

HEPWORTH
ACOUSTICS
Noise and Vibration Consultants

PROPOSED RESIDENTIAL DEVELOPMENT - 29/31 PARK GROVE, LEVENSHULME

NOISE IMPACT ASSESSMENT

On behalf of:

Advance Property Solutions

Report No: P17-452-R01v2
September 2018

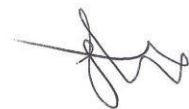
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1.0 INTRODUCTION

- 1.1 Hepworth Acoustics Ltd was commissioned by Advance Property Solutions to carry out a railway noise and vibration assessment in connection with a planning application for a residential development on land off Park Grove, Levenshulme.
- 1.2 The proposed development is for six two-bedroom apartments across three storeys at 29/31 Park Grove. The proposed site layout is shown in Figure 1.
- 1.3 The eastern site boundary is located adjacent to No. 33 Park Grove and the western boundary is adjacent to a four-line railway, which runs north/south parallel to the site. The railway tracks are elevated by approximately 2.0m above the height of the development land. To the south of the site are residential dwellings and to the north is a public open space. Park Grove itself is not accessible by vehicles and the parking for the development will be to the rear.
- 1.4 The railway line is used primarily by passenger trains, typically 2-4 coach services operated by Northern Trains, Arriva Trains Wales, Cross Country, East Midlands and Trans-Pennine. Virgin Trains intercity (typically 9-11 carriages) services also regularly operate on this line to and from Manchester Piccadilly. In the daytime approximately 30 trains pass the site per hour including approximately 8 local service trains which stop at the nearby Levenshulme Station, with a daily (07:00 - 23:00) total of approximately 430 trains. At night approximately 40 trains pass the site between 23:00 and 07:00 hours.
- 1.5 There is very little freight traffic on this line. Freightmaster (a frequently updated subscription-based online resource providing indicative rail freight timetables/routes) have informed that there are no freight trains using this line during the daytime and (07:00-23:00 hours) and approximately every six weeks, during engineering works on the nearby Styal line, up to 12 freight trains pass the site at night (23:00-07:00 hours). We have therefore included the passage of 12 freight trains during the night in our assessment as a worst-case scenario.
- 1.6 The total numbers of passing trains used for the assessment are summarised in Table 1.

Table 1: Total Number of Passing Trains

Train Type	Daytime 0700 - 2300 hours	Night-time 2300 - 0700 hours
Passenger	431	43
Freight	0	12

- 1.7 The noise assessment has included:
- An inspection of the development site;
 - Measurement of noise and vibration levels for a sample of passing trains.
 - Evaluating the daytime and night-time railway noise and vibration exposure levels;
 - Assessing the need for any noise mitigation measures and, if so, recommending a scheme of such measures.
- 1.8 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 RAILWAY NOISE & VIBRATION SURVEY

Railway Noise Survey

- 2.1 A railway noise survey was carried out at the site during the daytime on 27th September 2017 between 10:30 – 13:00 hours. During this time a total of 60 trains passed the site. Noise levels were measured during the passage of each train in terms of the 'sound exposure level' (SEL) and the maximum sound pressure level, L_{Amax} .
- 2.2 The noise monitoring was carried out using a Bruel & Kjaer 2250 'Class 1' sound level meter (Serial number 3011706). The meter was mounted onto a tripod with a microphone height of approximately 1.5 metres above the ground. A windshield was fitted to the microphone during all noise measurements. All measurements were carried out in 'free-field' conditions. Calibration checks were carried out before and after the noise survey with no variance in levels observed.
- 2.3 The site was very overgrown which limited choice of monitoring locations near to the western boundary. The noise monitoring was therefore carried out at the closest accessible location to the western boundary at a distance of 10m from the boundary with the railway land as shown on Figure 1.
- 2.4 During the survey, the weather conditions were dry and mild with light wind and considered suitable for carrying out noise measurements.
- 2.5 The results of the railway noise survey are detailed in Appendix II and the data has been used in the analysis below.
- 2.6 Railway noise is evaluated in terms of the 'equivalent continuous noise level', L_{Aeq} . period L_{Aeq} values for the site have been calculated from the results of the noise survey using the formula:
- $$L_{Aeq(T)} = SEL \text{ Average} + 10 \log N - 10 \log T$$
- where:
- $L_{Aeq(T)} = L_{Aeq}$ over time period T
 - SEL Average = (Log.) Average 'Sound Exposure Level'
 - N = Number of train passes in time period T
 - T = Time period in seconds
- 2.7 The railway noise calculations have been undertaken for the daytime and night-time periods using the SEL values and the train numbers from Table 1. The calculations were undertaken separately for

local and intercity services, and the results combined to obtain the overall noise level. The results are shown in Table 2.

- 2.8 No freight trains passed the site during the noise survey. Therefore, in the absence of source noise data for freight-trains passing this site, measured noise levels of freight train pass-bys from a previous survey undertaken on the West Coast Mainline have been used when calculating night-time railway noise levels at this site.

Table 2: Railway noise exposure values (dB)

Location	Daytime - $L_{Aeq,16h}$	Night-time $L_{Aeq,8hr}$	Night-time L_{Amax} (range)
4m from Western boundary	62	57	57 - 82

- 2.9 The measured peaks of noise from the trains that passed the site were in the range 57 - 82 dB L_{Amax}
- 2.10 The implications of the railway noise exposure values are set out in Sections 3.0.

Railway Vibration Survey

- 2.11 Manchester City Council Noise and Planning Guidance states that a ground borne vibration assessment based on British Standard 6472: 2008, *Guide to the evaluation of human exposure to vibration in buildings* may be required where railway lines pass within 75 metres of a proposed development.
- 2.12 BS 6472: 2008 sets out national guidance on measuring and assessing the potential annoyance resulting from vibration in buildings. The standard includes a section on intermittent vibrations which requires the vibration exposure to be determined in terms of a 'vibration dose value', VDV. This takes into account the magnitude of the vibration and the duration of exposure.
- 2.13 Vibration dose values (in $ms^{-1.75}$) in residential buildings at which various degrees of adverse comment may be expected are quoted in BS 6472 and are reproduced in Table 3:

Table 3: Extract from BS6472 in VDV ms^{-1.75}

Period	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Daytime (07:00 – 23:00)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Night-time (23:00 – 07:00)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

- 2.14 The vibration dose value for the day or night-time period can be calculated using the formula:

$$VDV_{b/d, \text{ day/night}} = \left(\int_0^T a^4 t (dt) \right)$$

where: $VDV_{b/d, \text{ day/night}}$ is the vibration dose value
 $a(t)$ is the frequency weighted acceleration in ms⁻²
 T is the total period of day or night (in seconds) during which vibration can occur

- 2.15 A ground vibration monitoring survey of passing trains was carried out at the site at Locations 2 which was 8m from the site boundary as shown in Figure 2.
- 2.16 A dual channel Vibrock V901 tri-axial vibration recorder with a VDV transducer was used to measure the railway vibration with the transducer located on a 200x150x25mm stone slab seated firmly into the ground to ensure a good coupling. Vibration measurements were taken between 10:30-13:00 on Wednesday 27th September.
- 2.17 The 1-hour vibration exposure values are shown in Table 4

Table 4 Railway Vibration Dose Values in ms^{-1.75}

Period	VDV		
	X	Y	Z
10:30 – 11:30	0.008	0.008	0.01
11:30 – 12:30	0.011	0.011	0.014
12:30 – 13:00	0.013	0.013	0.016

- 2.18 The corresponding daytime and night-time VDV values have been extrapolated from one-hour measurements and the highest in each of the X (parallel to the track), Y (perpendicular to the track) and Z (vertical) axes used. The highest extrapolated VDV values are shown Table 5.

Table 5: Railway Vibration Levels in $\text{ms}^{-1.75}$

Period	VDV		
	X	Y	Z
Day time	0.021	0.021	0.026

- 2.19 The extrapolated daytime and VDV values are well below the threshold values set out in BS 6472. Train numbers are far lower during the night and are of the similar type to daytime trains we therefore consider that vibration levels from trains running at night will be lower than that of the day time. Therefore, no special vibration isolation measures will be necessary at this site and vibration is not considered any further in this report.

3.0 ACOUSTIC DESIGN CRITERIA

- 3.1 For the purposes of determining the necessary noise mitigation and sound insulation measures for this development, we have adopted the design criteria as set out in para 3.6.1.1 of the Manchester City Council document, *“Planning & Noise Technical Guidance”* dated December 2015;

Manchester City Council has adopted the following internal noise limits for residential properties:

- *Bedrooms (night time - 23.00 - 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 15 times)*
- *Living Rooms (daytime - 07.00 - 23.00) 35 dB L_{Aeq}*
- *Gardens and terraces (daytime) 55 dB L_{Aeq}*

- 3.2 The acoustic design criteria detailed above is based on guidance set out in BS 8233: 2014, *Guidance on sound insulation and noise reduction for buildings* and is consistent with the recently published ProPG: 2017 ‘Professional Practice Guidance on Planning & Noise’.

- 3.3 BS 8233 also recognises that regular individual noise events at night can cause sleep disturbance. Peaks of noise from individual events are usually described in terms of L_{Amax} values and these can be highly variable and unpredictable. ProPG states that *“in most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events”*. This is broadly consistent with research described in WHO *Community Noise Guidelines* that states *“for a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night”*.

- 3.4 Therefore, we have adopted the 10th highest L_{Amax} value which is 74 dB L_{Amax}

- 3.5 BS 8233 states that if there is a reliance on closed windows to meet the guide values, *“there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level”*. Further, it is stated that assessments should be based on a room with *“adequate ventilation provided (e.g. trickle ventilators should be open)”*.

- 3.6 For private gardens, BS 8233:2014 and MCC's *Planning & Noise Technical Guidance* state that daytime noise level should not normally exceed 55dB $L_{Aeq,16hr}$. BS 8233 states that in some high noise areas (e.g. in close proximity to the strategic transport network such as at this site), noise levels higher than 55dB $L_{Aeq,16hr}$ may be justified, provided that daytime noise levels in private gardens are minimised by utilising the orientation of the dwellings, the layout of the site and acoustic screening by way of noise barriers.

4.0 NOISE MITIGATION MEASURES

Gardens

- 4.1 The calculated railway noise exposure levels at the most exposed part of the site were found to be 62 dB $L_{Aeq,16hr}$. Therefore, acoustic screening will be required for gardens to meet the noise criterion of 55 dB.
- 4.2 We recommend that an acoustic fence of 2.5m in height is installed at the southern and western boundaries of the shared garden areas as shown in Figure 2. This will reduce railway noise within the private gardens to below 55 dB L_{Aeq} .
- 4.3 The acoustic fence must be imperforate and of minimum 10 kg/m² surface mass with no holes or gaps. Suppliers of proprietary acoustic fences include Jacksons Fencing (www.jacksons-fencing.co.uk), Guardian Fencing (www.guardianfencing.com) and Ransfords (www.ransfords.co.uk).

Sound Insulation for Houses

- 4.4 Windows of standard well-sealed thermal double glazing (e.g. 4mm glass – 12mm cavity - 4mm glass) have a typical sound reduction performance of 25 dB $R_w + C_{tr}$. Therefore, where noise levels exceed 60 dB $L_{Aeq,16hr}$ during the daytime and/or 55 dB $L_{Aeq,8hr}$ and/or 70 dB L_{Amax} at night, higher specification glazing will be necessary.
- 4.5 For all living rooms we recommended we recommend double glazing with a minimum sound reduction performance of 28 dB $R_w + C_{tr}$. This would be achieved with the following double-glazing specifications:
- 6mm glass – nominal cavity - 4mm glass; or
- 4.6 Typical peaks of noise due to train pass-bys were up to around 82 dB L_{Amax} at during the daytime which we consider would be comparable at night. Therefore, a higher specification glazing is required for bedrooms. We recommend double glazing with a minimum sound reduction performance of 30 dB $R_w + C_{tr}$ for bedrooms. This would be achieved with the following double-glazing specifications:
- 4mm acoustic laminated glass (e.g. Saint Gobain 'Stadip Silence') – nominal cavity – 6.4 mm glass.

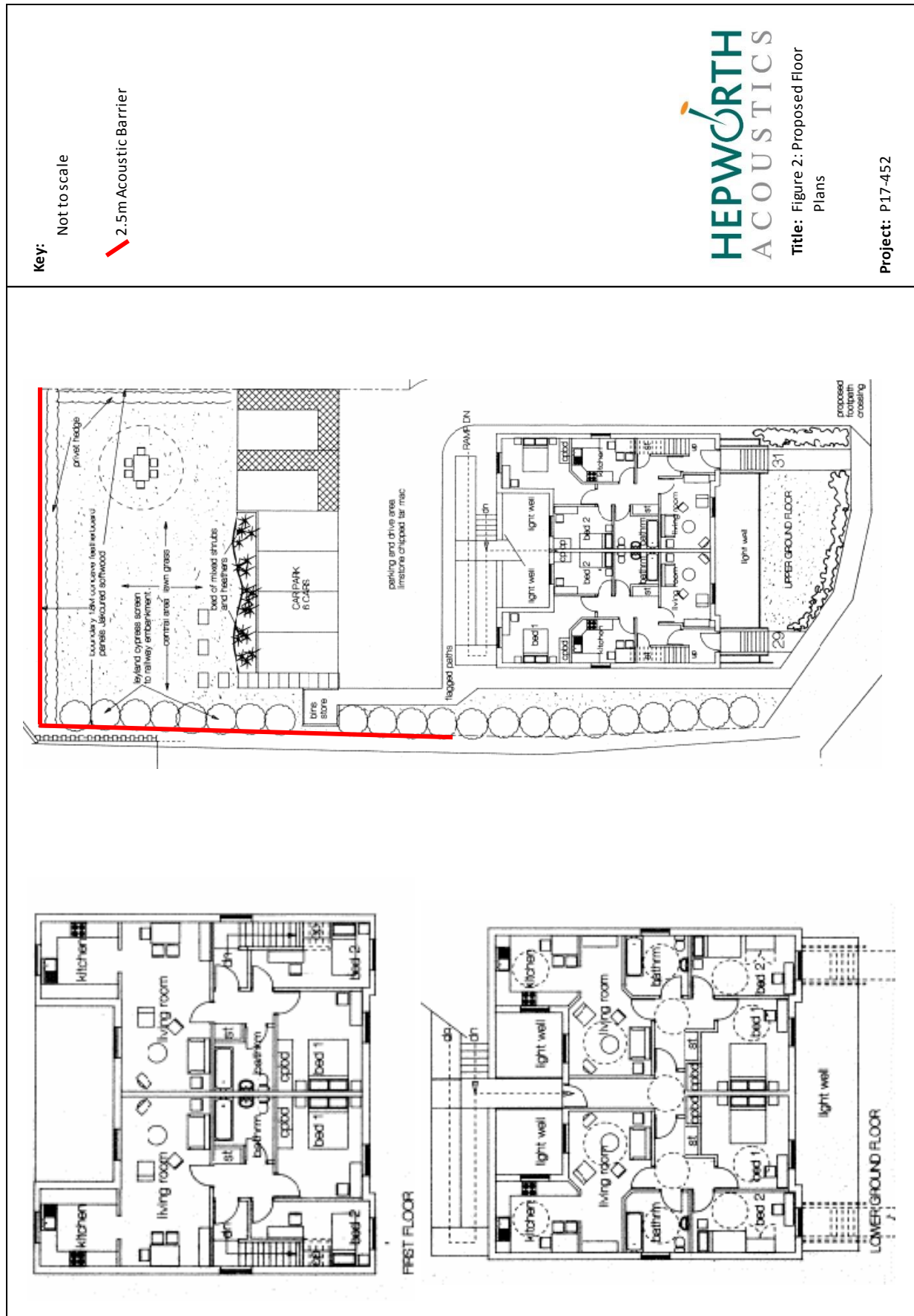
4.7 To ensure that L_{Amax} values in bedrooms at night are adequately controlled we would recommend that, instead of standard window frame slot vents, acoustic vents are installed. We recommend acoustic vents that have a rating of at least 42dB $D_{n,e,w}$ such as one of the following types:-

- Aereco EHA2 system (with acoustic canopy and sleeve),
- Titon SF Xtra Sound Attenuator Ventilator
- Rytons AAC125HP Acoustic Ventilator unit.

5.0 SUMMARY AND CONCLUSION

- 5.1 The impact of train noise and vibration has been assessed for a proposed residential development on Park Grove, Levenshulme in Manchester.
- 5.2 The assessment has been based upon a noise measurement survey and a ground vibration survey.
- 5.3 Manchester City Council's acoustic design criteria have been adopted that will ensure the protection of residential amenity
- 5.4 Ground vibration exposure levels were found to be well below the threshold for the onset of annoyance as defined in BS 6472 such that no vibration mitigation measures are necessary for any of the proposed dwellings.
- 5.5 A scheme of noise mitigation and sound insulation measures has been recommended in this report to achieve the adopted acoustic design criteria, and minimise noise levels in gardens as far as practicable.
- 5.6 If necessary, the implementation of an adequate scheme of noise mitigation measures can be ensured by the use of an appropriately worded planning condition.





Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

C_{tr} This is an A-weighted urban traffic noise spectrum, which can be added to $D_{nT,w}$ or R_w in some standards to take into account different source spectra such as low frequency sound.

D_n D_{nT} $D_{nT,w}$ This the Weighted Standardised Level Difference, is a single figure value of D_{nT} , and is the field measurement of airborne sound transmission

$D_{nT,w} + C_{tr}$ This is the Weighted Standardized Level Difference with Spectrum Adaption Term C_{tr}

L_{Aeq} This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{Amax} This is the maximum A-weighted noise level that was recorded during the monitoring period.

L_{A10} This is the A-weighted noise level exceeded for 10% of the time period. L_{A10} is usually used as a measure of traffic noise.

L_{A90} This is the A-weighted noise level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

SEL This is the A-weighted 'Sound Exposure Level' which is used for measuring discrete noise events. Essentially it is a measure of the sound energy of the whole noise event normalised to a period of 1 second. The SEL value can be used to calculate the actual L_{Aeq} value for a given time period if the number of noise events is known.

Appendix II: Noise Survey Results

Date(s): Wednesday 27th Sept 2017

Equipment: B&K 2250 'Type 1' sound analyser (serial no. 3099654) with tripod and calibrator

Weather: Daytime – Dry, warm 17C° and calm (0-3 m/s)

All levels in dB(A)

Location 1: Western boundary

Time	Direction	Measured Noise Level in dB(A)		Train Types
		L _{max}	SEL	
10:34	North	69.2	78.6	4 Coach Arriva Trains Wales
10:43	South	73.9	81.0	3 Coach Northern Rail
10:44	South	68.8	74.3	3 Coach Northern Rail
10:47	South	70.0	79.5	4 Coach East Midlands
10:48	North	65.5	64.1	3 Coach Northern Rail
10:52	North	68.8	73.4	3 Coach Northern Rail
10:56	South	68.4	73.6	2 Coach Northern Rail
10:56	South	73.5	78.0	3 Coach Northern Rail
10:57	North	73.8	83.2	11 Coach Virgin Trains
10:59	North	62.7	67.1	4 Coach Trans-Pennine
11:00	South	70.5	80.1	9 Coach Virgin Trains
11:01	South	68.3	74.8	2 Coach Northern Rail
11:04	North	68.2	66.0	3 Coach Arriva Wales
11:08	South	56.6	60.6	3 Coach Arriva Wales
11:10	North	67.3	64.7	4 Coach Cross Country
11:15	South	71.9	71.8	3 Coach Northern Rail
11:18	North	73.5	78.9	11 Coach Virgin Trains
11:20	North	75.4	82.1	4 Coach Northern Rail

11:23	North	69.6	71.6	2 Coach Northern Rail
11:24	South	72.8	73.5	9 Coach Virgin Trains
11:26	South	65.3	64.1	4 Coach Trans-Pennine
11:30	South	62.7	66.5	2 Coach Northern Rail (electric)
11:31	North	72.9	76.3	4 Coach East Midlands
11:33	South	72.5	73.7	4 Coach Cross Country
11:38	South	64.9	61.3	3 Coach Arriva Wales
11:39	North/South	74.7	80.3	11 Coach Virgin Trains
11:42	South	71.0	71.8	9 Coach Virgin Trains
11:46	North	58.9	62.4	3 Coach Northern Rail
11:48	North	82.2	82.3	11 Coach Virgin Trains & 3 Coach Northern Rail
11:49	South	69.5	74.0	4 Coach East Midlands
11:50	South	63.6	64.8	3 Coach East Midlands
11:54	North	70.0	68.7	3 Coach Northern Rail
11:54	North	61.4	59.9	2 Coach Northern Rail (electric)
11:57	North	80.1	85.5	11 Coach Virgin Trains
11:58	South	77.1	80.1	4 Coach Trans-Pennine
11:58	North	68.4	63.4	9 Coach Virgin Trains
12:01	South	66.4	72.8	4 Coach Trans-Pennine
12:07	North	65.9	66.1	3 Coach Arriva Wales
12:11	North	61.8	63.9	2 Coach Northern Rail (electric)
12:14	South	75.0	81.4	4 Coach Cross Country
12:16	South	68.4	69.0	2 Coach Northern Rail
12:18	North	68.8	67.9	2 Coach Northern Rail
12:19	North	79.3	86.5	3 Coach Northern Rail
12:24	North	70.5	77.6	11 Coach Virgin Trains
12:25	North	78.0	81.4	4 Coach Trans-Pennine
12:27	South	69.1	70.8	2 Coach Northern Rail
12:29	South	62.0	67.7	2 Coach Northern Rail (electric)
12:31	South	75.9	79.0	11 Coach Virgin Trains & 3 Coach Northern Rail
12:34	South	70.7	75.1	3 Coach Cross Country

12:36	North	69.4	71.1	3 Coach Arriva Wales
12:37	South	68.3	73.2	2 Coach Northern Rail
12:39	North	73.5	75.8	11 Coach Virgin Trains
12:41	North	69.9	77.0	2 Coach Northern Rail
12:42	South	76.1	83.9	9 Coach Virgin Trains
12:47	North	57.5	63.2	2 Coach Northern Rail (electric)
12:49	North	68.5	77.9	4 Coach East Midlands
12:50	South	68.9	72.9	3 Coach Northern Rail
12:53	North	63.8	63.5	2 Coach Northern Rail