Independent Acoustic Consultancy Practice

Environmental Noise & Vibration Survey

45 Affordable Residential Units
Danescourt

5287/ENS1

Hunter Acoustics

Independent Acoustic Consultancy Practice

Henstaff Court Business Centre
Llantrisant Road, Cardiff
CF72 8NG

t: +44(0)2920 891020

e: enquiries@hunteracoustics.co.uk

w: www.hunteracoustics.co.uk

Environmental Noise & Vibration Survey

Project:	**45 Affordable Residential Units**
Site Address:	De Braose Close Danescourt Cardiff CF5
HA Reference:	5287/ENS1
Date:	03/10/2019
Client:	Taff Housing Association Alexandra House 307-315 Cowbridge Road Cardiff CF5 1JD
Contact:	pipcole@btinternet.com

ISSUE / REVISION

Rev	Date			
1	03 September 2019	**Filename**	19.52870309_ENSdh_Rev1	
		Description	First issue	
			Prepared by:	**Checked by:**
		Name	Matthew Hunter TechIOA	David Hunter BSc(Hons) MSc MIOA
		Signature		
Rev	**Date**			
2	03 October 2019	**Filename**	19.52870309_ENSdh_Rev1	
		Description	Plot number amendment	
			Prepared by:	**Checked by:**
		Name	Matthew Hunter TechIOA	David Hunter BSc(Hons) MSc MIOA
		Signature		

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1. INTRODUCTION

It is proposed to develop 45 Affordable Residential Units on land at De Braose Close, Danescourt, Cardiff, CF5.

The local authority have requested an environmental noise survey be carried out to establish the potential impacts of existing noise sources upon the development site. The assessment should consider:

- The existing daytime and night time noise levels from the nearby railway
- An assessment of the expected impact the noise will have upon the future occupiers of the proposed dwellings
- Details of any mitigation measures that may be required as a result of the impact assessment;
- Plant noise (BS: 4142) for existing plant in the surrounding areas and proposed noise levels for any plant associated with the proposed accommodation.

2. PLANNING GUIDANCE

2.1 Technical Advice Note (Wales) 11 (TAN11)

TAN11 uses 'Noise Exposure categories' (NECs) ranging from A-D to aid local authorities in their consideration of applications for residential development near noise sources.

Noise bands defining categories A-D are set in terms of $L_{Aeq(16\ hour)}$ daytime, and $L_{Aeq(8\ hour)}$ night time levels for road traffic noise, free field 1.2-1.5m above ground level as follows;

Table 1 – Technical Advice Note (Wales) 11 Noise Exposure Categories

Table 1. Recommended noise exposure categories for new dwellings near existing noise sources (ref Table 2 of TAN 11 (Wales) October 1997) $L_{Aeq,T}$ dB					
Noise Source	**Time**	**Noise Exposure Categories**			
		A	**B**	**C**	**D**
Road Traffic	07:00-23:00	<55	55-63	63-72	>72
	23:00-07:00(2)	<45	45-57	57-66	>66
Rail Traffic	07:00-23:00	<55	55-66	66-74	>74
	23:00-07:00(2)	<45	45-59	59-66	>66

Air Traffic	07:00-23:00	<57	57-66	66-72	>72
	23:00-07:00[(2)]	<48	48-57	57-66	>66
Mixed Sources[(4)]	07:00-23:00	<55	55-63	63-72	>72
	23:00-07:00[(2)]	<45	45-57	57-66	>66

[(2)] Sites where individual noise events regularly exceed 82dBL_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D).
The above L_{Amax} guidance included in TAN 11 can be read in conjunction with BS 8233:1999 which recommends individual noise events should not ‘normally’ exceed 45dB(A) L_{max} (fast) in bedrooms between 23.00 and 07.00hrs (night-time).

It should be noted the latest BS 8233 2014 excluded this specific L_{Amax} guidance, though advises that L_{Amax} limits may be set for regular individual noise events such as scheduled aircraft or trains.

[(4)] **Mixed sources**: this refers to any combination of road, rail, air and industrial noise sources. The “mixed source” values are based on the lowest numerical values of the single source limits in the table. The “mixed source” NECs should only be used where no individual noise source is dominant.

Paragraph B17 of Annex B of TAN 11 advises that the likelihood of complaints about noise from an industrial development can be assessed, where the standard is appropriate, using guidance in BS 4142:1990. Therefore, referring to the notes at footnote 4 under Table 2 of TAN 11, BS 4142 is the appropriate standard to use if the dominant source is industrial noise; but not if a transport related noise source controls the overall ambient noise climate, or the site is ‘mixed source.’

Paragraph B17 of Annex B of TAN 11 refers to BS4142:1990 which has been superseded by BS 4142:2014.

2.2 BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

BS8233 quotes the following for residential development;

7.7.2 Internal ambient noise levels for dwellings

In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4.

Table 4 **Indoor ambient noise levels for dwellings**

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

NOTE 1 Table 4 provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The levels shown in Table 4 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

NOTE 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ *depending on the character and number of events per night. Sporadic noise events could require separate values.*

NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

NOTE 6 Attention is drawn to the Building Regulations [30, 31, 32].

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

Referring to note 4 above, we propose to use WHO guidelines quoting L_{max} *events not exceeding 45dB*$L_{Amax,f}$ *more than 10-15 times per night (2300-0700hrs), bearing in mind we are primarily concerned with rail noise for this site.*

For Garden spaces BS8233 advises;

7.7.3.2 Design criteria for external noise

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{\mathrm{Aeq},T}$, with an upper guideline value of 55 dB $L_{\mathrm{Aeq},T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

2.3 Rail Vibration

The following limits have been issued by Cardiff Council on similar schemes;

Prior to commencement of development a scheme shall be submitted to and approved in writing by the Local Planning Authority to provide that the dwellings are designed and constructed so as to ensure that vibration dose values do not exceed 0.4m/s1.75 between 07.00 and 23.00 hours, and 0.26m/s1.75 between 23.00 and 07.00 hours, as calculated in accordance with BS 6472:1992, entitled "Guide to Evaluation of Human Exposure to Vibration in Buildings", [1Hz to 80Hz]. The dwellings shall be constructed in accordance with the approved scheme.

Reason: To ensure that the amenities of future occupiers are protected."

3. SITE SURVEYS

3.1 Procedures

3.1.1 Continuous Noise Monitoring

Figure 1 – Site Plan showing Monitoring Positions

Figure 1 above shows the development site boundary and continuous monitoring location used namely:

Position A — Located on the north eastern boundary of the site approximately 7m to the nearest rail line and approximately 2m above local ground height

The density of undergrowth/trees made measurements on the main site impractical. Position A was therefore selected as an appropriate source measurement position for the railway line. Results are then used to calibrate a noise map acoustic model across the site. Continuous noise monitoring has been carried out over 24hrs from 1445hrs on 11/07/2019 in order to assess the existing noise climate at the proposed residential site.

Data including L_{max}, L_{eq}, and L_{90} was logged at 1-minute intervals over the monitoring period.

3.1.2 Continuous Vibration Monitoring

Continuous vibration Monitoring was set up at the base of a fence post at position A. Monitoring was undertaken over 24hrs in parallel with the noise monitoring from 1445hrs on 11/07/2019

Vibration levels were monitored in three orthogonal axes: radial (horizontal, perpendicular to line of tracks), tangential (horizontal, parallel to line of tracks) and vertical.

Hourly VDVs were logged at Position A;

Position A Located at the base of rail fence post, approximately 7m from closest rail line.

3.2 Equipment

Table 3.1 – Equipment List

Make	Description	Model	Serial Number	Last Calibrated	Certificate No.
Norsonic AS	Calibrator (113.95dB @ 999.27Hz)	1251	24202	10 August 2018	UCRT17/1718
NTi	Type 1 - Sound Level Meter	XL2-TA	A2A-10021-E0	24 August 2017	UCRT17/1722
	Preamplifier	MA220	5435	24 August 2017	UCRT17/1722
	Microphone	Capsule	8547	24 August 2017	UCRT17/1722
Svantek	Type 1 - Sound & Vibration Data Logger	SVAN 948	6962	25 August 2017	TCRT17/1537
Dytran	Tri-axial Accelerometer	3233A	158	25 August 2017	TCRT17/1537
Dytran	Cable	6483A09	-	25 August 2017	TCRT17/1537

Measurement systems were calibrated before and after the survey, no variation occurred.

3.3 Weather Conditions

Figure B.1 & Figure B.2 in Appendix B shows approximate weather data for monitoring period. To summarise, weather conditions were mainly dry and warm with wind levels generally low.

4. RESULTS

4.1 Continuous Noise Monitoring

Results of the survey are shown in Figure B.3 in Appendix B.

Ambient noise levels on site were controlled by train pass-bys on the Cardiff City Line. The following $L_{Aeq,16hr}$ daytime and $L_{Aeq,8hr}$ night-time noise levels have been measured;

Table 4.1 – Survey Results Table

Position A				
11/07/2019 - 12/07/2019	Daytime	0700-2300hrs	$L_{Aeq,16hr}$	= 55.5 dB
	Night-time	2300-0700hrs	$L_{Aeq,8hr}$	= 44.6 dB

* 1no $L_{Amax,F}$ event above 82dB was recorded during the night at position A , this was caused by a train pass-by.

L_{Aeq} and L_{Amax} sprinter train pass-by spectra at position A is shown in graph Figure B.4 in Appendix B. Typical $L_{Amax,F}$ events from train-bys were between 75-85dB.

L_{Aeq} and L_{Amax} octave band spectra for the daytime sample measurements of train pass-bys undertaken at Positions 1 & 2 are shown in Figure B.5 and Figure B.6 in Appendix B.

4.2 Continuous Vibration Monitoring

Table B.1 in Appendix B shows hourly vibration dose values measured at Position A, together with the daytime (0700-2300hrs) and night-time (2300-0700hrs) VDV levels for comparison with criteria quoted in the typical local authority planning condition.

Measurement results indicate the radial axis of vibration to be dominant, therefore radial VDVb figures are assessed.

VDVs for comparison with the typical planning condition are as follows:

VDVb,day(0700-2300hrs) = 0.15 m/s1.75 Limit = 0.4 m/s1.75

VDVb,night(2300-0700hrs) = 0.02 m/s1.75 Limit = 0.26 m/s1.75

5. DISCUSSION

Measured noise levels put the site at the boundary of NEC A & B of TAN11 (bearing in mind position A was on the site boundary fence and is at the lower end of NEC B), standard thermal double glazing and trickle vents should be sufficient to meet the internal criteria quoted in section 2.1 of this report.

Whilst British Standard 8233 does not quote L_{Amax}, we would recommend an L_{Amax} criteria internal of 45dB(A) should not be exceeded more than 10-15 times per night. 1no sprinter train was recorded during the night-time period and no freight trains were recorded passing the meter therefore this internal criteria should also be met with standard thermal double glazing and trickle vents.

However as there are frequent train pass-bys from 0700hrs and up to 2300hrs, we would recommend an Rw28 glazing system and acoustic trickle ventilators are used for plots adjacent to the rail line to reduce L_{Amax} levels to internal areas. See below;

Table 5.1 – Window Glazing Sound Reduction Index Figures

Element	Description	Sound Reduction Index (SRI: BS EN ISO 140) at Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
Windows	For budgetary guidance: based on Pilkington 6mm / 6 - 16mm / 4mm	21	20	25	38	37

Table 5.2 – Acoustic Trickle Ventilator Specifications

Element	Description	Dn,e at Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
Ventilator	For budgetary guidance: based on Greenwood EAR42W	34	40	39	42	49

Standard thermal double glazing and trickle vents are indicated sufficient on remaining facades of the development.

Figure 2 – Facades Requiring Additional Sound Insulation Measures

Facades highlighted in **RED** are recommended to have the uprated glazing system and acoustic trickle ventilators.

Gardens

The daytime level measured on the critical boundary was 55.5dB(A). Garden levels are therefore indicated to meet the 55dB(A) garden criterion quoted in section 2.1 of this report with a 2.1m high imperforate close boarded boundary fence (7kg/m2 minimum mass per unit area).

Vibration

Measured VDV's are well within criteria quoted in Cardiff's standard condition (taken from BS6472). Vibration is not indicated an issue on this site.

6. CONCLUSION

Environmental noise and vibration surveys have been carried out to assess existing ambient and background noise levels impinging on the proposed development site on land at De Braose Close, Danescourt, Cardiff, CF5.

Survey results have been used for comparison with current planning guidance.

The development site is indicated to fall at the boundary of NEC A and B of TAN 11.

Whilst the number of train pass-by events at night (between 2300-0700hrs) is indicated to be low, regular sprinter train pass-bys occur from 0700hrs and up to 2300hrs. Specifications have therefore been included in this report for acoustic double glazing and acoustic trickle vents for facades adjacent to the rail line, to reduce impact from daytime train L_{max} events. Standard thermal double glazing and standard trickle vents are indicated sufficient for remaining facades.

Garden spaces are indicated to meet the 55dB(A) criterion with a 2.1m high imperforate screen (7kg/m^2) running along the boundary with the rail line.

APPENDIX A - ACOUSTIC TERMINOLOGY

Human response to noise depends on a number of factors including loudness, frequency content and variations in level with time. Various frequency weightings and statistical indices have been developed in order to objectively quantify 'annoyance'.

The following units have been used in this report:

dB(A)	The sound pressure level A-weighted to correspond with the frequency response of the human ear and therefore a persons' subjective response to frequency content.
L_{eq}	The equivalent continuous sound level is a notional steady state level which over a quoted time period would have the same acoustic energy content as the actual fluctuating noise measured over that period.
D_{nT}	Standardised level difference corresponding to a reference value of the reverberation time in a receiver room.
$D_{nT,w}$	Single number 'weighted standardised level difference'.
C_{tr}	Correction factor used in level difference calculation to take into account low frequency sounds.
R_w	Weighted Sound Reduction Index. R_w is a single number (dB) referring to the ability of a wall or other building structure to provide sound insulation. The higher the number, the better the sound insulation. R_w refers to sound insulation achieved in an acoustic testing laboratory.
$L'_{nT,w}$	Single number 'weighted standardised impact sound pressure level'.
T_{60}	Reverberation time - the time taken for a steady state sound to drop by 60 dB. A reference reverberation time of T_0 = 0.5 second is used during sound insulation calculations representing average room reverberation time.

APPENDIX B - DIAGRAMS, GRAPHS AND TABLES

Figure B.1 – Approximate Weather History Graph (11/07/2019)

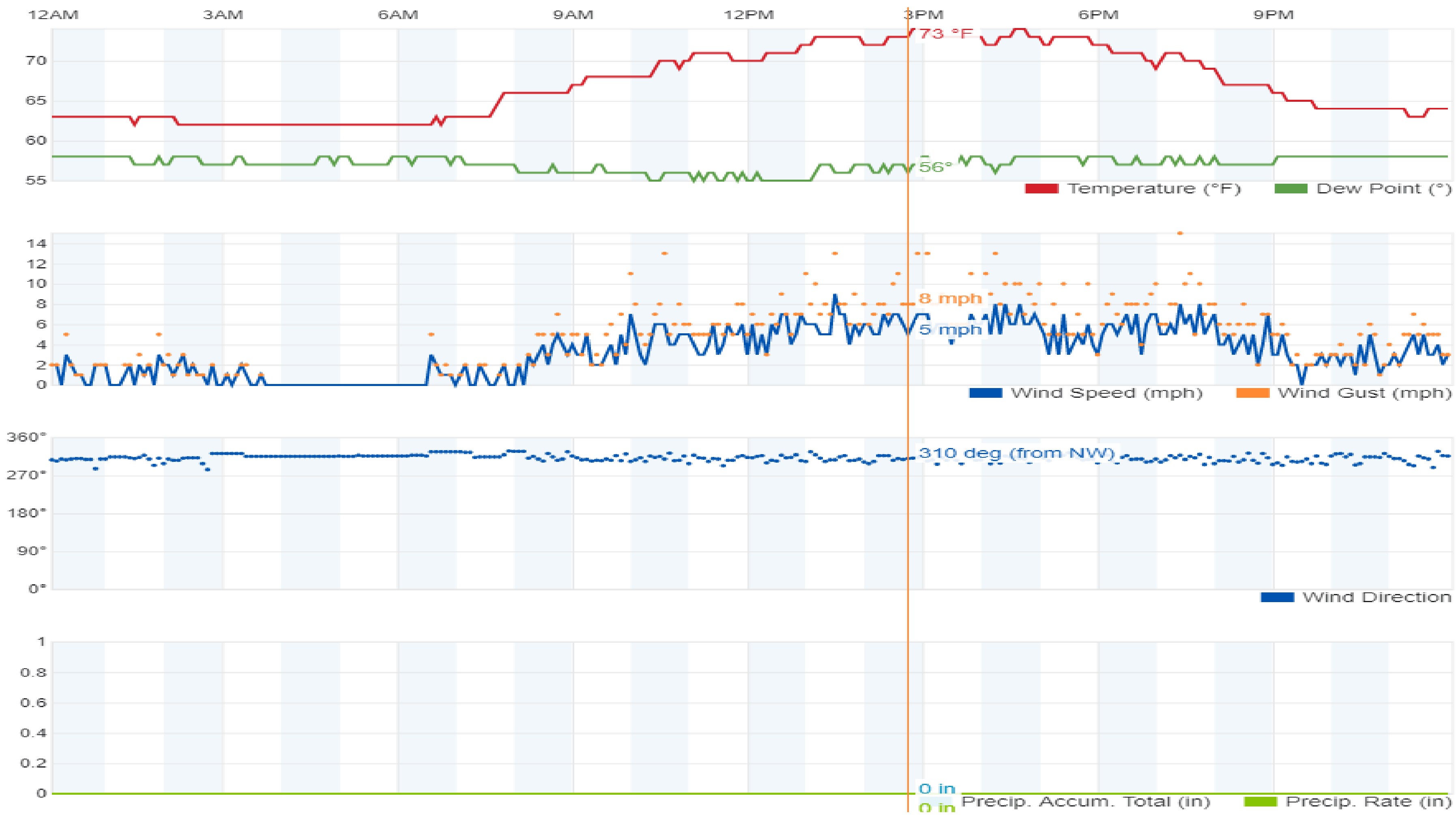

Figure B.2 – Approximate Weather History Graph (12/07/2019)

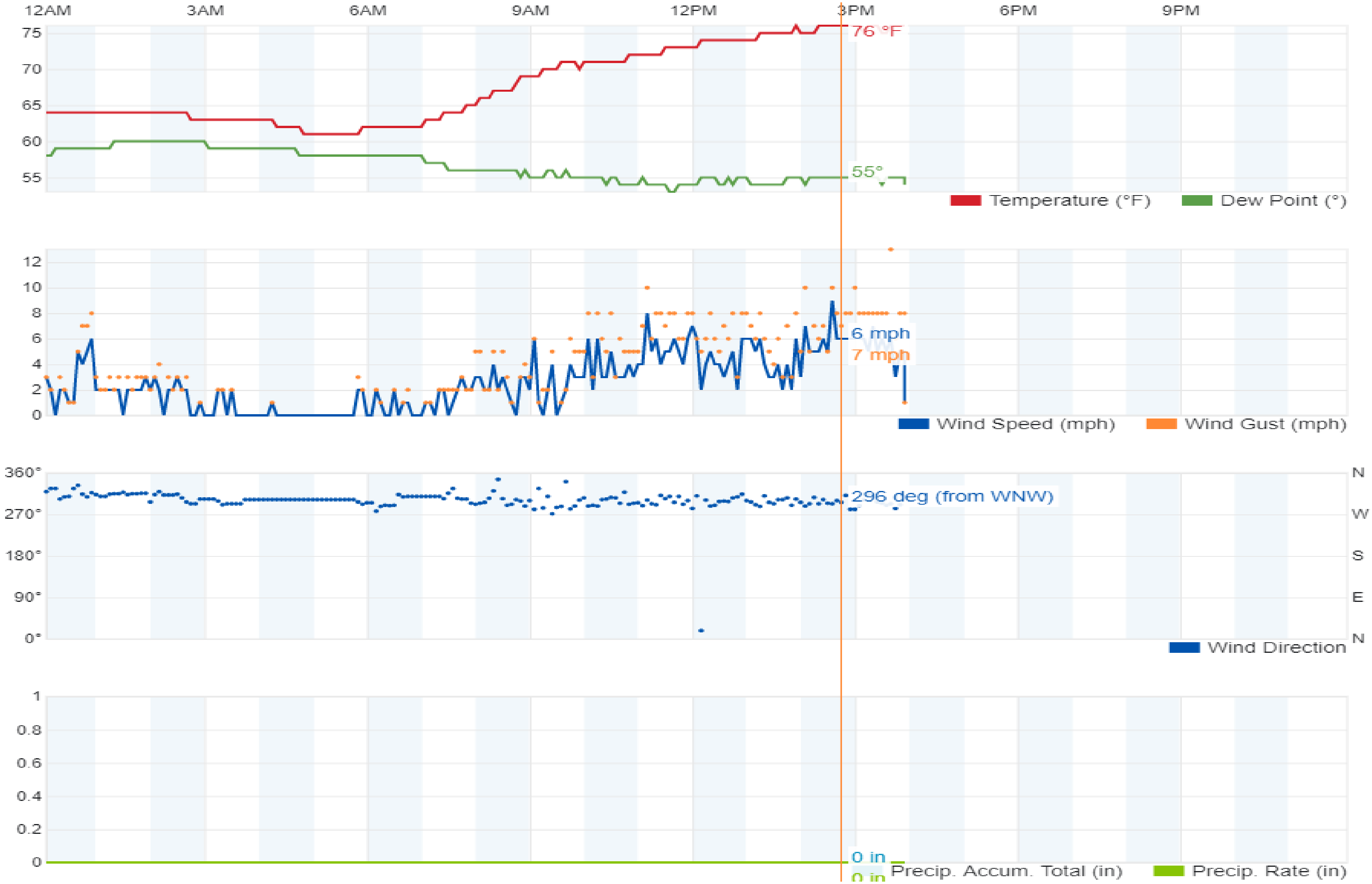

Figure B.3 – Time History at Position A (11-12/07/2019)

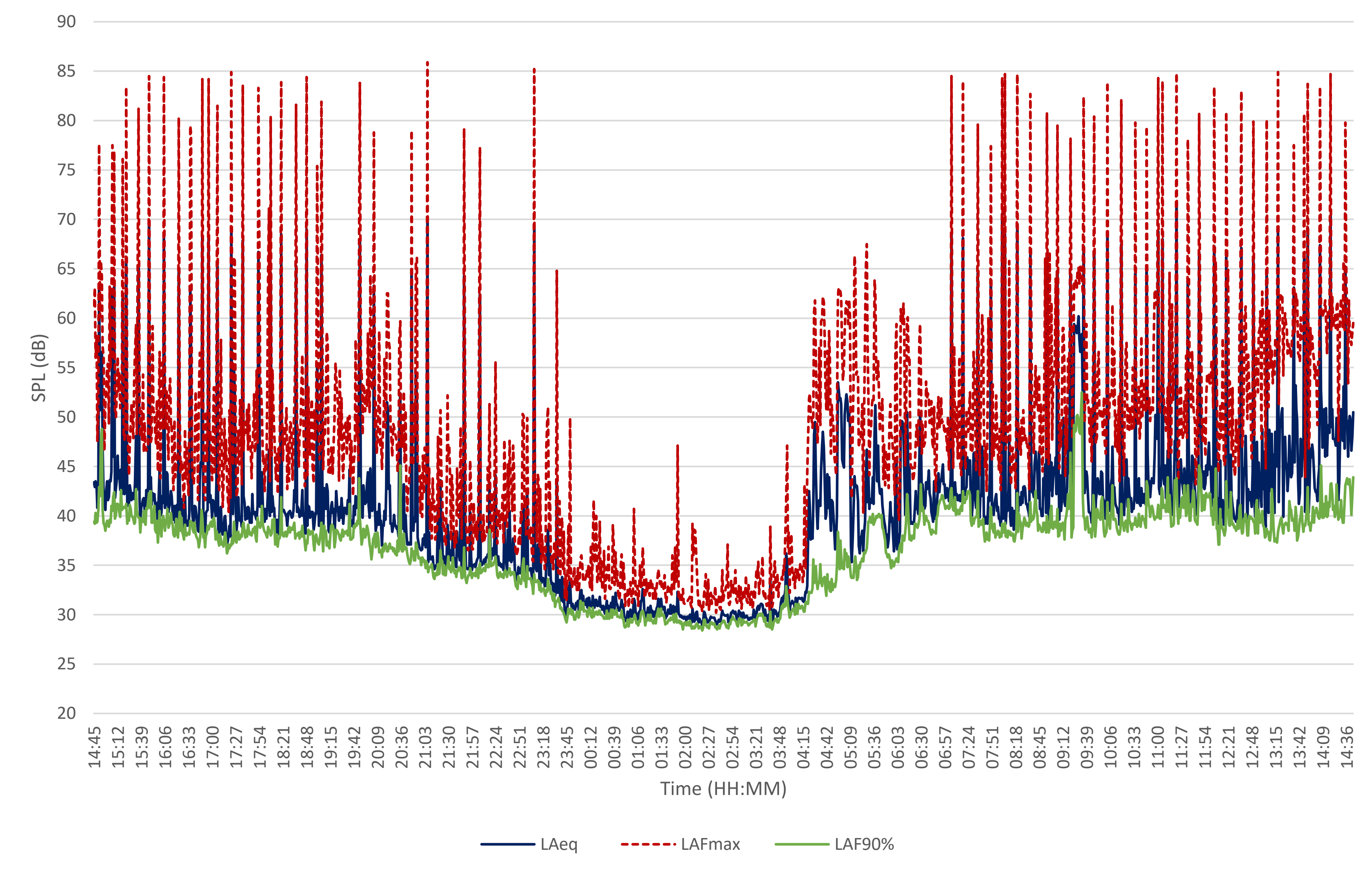

Figure B.4 – Train Pass-by Octave Band Spectra at Position A

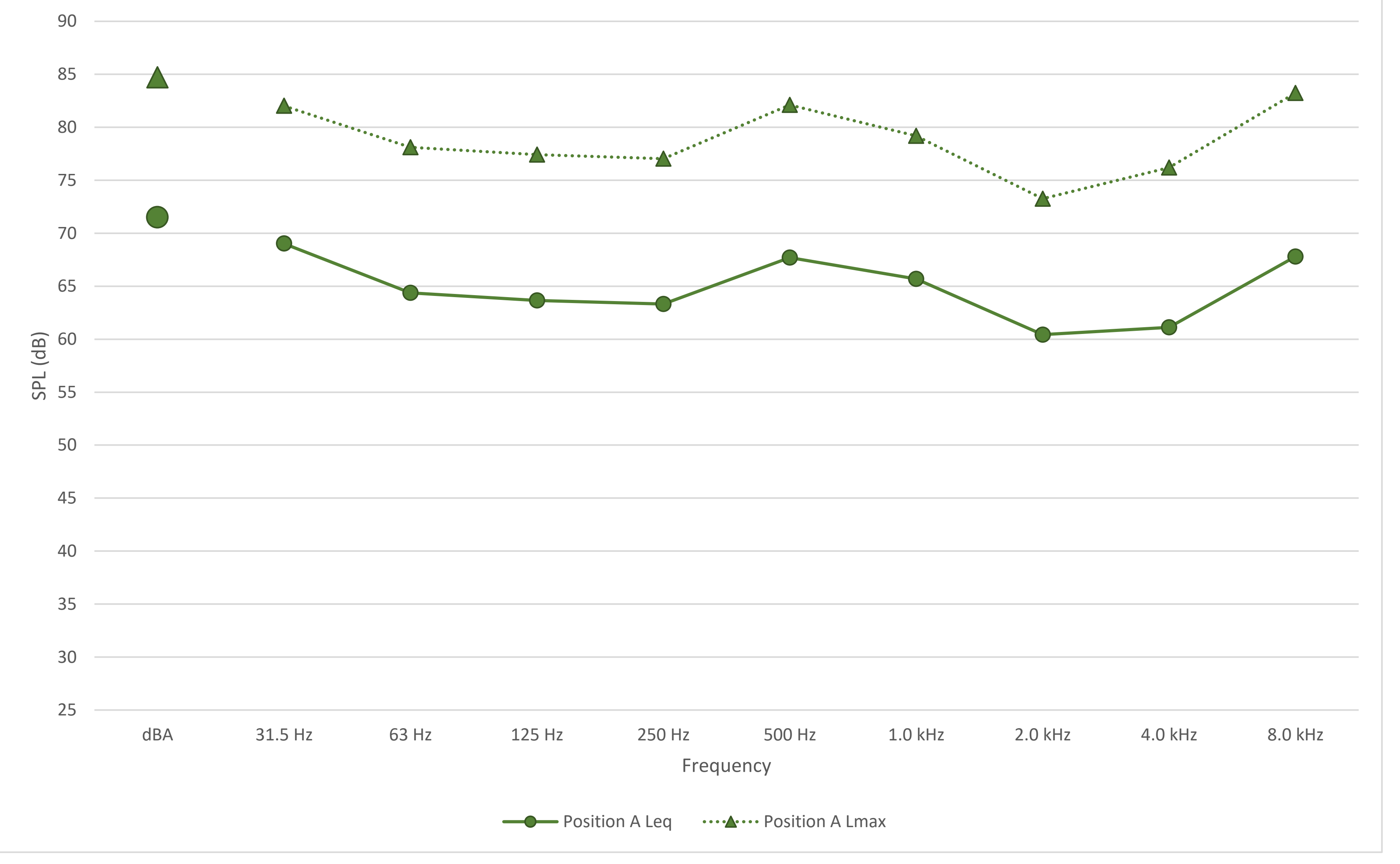

Figure B.5 - Train Pass-by Octave Band Spectra at Position 1

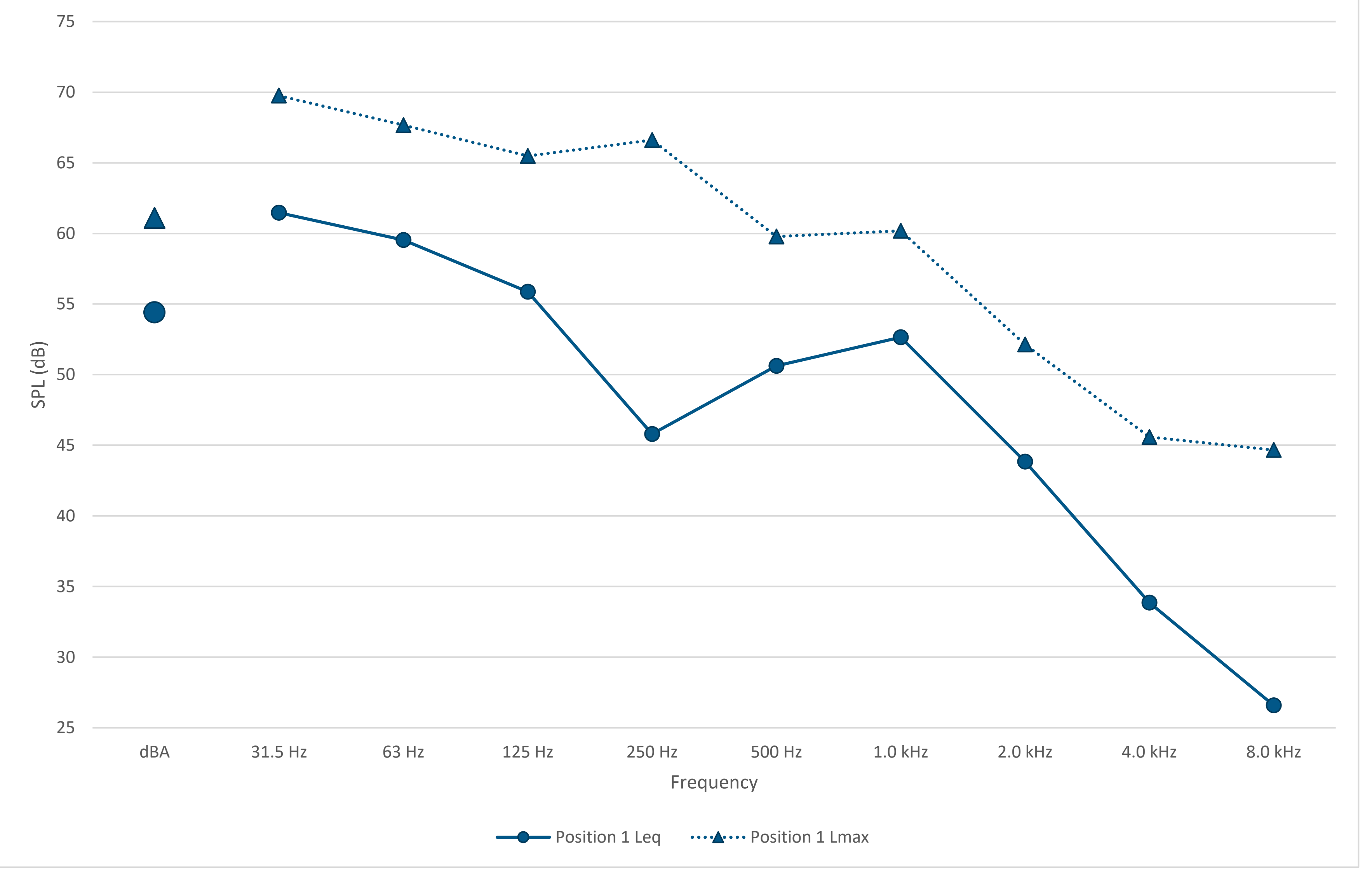

Figure B.6 - Train Pass-by Octave Band Spectra at Position 2

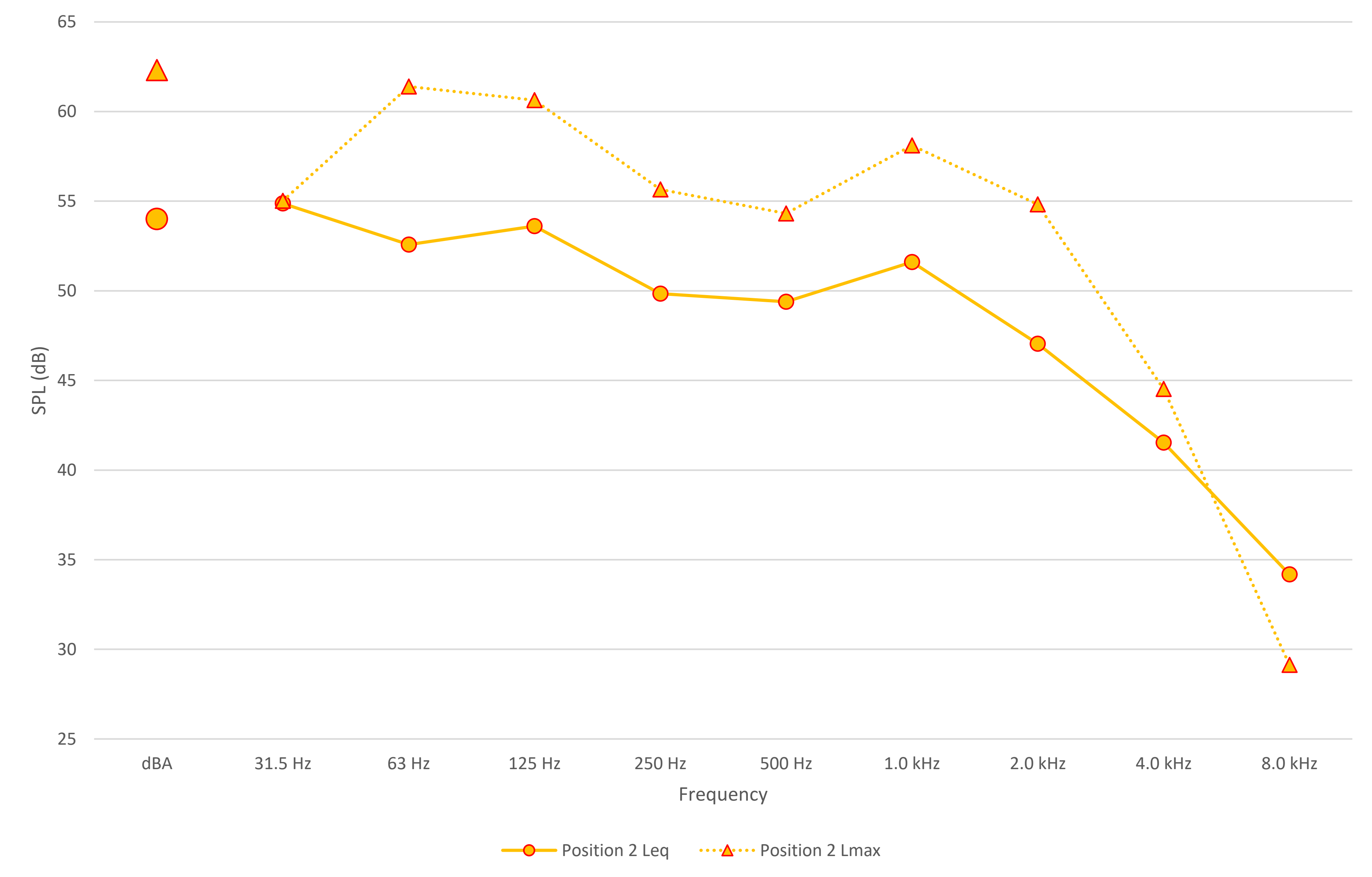

Table B.1 – Hourly Vibration Dose Values at Position A

Date	Start	Channel	Weighting	VDV, $ms^{-1.75}$	Date	Start	Channel	Weighting	VDV, $ms^{-1.75}$
11/07/2019	14:45	Radial	W_d	1.10E-01	11/07/2019	02:45	Radial	W_d	7.34E-03
11/07/2019	14:45	Tangential	W_d	4.61E-02	11/07/2019	02:45	Tangential	W_d	2.78E-03
11/07/2019	14:45	Vertical	W_b	4.14E-02	11/07/2019	02:45	Vertical	W_b	2.31E-03
11/07/2019	15:45	Radial	W_d	1.12E-01	30/03/2010	03:45	Radial	W_d	1.07E-02
11/07/2019	15:45	Tangential	W_d	5.10E-02	30/03/2010	03:45	Tangential	W_d	3.18E-03
11/07/2019	15:45	Vertical	W_b	4.06E-02	30/03/2010	03:45	Vertical	W_b	2.83E-03
11/07/2019	16:45	Radial	W_d	9.37E-02	30/03/2010	04:45	Radial	W_d	1.39E-02
11/07/2019	16:45	Tangential	W_d	4.25E-02	30/03/2010	04:45	Tangential	W_d	4.53E-03
11/07/2019	16:45	Vertical	W_b	4.26E-02	30/03/2010	04:45	Vertical	W_b	3.74E-03
11/07/2019	17:45	Radial	W_d	5.83E-02	30/03/2010	05:45	Radial	W_d	8.50E-03
11/07/2019	17:45	Tangential	W_d	2.50E-02	30/03/2010	05:45	Tangential	W_d	2.58E-03
11/07/2019	17:45	Vertical	W_b	3.21E-02	30/03/2010	05:45	Vertical	W_b	2.41E-03
11/07/2019	18:45	Radial	W_d	6.39E-02	30/03/2010	06:45	Radial	W_d	8.01E-03
11/07/2019	18:45	Tangential	W_d	3.15E-02	30/03/2010	06:45	Tangential	W_d	4.61E-03
11/07/2019	18:45	Vertical	W_b	3.00E-02	30/03/2010	06:45	Vertical	W_b	3.00E-02
11/07/2019	19:45	Radial	W_d	2.43E-02	30/03/2010	07:45	Radial	W_d	1.07E-02
11/07/2019	19:45	Tangential	W_d	1.20E-02	30/03/2010	07:45	Tangential	W_d	5.69E-03
11/07/2019	19:45	Vertical	W_b	2.68E-02	30/03/2010	07:45	Vertical	W_b	3.38E-02
11/07/2019	20:45	Radial	W_d	1.56E-02	30/03/2010	08:45	Radial	W_d	1.06E-02
11/07/2019	20:45	Tangential	W_d	6.92E-03	30/03/2010	08:45	Tangential	W_d	5.68E-03
11/07/2019	20:45	Vertical	W_b	3.28E-02	30/03/2010	08:45	Vertical	W_b	2.38E-02
11/07/2019	21:45	Radial	W_d	1.19E-02	30/03/2010	09:45	Radial	W_d	1.76E-02
11/07/2019	21:45	Tangential	W_d	5.07E-03	30/03/2010	09:45	Tangential	W_d	1.28E-02
11/07/2019	21:45	Vertical	W_b	2.37E-02	30/03/2010	09:45	Vertical	W_b	2.95E-02
11/07/2019	22:45	Radial	W_d	1.10E-02	30/03/2010	10:45	Radial	W_d	2.17E-02
11/07/2019	22:45	Tangential	W_d	4.84E-03	30/03/2010	10:45	Tangential	W_d	1.94E-02
11/07/2019	22:45	Vertical	W_b	2.00E-02	30/03/2010	10:45	Vertical	W_b	4.05E-02
11/07/2019	23:45	Radial	W_d	9.45E-03	30/03/2010	11:45	Radial	W_d	2.69E-02
11/07/2019	23:45	Tangential	W_d	4.16E-03	30/03/2010	11:45	Tangential	W_d	1.36E-02
11/07/2019	23:45	Vertical	W_b	3.27E-03	30/03/2010	11:45	Vertical	W_b	2.90E-02
11/07/2019	00:45	Radial	W_d	9.55E-03	30/03/2010	12:45	Radial	W_d	4.30E-02
11/07/2019	00:45	Tangential	W_d	5.06E-03	30/03/2010	12:45	Tangential	W_d	1.46E-02
11/07/2019	00:45	Vertical	W_b	3.36E-03	30/03/2010	12:45	Vertical	W_b	3.08E-02
11/07/2019	01:45	Radial	W_d	7.83E-03	30/03/2010	13:45	Radial	W_d	1.02E-01
11/07/2019	01:45	Tangential	W_d	3.35E-03	30/03/2010	13:45	Tangential	W_d	4.27E-02
11/07/2019	01:45	Vertical	W_b	2.48E-03	30/03/2010	13:45	Vertical	W_b	4.10E-02
Radial Totals					VDV_d (Day : 0700-2300hrs)			0.145	$ms^{-1.75}$
					VDV_d (Night : 2300-0700hrs)			0.021	$ms^{-1.75}$
Tangential Totals					VDV_d (Day : 0700-2300hrs)			0.065	$ms^{-1.75}$
					VDV_d (Night : 2300-0700hrs)			0.013	$ms^{-1.75}$
Vertical Totals					VDV_b (Day : 0700-2300hrs)			0.066	$ms^{-1.75}$
					VDV_b (Night : 2300-0700hrs)			0.042	$ms^{-1.75}$

APPENDIX C - DRAWING LISTS

C.1 Davies Llewelyn and Jones Drawings and Documents

The following drawing has been used in our assessment;

Table C.1

Drawing Title	Drawing Number	Rev	Date
Proposed Site Layout	(SK)001	N	09/2019