Our ref: NIA/7117/17/7025/v5 Harrogate Road

13th October 2017

NOISE IMPACT ASSESSMENT FOR PROPOSED JUNCTION IMPROVEMENT SCHEME HARROGATE ROAD / NEW LINE JUNCTION, GREENGATES, BRADFORD

1.00 INTRODUCTION

1.01 Environmental Noise Solutions has been commissioned by City of Bradford Metropolitan District Council (CBMDC) to carry out an operational noise impact assessment for the proposed road improvement scheme at the junction of Harrogate Road and New Line, Greengates, Bradford (hereafter referred to as the Scheme).

1.02 The Scheme aims to reduce congestion by increasing the number of lanes, introducing right turn lanes onto New Line, constructing a P-Loop Junction to cater for left and right turns from Harrogate Road onto New Line, and realigning the entrance road into the Farmfoods store.

1.03 The objectives of the noise impact assessment were to:

- Identify the noise-sensitive receptors (NSRs) likely to be affected by the Scheme and determine the baseline ambient noise climate at the subject site.
- Determine the noise impact of the Scheme with reference to pertinent guidelines.
- Identify dwellings that could qualify under the Noise Insulation Regulations 1975 (as amended 1988).

1.04 This report details the methodology and results of the assessment.

1.05 This report has been prepared for CBMDC for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult CBMDC and ENS as to the extent to which the findings may be appropriate for their use.

1.06 A glossary of acoustic terms used in the main body of the text is contained in Appendix 1.

2.00 NOISE IMPACT ASSESSMENT CRITERIA

<u>The Design Manual for Roads and Bridges (DMRB): Volume 11: Environmental Assessment</u>

2.01 Section 3 Part 7 of this document is that which is pertinent to noise and vibration and was published by the Department of Transport in 1993 with later amendments, the latest of which is November 2011. This document sets out procedures for undertaking the environmental assessment of new road schemes, including the assessment of noise effects from road traffic. In particular, Section 3 Part 7 describes a method for assessing the severity of a noise impact, in terms of the number of people who will be bothered from any noise increase due to a new road scheme. In undertaking a DMRB assessment, the calculation of traffic noise levels uses the methodology contained within the Calculation of Road Traffic Noise (CRTN) document as described below.

2.02 Although the DMRB strictly applies to new road schemes, the principles of the approach contained within the document can also be applied to the assessment of noise from road traffic in general. The Scheme has the potential to affect road traffic noise levels along existing roads, hence the need for this assessment.

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2.03 The DMRB assessment suggests that the magnitude of noise changes from a project should be classified into levels of impact. The November 2011 amendment to Section 3 Part 7 gives detailed consideration to how impact magnitude will be affected by whether a noise level change will occur in the short term (e.g. as a result of a sudden opening of a scheme), or whether the noise level change would occur in the long term (e.g. gradually over time, such as that associated with natural traffic growth).

2.04 The two example classification scales are duplicated in Tables 2.1 (short term) and 2.2 (long term) below.

Table 2.1 – Classification of Magnitude of Noise Effects in the Short Term

Noise Change, $L_{A10,18h}$, dB	Magnitude of Impact
0	No Change
0.1 to 0.9	Negligible
1.0 to 2.9	Minor / Low
3.0 to 4.9	Moderate / Medium
5.0+	Major / High

Table 2.2 – Classification of Magnitude of Noise Effects in the Long Term

Noise Change, $L_{A10,18h}$, dB	Magnitude of Impact
0	No Change
0.1 to 2.9	Negligible
3.0 to 4.9	Minor
5.0 to 9.9	Moderate
10.0+	Major

2.05 The DMRB confirms that the above scales apply to the impact magnitude, not the impact significance. The impact significance will depend upon both the impact magnitude and the sensitivity of the receiving environment.

2.06 The DMRB also provides methods for carrying out Simple and Detailed Assessments of the impact. The DMRB **Simple** Assessment requires comparisons of the following sets of data:

- Do-Minimum scenario (without the Scheme) in the baseline year against Do-Something scenario (with the Scheme) in the baseline year (short term).
- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

2.07 Where there is permanent change in magnitude of 1 dB $L_{A10,18h}$ in the short term scenario (i.e. 2021 baseline year) or 3 dB $L_{A10,18h}$ in the long term scenario (i.e. 2036 future assessment year), then a Detailed Assessment is required.

2.08 The DMRB **Detailed** Assessment requires comparisons of the following sets of data:

- Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year (long term).
- Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).
- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

Calculation of Road Traffic Noise (CRTN) 1988

2.09 Published by the Department of Transport and the Welsh Office in 1988, this document sets out standard procedures for calculating noise levels from road traffic. The calculation methods use a number of input variables, including traffic flow volume, average vehicle speed, percentage of heavy goods vehicles, type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground. CRTN predicts the $L_{10\ (18hour)}$ dB(A) or $L_{10\ (1hour)}$ dB(A) noise level for any receptor point at a given distance, up to 300 m, from the road.

Noise Insulation Regulations 1975 (as amended 1988)

2.10 With respect to altered highways, Regulation 4 of the Noise Insulation Regulations 1975, as amended 1988 (NIR) provides authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation.

2.11 The noise level parameters used in the NIR are described below:

- Prevailing Noise Level (PNL) means the level of noise, expressed as a level of $L_{10\ (18\text{-}hour)}$, one metre in front of the most exposed of any windows and doors in a façade of a building caused by traffic using any highway immediately before works for the construction of a highway or additional carriageway, or for the alteration of a highway, as the case may be, were begun.

- Relevant Noise Level (RNL) means the level of noise, expressed as a level of $L_{10\ (18\text{-}hour)}$, one metre in front of the most exposed of any windows and doors in a façade of a building caused or expected to be caused by traffic using or expected to use any highway.

2.12 The Regulations apply only to dwellings (or buildings used for residential purposes) which are ≤ 300 metres from the nearest point of the altered highway, and the criteria outlined in the NIR are as follows:

- The RNL must not be less than 67.5 dB $L_{A10,18h}$.

- The RNL is at least 1.0 dB(A) more than the PNL.

- The contribution to the increase in the RNL from the altered highway must be at least 1.0 dB(A).

3.00 PROPOSED SCHEME AND BASELINE NOISE SURVEY

3.01 The Harrogate Road / New Line junction is to be improved in order to alleviate delays caused by the large volumes of traffic using the junction. Improvements to the junction include:

- Increasing the number of traffic lanes for the ahead and left turn vehicle movements at the junction.

- The introduction of right turn lanes on New Line.

- The introduction of a P-Loop Junction to cater for left and right turning vehicles from Harrogate Road onto New Line.

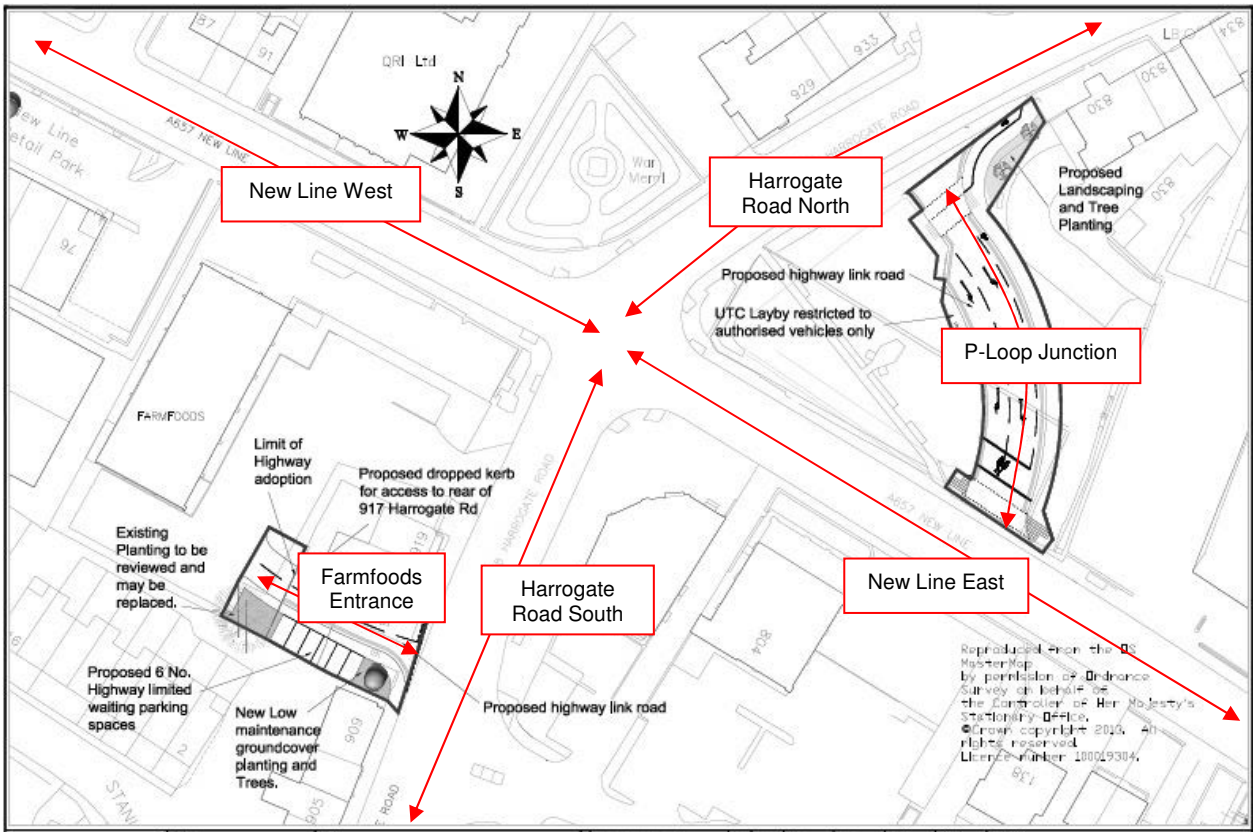
- Realignment of the Farmfoods store entrance road.

3.02 The number of vehicles using the Farmfoods entrance is estimated using the scenario of every space being used by 2 no. customers in a worst case hour (i.e. 38 no. spaces x 4 vehicle movements = **152 no. vehicle movements per hour**).

3.03 A traffic assessment produced by the CBMDC for the Scheme provides information relating to traffic flow volumes, speeds and compositions for the 5 sections of the junction as follows (see Figure 3.1 below for annotated layout):

- Harrogate Road North
- Harrogate Road South
- New Line West
- New Line East
- P-Loop Junction (new)

Figure 3.1 – Road Sections



3.04 The nearest noise sensitive receptors (NSRs) which have the potential to be affected by the Scheme are summarised below along with the relevant road section:

Table 3.1 – Summary of Noise Sensitive Receptors

Road Section	Noise Sensitive Receptor(s)	No. of Dwellings
Harrogate Road North	No. 1 and 4 Carr Bottom Road No. 832A, 834–836 and 929–933 Harrogate Road	8
Harrogate Road South	No. 885, 903–905, 917A and 919 Harrogate Road	5
New Line West	No. 60 and 63–91 New Line No. 1 The Grove	16
New Line East	No. 138, 138A, 138B, 142–150, 150A and 152 New Line	10
P-Loop Junction	No. 10–13 Barraclough Buildings	4
Farmfoods Entrance	No. 2 –16 Stanley Street	8

3.05 It should be noted that No. 917A and 919 Harrogate Road are not considered within the impact assessment of the new Farmfoods entrance road, on the basis that the existing entrance road is a comparable distance from these dwellings to the new entrance road.

3.06 In order to establish the baseline ambient noise levels at the NSRs, noise monitoring was carried out by CBMDC between 1600 and 1800 hours on Monday 11th January 2016.

3.07 For the purpose of the assessment, the following noise monitoring positions were adopted (the approximate location of the noise monitoring positions is contained in Appendix 2 for reference):

- MPA was located adjacent to 150 New Line
- MPB was located adjacent to 138 New Line
- MPC was located adjacent to 899 Harrogate Road
- MPD was located adjacent to 919 Harrogate Road
- MPE was located adjacent to 85 New Line
- MPF was located adjacent to 91 New Line
- MPG was located adjacent to 830 Harrogate Road

3.08 The following table contains a summary of the measurement data at each measurement position.

Table 3.2 – Summary of Noise Measurement Data

Position	L_{Aeq} (dB)	L_{A90} (dB)	L_{A10} (dB)	L_{AMax} (dB)
MPA	69.9	62.0	72.0	84.1
MPB	71.5	62.5	74.5	83.5
MPC	70.3	63.5	73.5	82.3
MPD	72.4	64.5	74.5	83.9
MPE	70.1	62.0	73.5	83.6
MPF	71.9	64.5	74.5	82.8
MPG	72.2	64.0	75.0	86.4

4.00 NOISE IMPACT ASSESSMENT

Farmfoods Entrance Road

4.01 A total of 152 no. vehicle movements per hour on the Farmfoods entrance road has been predicted based on 2 no. customers using each space in a worst case hour. In order to calculate the noise level associated with vehicle movements, the Sound Exposure Level (SEL) may be used.

4.02 For reference, the SEL of a single discrete noise event is the level, which if maintained constant for a period of one second would contain as much A-weighted sound energy as is contained in the actual noise event. The SEL of a noise source is a useful measurement for estimating average levels for repetitive discrete events such as vehicle passes.

4.03 ENS has previously measured SELs of 65 dB(A) associated with cars moving at slow speed, at a distance of 5 metres.

4.04 The formula used for calculating the ambient noise level (L_{Aeq}) from measured activity SELs is as follows:

$L_{Aeq\ (1\ hour)} = 10 \times \log_{10} ((n \times 10^{SEL/10}) / T)$ where:

T is reference time interval (i.e. 3600 seconds)
SEL is the single event level for a car pass-by (i.e. 65 dB)
n is the number of occurrences of the SEL (i.e. 152 vehicle movements)

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4.05 The resultant noise level associated with vehicle movements is calculated at 51 dB $L_{Aeq\ (1\ hour)}$ at 5 metres.

4.06 NSRs on Stanley Street are circa 25 metres from the new entrance road. Based on point source attenuation of 6 decibels per doubling of distance, the resultant noise level associated with vehicle movements at dwellings on Stanley Street is calculated at **37 dB $L_{Aeq\ (1\ hour)}$**.

4.07 To put this level in context:

- WHO Guidelines for Community Noise states: *During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50 dB.*

- British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' sets a guideline **indoor** ambient noise level of 35 dB $L_{Aeq\ (0700\text{-}2300)}$ within dwellings during the daytime. Allowing 15 dB attenuation for a partially-open window, worst case indoor noise levels associated with vehicle movements on the entrance road are ≤ 22 dB $L_{Aeq\ (1\ hour)}$.

4.08 It is therefore considered that the noise impact of the new entrance road will be negligible at the nearest NSRs.

P-Loop Junction – DMRB Simple Assessment

4.09 In terms of proximity to the roads, site plans indicate the following:

- Within the Harrogate Road North, Harrogate Road South and New Line West sections of the Scheme, there are no material changes to the positions of the roads relative to the nearest dwellings.

- Within the New Line East section of the Scheme, the position of the nearside kerb is moving from circa 12 metres to circa 8.5 metres to the façade of the nearest dwellings.

- The P-Loop Junction is circa 30 metres from the façade of No. 1 Barraclough Buildings, and will re-direct a proportion of traffic from the existing roads.

4.10 Assuming line-source propagation, traffic noise levels at NSRs identified within the New Line East section of the Scheme will increase by circa +1.5 dB (i.e. = 10 x log [12 / 8.5]) due to increased proximity to the road.

4.11 For the purpose of the assessment, the impact of the P-Loop is assessed against traffic using Harrogate Road North. Traffic data provided by CBMDC indicates that circa 31% of inbound traffic on Harrogate Road North will utilise the P-Loop Junction, with 69% continuing on to the junction.

4.12 Harrogate Road North is set back circa 60 metres from dwellings at the Barraclough Buildings, whilst the proposed P-Loop Junction is set back circa 30 metres. Assuming line-source propagation, and a proportion of 31% inbound traffic on the P-Loop, this equates to an increase of circa +1 dB (i.e. = (10 x log [60 / 30]) x 31%).

4.13 Tables 4.1 and 4.2 overleaf summarise the total changes in magnitude in the short term and long term, based on the traffic data provided by CBMDC and site layout plans.

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Table 4.1 – Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term)

Noise sensitive receptor(s)	Road Section	2021 Do-Minimum AADT	2021 Do-Something AADT	Change in magnitude due to traffic flow	Change in magnitude due to distance	Total change in magnitude
No. 1 and 4 Carr Bottom Road No. 832A, 834–836 and 929–933 Harrogate Road	Harrogate Road North	23109	24451	+0.2 dB	0 dB	+0.2 dB
No. 885, 903–905, 917A and 919 Harrogate Road	Harrogate Road South	20528	22178	+0.3 dB	0 dB	+0.3 dB
No. 60 and 63–91 New Line No. 1 The Grove	New Line West	19340	19407	0 dB	0 dB	0 dB
No. 138, 138A, 138B, 142–150, 150A and 152 New Line	New Line East	23076	22738	0 dB	+1.5 dB	+1.5 dB
No. 10–13 Barraclough Buildings	P-Loop Junction	21463	24358	+0.6 dB	+ 1 dB	+1.6 dB

Table 4.2 – Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term)

Noise sensitive receptor(s)	Road Section	2021 Do-Minimum AADT	2036 Do-Something AADT	Change in magnitude due to traffic flow	Change in magnitude due to distance	Total change in magnitude
No. 1 and 4 Carr Bottom Road No. 832A, 834–836 and 929–933 Harrogate Road	Harrogate Road North	23109	30704	+1.2 dB	0 dB	+1.2 dB
No. 885, 903–905, 917A and 919 Harrogate Road	Harrogate Road South	20528	27820	+1.3 dB	0 dB	+1.3 dB
No. 60 and 63–91 New Line No. 1 The Grove	New Line West	19340	24005	+0.9 dB	0 dB	+0.9 dB
No. 138, 138A, 138B, 142–150, 150A and 152 New Line	New Line East	23076	28535	+0.9 dB	+1.5 dB	+2.4 dB
No. 10–13 Barraclough Buildings	P-Loop Junction	21463	30560	+1.5 dB	+ 1.0 dB	+2.5 dB

4.14 As shown in the above tables, dwellings affected by the New Line East and P-Loop Junction sections of the Scheme will exceed the **short term** thresholds described in the DMRB and should therefore be provided with a Detailed Assessment to determine noise nuisance levels.

P-Loop Junction – DMRB Detailed Assessment

4.15 The DMRB contains a procedure for deriving the % of people bothered very much or quite a lot by traffic noise from the calculated $L_{A10\ (18\ hour)}$ level. The $L_{A10\ (18\ hour)}$ levels are modelled in accordance with the CRTN.

4.16 The change in the % of people bothered very much or quite a lot by road traffic noise between the baseline year and the future assessment year is first compared without the Scheme (Do-Minimum Scenario) as detailed in Table 4.3 overleaf.

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Table 4.3 – Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year (long term change in nuisance level)

Noise sensitive receptor(s)	Road Section	2021 Do-Minimum		2036 Do-Minimum		
		$L_{A10, 18h}$	% of people bothered	$L_{A10, 18h}$	% of people bothered	Change in % of people bothered
No. 138, 138A, 138B, 142–150, 150A and 152 New Line	New Line East	70.5 dB	34 %	70.8 dB	34 %	0 %
No. 10–13 Barraclough Buildings	P-Loop Junction	57.3 dB	11 %	57.2 dB	11 %	0 %

4.17 For reference, the daytime traffic noise level outside No. 150 New Line (MPA) was measured at 72.0 $L_{A10, T}$. The CRTN states that the $L_{A10 (18 hour)}$ can be predicted using the equation:

(i) $L_{A10 (18 hour)} = L_{A10 (3 hour)} - 1$ dB

4.18 Although the procedure contained in CRTN has not been strictly adopted (with shorter measurement periods used), the estimation of the $L_{A10 (18 hour)}$ is still considered suitable for the purpose of establishing the validity of the modelled noise level.

4.19 Based on the above formula (i), the $L_{A10 (18 hour)}$ noise level is measured / calculated as 71 dB $L_{A10 (18 hour)}$ at MPA, whilst the modelled level was predicted as 70.5 dB $L_{A10 (18 hour)}$. There is therefore a negligible difference between the measured and modelled noise levels.

4.20 The long-term change in the % of people bothered between the baseline year and the future assessment year is then compared with the Scheme in place (Do-Something Scenario) as detailed in Table 4.4.

Table 4.4 – Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term change in nuisance level)

Noise sensitive receptor(s)	Road Section	2021 Do-Minimum		2036 Do-Something		
		$L_{A10, 18h}$	% of people bothered	$L_{A10, 18h}$	% of people bothered	Change in % of people bothered
No. 138, 138A, 138B, 142–150, 150A and 152 New Line	New Line East	70.5 dB	34 %	72.5 dB	40 %	+ 6 %
No. 10–13 Barraclough Buildings	P-Loop Junction	57.3 dB	11 %	63.8	16 %	+ 5 %

4.21 Finally, the short-term response to the opening of the Scheme is considered. The DMRB provides a graph for determining the change in the % of people bothered very much or quite a lot by traffic noise relative to the short term change in $L_{A10 (18 hour)}$. This change is added to the % of people bothered in the Do-Minimum baseline scenario in order to establish the total % of people bothered in the short term.

Table 4.5 – Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term change in nuisance level)

Noise sensitive receptor(s)	Road Section	2021 Do-Minimum		2021 Do-Something			
		$L_{A10, 18h}$	% of people bothered (a)	$L_{A10, 18h}$	Change in $L_{A10, 18h}$	Change in % of people bothered (b)	Total % of people bothered (a+b)
No. 138, 138A, 138B, 142–150, 150A and 152 New Line	New Line East	70.5 dB	34 %	71.5 dB	+1.0 dB	21 %	55 %
No. 10–13 Barraclough Buildings	P-Loop Junction	57.3 dB	11 %	62.9 dB	+5.6 dB	35 %	46 %

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4.22 As the **total** % of people bothered very much or quite a lot by traffic noise is greater in the short term, the **change** in % of people bothered in the short term is adopted as worst case, in accordance with the DMRB methodology. Table 4.6 provides a summary of the changes in noise nuisance levels.

Table 4.6 – Detailed Assessment Traffic Noise Nuisance Summary

		Do-Minimum	Do-Something
Change in nuisance level		**Number of dwellings**	**Number of dwellings**
Increase in nuisance level	**< 10%**	0	0
	10 < 20%	0	0
	20 < 30%	0	10
	30 < 40%	0	4
	> 40%	0	0
No Change	**0%**	14	0
Decrease in nuisance level	**< 10%**	0	0
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

Noise Insulation Regulations 1975 (as amended 1988)

4.23 The only properties which fulfil the criteria detailed in the NIR, and therefore eligible for a discretionary grant in respect of the cost of undertaking noise insulation work, are No. 138, 138A, 138B, 142–150, 150A and 152 New Line, as:

- The RNL at these properties is expected to exceed 67.5 dB $L_{A10\ (18\ hour)}$ (see Table 4.5).
- The Scheme is predicted to increase the RNL at these properties by circa 1.5 dB relative to the PNL (see Table 4.1).

5.00 SUMMARY

5.01 Dwellings within the Harrogate Road North, Harrogate Road South and New Line West sections of the Scheme are predicted to experience an increase of ≤ 0.3 dB in road traffic noise levels due to increased traffic volumes. Changes of this magnitude are categorised as 'negligible' in accordance with the DMRB and a detailed assessment of noise nuisance was not required.

5.02 Dwellings affected by the New Line East and P-Loop Junction sections of the Scheme are predicted to experience a 1.5–1.6 dB increase in road traffic noise levels in the short term due to increased traffic volumes and proximity to the highway. Although changes of this magnitude are categorised as 'minor/low' in accordance with the DMRB, a detailed assessment of noise nuisance was required.

5.03 In the long term Do-Minimum Scenario, the % of people bothered very much or quite a lot by traffic noise at dwellings affected by the New Line East and P-Loop Junction sections of the Scheme is not set to increase.

5.04 In the Do-Something Scenario, the % of people bothered very much or quite a lot by traffic noise at dwellings affected by the New Line East section of the Scheme is set to increase by 21% in the short term (considered worst case), and by 6% in the long term.

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5.05 In the Do-Something Scenario, the % of people bothered very much or quite a lot by traffic noise at dwellings affected by the P-Loop Junction section of the Scheme is set to increase by 35% in the short term (considered worst case), and by 5% in the long term.

5.06 Dwellings at No. 138, 138A, 138B, 142–150, 150A and 152 New Line are eligible for a discretionary grant in respect of the cost of undertaking noise insulation work, in accordance with the Noise Insulation Regulations 1975 (as amended 1988).

5.07 The noise impact of the realigned Farmfoods entrance road is considered to be negligible.

I trust the foregoing is sufficient for your needs. Should you have any queries regarding the above, please do not hesitate to contact me.

Yours sincerely

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Appendix 1
Glossary of Acoustic Terms

Sound Pressure Level (L_p)

The basic unit of sound measurement is the sound pressure level. As the pressures to which the human ear responds can range from 20 µPa to 200 Pa, a linear measurement of sound levels would involve many orders of magnitude. Consequently, the pressures are converted to a logarithmic scale and expressed in decibels (dB) as follows:

$$L_p = 20 \log_{10}(p/p_0)$$

Where L_p = sound pressure level in dB; p = rms sound pressure in Pa; and p_0 = reference sound pressure (20 µPa).

A-weighting Network

A frequency filtering system in a sound level meter, which approximates under defined conditions the frequency response of the human ear. The A-weighted sound pressure level, expressed in dB(A), has been shown to correlate well with subjective response to noise.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq, T}$

The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time. $L_{Aeq, 16h}$ (07:00 to 23:00 hours) and $L_{Aeq, 8h}$ (23:00 to 07:00 hours) are used to qualify daytime and night time noise levels.

$L_{A10, T}$

The A-weighted sound pressure level in decibels exceeded for 10% of the measurement period, T. $L_{A10, 18h}$ is the arithmetic mean of the 18 hourly values from 06:00 to 24:00 hours.

$L_{A90, T}$

The A-weighted sound pressure level of the residual noise in decibels exceeded 90% of a given time interval, T. L_{A90} is typically taken as representative of background noise.

$L_{AF\ max}$

The maximum A-weighted noise level recorded during the measurement period. The subscript 'F' denotes fast time weighting, slow time weighting 'S' is also used.

Sound Exposure Level (SEL or L_{AE})

The energy produced by a discrete noise event averaged over one second, no matter how long the event actually took. This allows for comparison between different noise events which occur over different lengths of time.

Weighted Sound Reduction Index (R_W)

Single number quantity which characterises the airborne sound insulation properties of a material or building element over a defined range of frequencies (R_W is used to characterise the insulation of a material or product that has been measured in a laboratory).

Appendix 2
Drawings (Site Plan / Noise Monitoring Positions)