N5 experiences a significant reduction in noise levels. In all cases the predicted relevant noise level is only marginally above the design goal. In consideration of this fact and the overall reduction in noise levels experienced at these receptors, it is deemed to be appropriate that mitigation would not be required at these locations.

Note B These locations are not deemed to be noise sensitive as per the definitions provided in the NRA/TII Guidance Documents.

Note C This property forms part of the CPO register and will be demolished as part of the proposed development, as such it is not considered to be a noise sensitive receptor.