Land off Blackmoorfoot Road and Felks Stile Road Huddersfield

Acoustic Planning Report
0276/APR1
Revision 1

30 July 2020

For:

Empire Knight Group Limited

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Contents

		Page
1.0	Introduction	1
2.0	Objectives	1
3.0	Site Description	1
4.0	Local Authority Requirements	2
5.0	Environmental Sound Survey	3
6.0	Environmental Sound Assessment	8
7.0	Industrial Sound Survey	16
8.0	Industrial Sound Impact Assessment	19
9.0	Conclusions	24

Appendices

Time History Graphs 0276/THG1 to 0276/THG4

Lighthouse Acoustics is the trading name of Lighthouse Enterprises UK Limited
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1.0 Introduction

Lighthouse Acoustics has been appointed by Empire Knight Group Limited to undertake an environmental sound survey at Land to the north of Blackmoorfoot Road and to the east of Felks Stile Road, Huddersfield, HD4 7AD, and to undertake a detailed sound assessment for the proposed residential development.

The survey methodology, results and assessments are presented in this report.

2.0 Objectives

To establish the Local Authority's acoustic requirements for the proposed residential development.

To visit site to undertake a detailed environmental sound survey in order to establish existing environmental sound levels at the proposed development due to surrounding transportation sound sources.

To produce a detailed sound map of the proposed site layout based on information received from the developer/architect and the results of the environmental sound survey and to undertake a detailed sound assessment to establish the acoustic specification for glazing/ventilation elements required across the proposed development in order to achieve the acoustic requirements of the Local Authority.

If deemed to be necessary, to undertake a survey of existing industrial/commercial sound from the adjacent industrial/commercial along with an industrial/commercial sound assessment to ascertain whether any acoustic measures are required across the proposed development in order to achieve the acoustic requirements of the Local Authority.

3.0 Site Description

The proposed development is situated at Land to the north of Blackmoorfoot Road and to the east of Felks Stile Road, Huddersfield, HD4 7AD. The site currently comprises industrial/storage and distribution compound for a fireworks operator and agricultural fields.

The site is bound by existing residential properties and a caravan storage facility to the north east, Blackmoorfoot Road to the south east, Felks Stile Road to the south west and open grassland to the north west.

A quarry is situated to the south east of the site opposite Blackmoorfoot Road whilst a golf club is situated to the south west of the site opposite Felks Stile Road.

Manchester Road, (A62) is situated approximately 750m to the north west of the site.

The site plan below indicates the extent of the site and the surrounding environment.

Site plan indicating the extent of the site and the surrounding environment

4.0 Local Authority Requirements

The Senior Technical Officer at Kirklees Council has been contacted to discuss their acoustic requirements for the proposed development.

They have confirmed that environmental sound should achieve the levels for internal and external areas as specified in BS 8233: 2014, "Guidance on sound insulation and noise reduction for buildings". These levels are presented in the table below.

Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Living Room	35dB $L_{Aeq,16hour}$	-
Dining Room	40dB $L_{Aeq,16hour}$	
Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$
External amenity space (gardens, patios, balconies)	55dB $L_{Aeq,16hour}$	-

In addition, BS 8233: 2014 states the following:

> *"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."*

Based on the above it is proposed that individual noise events should not normally exceed $L_{Amax,F}$ 45dB by more than 15 times in bedrooms during the night-time period (23:00 to 07:00 hours) as per the World Health Organisation document on "Guidelines for Community Noise".

With regard to potential commercial sound from the adjacent caravan storage facility to the north east of the site and quarry situated to the south east of the site opposite Blackmoorfoot Road, they have requested that an assessment be carried out in accordance with BS 4142:2014 "Methods for rating and assessing industrial and commercial sound" if deemed to be necessary.

5.0 Environmental Sound Survey

5.1 Measurements

The site was attended between 13:00 to 15:00 hours on Monday 11 December 2017 and between 13:00 to 15:00 hours on Tuesday 11 December 2017. During these periods, the location of the various sound sources was established.

In order to obtain comprehensive measurements of transportation sound, automated environmental sound measurements were undertaken from 14:00 hours on Monday 11 December 2017 to 14:00 hours on Tuesday 11 December 2017. During this period the L_{Amax}, L_{Aeq} and L_{A90} sound pressure levels were measured continuously over 15 minute periods along with the corresponding octave band sound pressure levels.

5.2 Weather Conditions

At the start of the survey period the wind conditions were calm (<1m/s) and the sky was clear. There was no rainfall and road surfaces were dry. The temperature was approximately 3°C.

At the end of the survey period the wind conditions were calm (<1m/s) and the sky was overcast. There were brief periods of light rainfall and road surfaces were damp. The temperature was approximately 2°C.

Based on site observations and publicly available weather data for the survey period it is understood that weather conditions remained similar for the duration of the survey with no significant periods of rainfall or strong breezes. The weather conditions during the survey period are therefore considered to be suitable for undertaking measurements of sound levels.

5.3 Measurement Positions

Environmental sound levels were measured at four positions on-site as described in the table below.

Position	Description
A	Microphone situated along the south eastern site boundary overlooking Blackmoorfoot Road at 1.5m above ground level in free field conditions.
B	Microphone situated along the southern western site boundary overlooking Felks Stile Road at 1.5m above ground level in free field conditions.
C	Microphone situated along the north western site boundary at 1.5m above ground level in free field conditions.
D	Microphone situated towards the north eastern site boundary at 1.5m above ground level in free field conditions.

The measurement positions are shown on the site plan below.

Site plan showing measurement positions

The measurement positions were selected in order to assess typical environmental sound levels at the site.

5.4 Equipment

The following equipment was used to undertake the environmental sound survey.

Equipment	Manufacturer	Model	Serial No.	Calibration Date
Class 1 Sound Level Meter	Casella	633C	0721320	11/09/2017
Preamplifier	Casella	495	001414	11/09/2017
Microphone	Casella	251	1025	11/09/2017
Class 1 Sound Level Meter	Casella	633C	0721319	08/09/2017
Preamplifier	Casella	495	001446	08/09/2017
Microphone	Casella	251	1996	08/09/2017
Class 1 Sound Level Meter	Casella	633C	5262813	23/03/2017
Preamplifier	Casella	495	003391	23/03/2017
Microphone	Casella	251	1031	23/03/2017
Class 1 Sound Level Meter	Casella	633C	2811231	10/05/2017
Preamplifier	Casella	495	001239	10/05/2017
Microphone	Casella	251	1841	10/05/2017
Class 1 Sound Calibrator	Casella	120/1	3864878	13/11/2017
Environmental Noise Kits	Casella	6847	-	-
Microphone Extension Cables	Casella	C6717/5	-	-
Weather Protection Systems	Casella	6737	-	-

Field calibration checks were performed on the sound level meters prior to and on completion of the survey and were found to be within acceptable tolerance limits.

5.5 Results

5.5.1 Time History Graphs

The results of the environmental sound survey are presented on Time History Graphs 0276/THG1 to 0276/THG4 enclosed at the rear of the report.

5.5.2 $L_{Aeq,T}$ Ambient Sound Levels

In order to compare the results of the environmental sound survey with the internal noise limits it is necessary to convert the $L_{Aeq,15min}$ sound levels into singe figure daytime $L_{Aeq,16hour}$ and night-time $L_{Aeq,8hour}$ sound levels. This has been calculated using the following formula:

$$L_{Aeq,T} = 10\,log_{10}\left(\frac{1}{N}\sum_{i}^{N} 10^{L_{Aeq,15min}{}^{i}/10}\right)$$

The calculated daytime $L_{Aeq,16hour}$ and night-time $L_{Aeq,8hour}$ sound levels at each measurement position are presented in the table below.

Position	Daytime $L_{Aeq,16hour}$ (dB)	Night-time $L_{Aeq,8hour}$ (dB)
A	67	57
B	53	42
C	46	37
D	44	35

The corresponding daytime $L_{Aeq,16hour}$ and night-time $L_{Aeq,8hour}$ octave band sound pressure levels at each measurement position are presented in the table below.

Position	Period	L_{eq} Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
A	Daytime (16 hour)	66	60	58	60	64	61	51	41	67
	Night-time (8 hour)	55	49	48	49	55	51	42	31	57
B	Daytime (16 hour)	61	54	49	49	50	46	38	29	53
	Night-time (8 hour)	50	42	38	39	38	35	26	18	42
C	Daytime (16 hour)	54	51	47	44	42	34	29	23	46
	Night-time (8 hour)	47	40	37	37	33	21	17	16	37
D	Daytime (16 hour)	52	49	46	42	38	29	25	31	44
	Night-time (8 hour)	45	40	38	35	30	19	14	16	35

5.5.3 $L_{Amax,F}$ Sound Level Events

The highest 15No. individual $L_{Amax,F}$ sound level events measured during the night-time period (23:00 to 07:00 hours) over the survey period at each position are presented in the table below along with the corresponding octave band sound pressure levels.

Position	$L_{max,F}$ Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
A	79	81	76	81	86	80	70	57	88
	93	84	84	76	81	77	73	65	84
	76	73	71	73	82	78	69	56	84
	81	82	75	75	82	77	66	55	84
	81	73	77	75	80	77	67	53	82
	79	72	70	74	79	76	65	56	81
	80	78	81	78	78	77	68	59	81
	83	73	73	76	79	75	66	54	81
	76	71	70	73	79	74	65	56	81
	83	75	71	74	78	75	64	56	81
	82	74	68	71	78	74	64	50	80
	75	73	72	73	79	73	64	56	80
	78	76	74	72	78	74	64	56	80
	71	73	70	73	78	74	61	49	80
	75	75	71	73	77	74	64	54	79

Position	$L_{max,F}$ Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
B	77	70	57	61	69	66	58	45	71
	75	69	63	66	61	65	58	50	68
	77	66	64	70	65	57	49	43	68
	68	60	55	58	66	62	54	46	68
	73	58	52	58	63	60	49	38	66
	80	66	65	59	63	59	49	41	65
	65	57	57	58	63	60	51	40	65
	63	72	57	61	62	59	49	44	65
	66	58	53	60	62	59	49	40	65
	71	66	54	58	62	58	49	41	65
	72	63	62	61	62	59	51	40	64
	76	61	55	58	62	59	49	39	64
	74	65	57	59	62	58	49	42	64
	70	58	59	58	61	59	51	39	64
	63	56	49	56	61	58	50	37	64

Position	$L_{max,F}$ Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
C	58	57	54	50	57	55	62	41	64
	59	61	69	57	45	35	22	19	61
	62	59	56	53	59	46	43	39	59
	55	51	51	52	55	50	31	34	57
	57	58	59	58	41	29	21	21	56
	58	53	50	47	43	50	38	39	52
	54	51	57	53	42	32	21	19	51
	58	54	51	52	50	37	36	38	51
	60	60	57	50	49	35	36	38	50
	61	57	53	48	48	41	40	39	50
	67	64	51	47	42	33	30	33	48
	66	57	48	45	41	40	41	40	47
	55	50	56	43	36	28	20	19	47
	62	54	46	45	45	33	21	21	47
	60	54	50	48	39	37	40	39	47

Position	$L_{max,F}$ Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
D	57	69	69	57	40	34	38	37	61
	59	51	60	52	35	33	34	37	54
	54	54	60	54	39	28	17	17	54
	57	57	56	53	41	24	28	21	52
	72	66	52	53	47	29	18	23	52
	66	60	53	45	40	36	36	39	49
	67	60	53	47	45	36	37	40	49
	60	53	55	46	42	36	35	38	47
	52	49	46	49	45	28	26	29	47
	59	50	47	41	44	39	36	39	47
	66	54	51	45	41	35	36	38	47
	62	55	50	41	37	35	36	39	46
	55	55	49	49	39	34	35	38	46
	60	51	49	45	41	35	37	40	46
	61	51	46	43	38	36	37	40	45

5.6 $L_{A90,T}$ Background Sound Levels

The lowest representative daytime and night-time $L_{A90,15min}$ background sound levels measured at each position during the survey period are detailed in the table below.

Position	Lowest Representative $L_{A90,15min}$ Background Sound Levels (dB)	
	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
A	46	33
B	43	32
C	42	31
D	40	30

5.7 Discussion of Sound Climate

At the start and end of the survey period the dominant sound source at Position A was noted to be frequent road traffic along Blackmoorfoot Road to the south east of the site. During lulls of passing road traffic, road traffic from the surrounding road network contributed towards the measured sound climate.

At the start and end of the survey period the dominant sound source at Position B was noted to be frequent road traffic along Felks Stile Road to the south west of the site. During lulls of passing road traffic, road traffic from the surrounding road network contributed towards the measured sound climate.

At the start and end of the survey period the dominant sound source at Position C was noted to be distant road traffic from the surrounding road network and nearby Manchester Road, (A62) to the north west of the site.

At the start and end of the survey period the dominant sound source at Position D was noted to be distant road traffic from the surrounding road network and nearby Manchester Road, (A62) to the north west of the site.

Whilst we are unable to comment on dominant sound sources or individual sound events during the entire survey period, based on the surrounding environment it is likely that road traffic along the surrounding road network remained the dominant sound sources.

6.0 Environmental Sound Assessment

6.1 Assessment Method

In order to assess environmental sound levels across the proposed residential development a three dimensional model of the site has been constructed using SoundPLAN sound mapping software.

The software uses the measured sound data to predict how environmental sound from the surrounding transportation sound sources radiates across the site returning a colour contour map showing the variations in sound levels.

The calculation method used by the software takes into account acoustic corrections such as distance propagation, ground absorption, reflections and screening.

In order to establish the acoustic specification for glazing/ventilation elements required to achieve the internal daytime $L_{Aeq,16hour}$, night-time $L_{Aeq,8hour}$ and night-time $L_{Amax,F}$ requirements an assessment has been undertaken in accordance with the more rigorous calculation method detailed in BS 8233:2014, "Guidance on sound insulation and noise reduction for buildings".

This calculation method takes into account the external sound pressure level, the sound reduction indicies of the façade elements, the area of the facade and the absorption within the room at octave band centre frequencies.

6.2 Proposed Site Layout

The assessment has been based on the following site layout drawing.

Author	Drawing No.	Revision	Date
Planit I.E. Limited	PL1713-PLA-XX-XX-DR-U-0010	P02	17.07.20

The proposals include the construction of up to 770 residential dwellings (Use Class C3), including up to 70 care apartments (Use Class C2/C3) with doctors surgery of up to 350m^2 (Use Class D1), up to 500m^2 of Use Class A1/A2/A3/A4/A5/D1 floorspace (dual use), vehicular and pedestrian access points off Blackmoorfoot Road and Felks Stile Road and associated works.

6.3 Acoustic Requirements

The proposed residential dwellings will typically comprise living room, kitchen/dining room and bedroom spaces. Residential dwellings will feature rear gardens.

Based on the requirements of the Local Authority detailed in Section 4.0, the following internal and external sound limits have been assessed to.

Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Living Room	35dB $L_{Aeq,16hour}$	-
Kitchen/Dining Room	40dB $L_{Aeq,16hour}$	
Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$ 45dB $L_{Amax,F*}$
Rear Gardens	55dB $L_{Aeq,16hour}$	-

* should not normally be exceeded more than 15 times per night.

6.4 Construction Proposals

It is understood that the external walls and roof of the buildings will comprise the following typical constructions.

Element	Typical Construction
External Walls	Brickwork with cavity, insulation and internal plasterboard lining
Roof	Tiled with insulation in loft and plasterboard ceiling

The following typical Sound Reduction Indicies have been assumed for the various elements.

Element	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
External Walls	32	40	44	45	51	56	56	56
Roof	20	28	34	40	45	49	49	49

6.5 Room Assumptions

The following typical dimensions and finishes/furnishings have been assumed for the purpose of the assessment.

Room Type	Typical Room Dimensions	Typical Window Dimensions	Typical Room Finishes / Furnishings
Living Room	4m x 5m x 2.4m	$5m^2$	Carpet, curtains, sofa
Kitchen/Dining Room	4m x 5m x 2.4m	$5m^2$	Hard Floor, curtains, table, chairs
Bedroom	3m x 4m x 2.4m	$1m^2$	Carpet, curtains, bed

6.6 Ventilation Provision

6.6.1 Background Ventilation

In order to achieve the internal daytime and night-time requirements openable windows must remain closed. Background ventilation shall therefore be provided by ventilators in the building façade and shall provide the following minimum element normalised level differences in the open position when tested in accordance with BS EN ISO 10140-2: 2010.

Facade Zone	Element Normalised Level Difference, $D_{n,e}$ (dB) in Open Position at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
1	27	33	39	39	43	50	50	50
2	27	33	39	39	43	50	50	50
3	31	34	39	34	41	31	33	35

Should more than one ventilator be required per room the above element normalised level differences shall be increased by the following values:

Number of Ventilators Required Per Room	Additional Performance Required Per Ventilator (dB)
1	0
2	+3
3	+5
4	+6

The table below presents typical configurations and $D_{n,e,w}$ sound insulation values which may be expected to achieve the sound insulation performance specified above.

Facade Zone	Typical Open $D_{n,e,w}$ Sound Insulation Value (dB)	Typical Configuration
1	40	Acoustic Window Ventilators (e.g. Greenwood EAR42W)
2	40	Acoustic Window Ventilators (e.g. Greenwood EAR42W)
3	35	Standard Window Ventilators

Acoustic test data for the proposed ventilators should be forwarded for review.

Facade Zones 1, 2 and 3 are indicated on the following sound maps for daytime and night-time periods at Ground floor (2.5m) and 1st floor (5.0m) heights.

6.6.2 Purge Ventilation

Purge ventilation will be provided via openable windows at the occupants discretion. As such, the internal daytime and night-time requirements may potentially be exceeded during purge ventilation conditions.

6.7 Glazing Specifications

In order to achieve the internal daytime and night-time requirements the glazing/external door system as a whole including glass, frame, seals and openings shall provide the following minimum sound insulation performance when tested in accordance with BS EN ISO 10140-2: 2010.

Facade Zone	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
1	21	25	22	33	40	43	44	48
2	20	24	20	25	34	37	35	39
3	20	24	20	25	34	37	35	39

The table below presents typical configurations and R_w sound insulation values which may be expected to achieve the sound insulation performance specified above.

Facade Zone	Typical R_w Sound Insulation Value (dB)	Typical Configuration
1	35	10mm/16mm/4mm
2	30	4mm/16mm/4mm
3	30	4mm/16mm/4mm

Acoustic test data for the proposed glazing systems should be forwarded for review.

Facade Zones 1, 2 and 3 are indicated on the following sound maps for daytime and night-time periods at Ground floor (2.5m) and 1st floor (5.0m) heights.

6.8 Internal Daytime Requirements

The sound map below indicates the external daytime $L_{Aeq,16hour}$ environmental sound levels across the proposed site at Ground floor level (2.5m).

Sound map indicating the external daytime $L_{Aeq,16hour}$ environmental sound levels at Ground floor level (2.5m)

As can be seen, the vast majority of the site should fall within Zone 3 at Ground floor level. Plots towards the south eastern site boundary are likely to fall within Zones 1 and 2 whilst plots towards the south western site boundary are likely to fall within Zone 2.

The sound map below indicates the external daytime $L_{Aeq,16hour}$ environmental sound levels across the proposed site at 1st floor level (5.0m).

Sound map indicating the external daytime $L_{Aeq,16hour}$ environmental sound levels at 1st floor level (5.0m)

As can be seen, the vast majority of the site should fall within Zone 3 at 1st floor level. Plots towards the south eastern site boundary are likely to fall within Zones 1 and 2 whilst plots towards the south western site boundary are likely to fall within Zone 2.

6.9 Internal Night-time Requirements

The sound map below indicates the external night-time $L_{Aeq,8hour}$ environmental sound levels across the proposed site at Ground floor level (2.5m).

Sound map indicating the external night-time $L_{Aeq,8hour}$ environmental sound levels at Ground floor level (2.5m)

As can be seen, the vast majority of the site should fall within Zone 3 at Ground floor level. Only plots towards the south eastern site boundary are likely to fall within Zone 2.

The sound map below indicates the external night-time $L_{Aeq,8hour}$ environmental sound levels across the proposed site at 1st floor level (5.0m).

Sound map indicating the external night-time $L_{Aeq,8hour}$ environmental sound levels at 1st floor level (5.0m)

As can be seen, the vast majority of the site should fall within Zone 3 at 1st floor level. Only plots towards the south eastern site boundary are likely to fall within Zone 2.

6.10 External Daytime Requirements

The sound map below indicates the external daytime $L_{Aeq,16hour}$ environmental sound levels across the proposed site at head height (1.8m).

Sound map indicating the external daytime $L_{Aeq,16hour}$ environmental sound levels at head height (1.8m)

As can be seen, external daytime $L_{Aeq,16hour}$ environmental sound levels across the entire site are likely to achieve the external daytime requirement of $L_{Aeq,16hour}$ <55dB in rear gardens.

7.0 Industrial Sound Survey

7.1 Introduction

No significant sources of industrial sound were audible within the site from either the caravan storage facility to the north east of the site or the quarry situated to the south east of the site opposite Blackmoorfoot Road during the time on-site during the daytime period (13:00 to 15:00 hours on Monday 11 December 2017 and 13:00 to 15:00 hours on Tuesday 11 December 2017). As such, it is a good indication that an industrial sound impact assessment is unlikely to be required for the daytime period.

It is understood that the saw shed of the quarry, situated adjacent to Blackmoorfoot Road, operates continuously 24 hours a day. As such, a return site visit was made during the evening period once residual noise levels had reduced in order to measure industrial sound levels from the saw shed.

7.2 Measurements

Manned industrial sound measurements were undertaken between 21:00 and 22:00 hours on Monday 11 December 2017. During this period the L_{Amax}, L_{Aeq} and L_{A90} sound levels of industrial sound from the saw shed were measured over 5 minute periods along with the corresponding one third octave band sound pressure levels. Measurements were paused for any passing vehicles along Blackmoorfoot Road.

7.3 Weather Conditions

During the survey period the wind conditions were calm (<1m/s) and the sky was clear. There was no rainfall and road surfaces were dry. The temperature was approximately 0°C.

The weather conditions during the survey period are therefore considered to be suitable for undertaking measurements of sound levels.

7.4 Measurement Positions

Environmental sound levels were measured at three positions on-site as described in the table below.

Position	Description
i	Microphone situated along Blackmoorfoot Road opposite the saw shed of the quarry at 1.5m above ground level at 1m from a wall.
ii	Microphone situated along Blackmoorfoot Road at the existing site entrance at 1.5m above ground level in free field conditions.
iii	Microphone situated along Blackmoorfoot Road to the south west of Sands House Lane at 1.5m above ground level in free field conditions.

The measurement positions are shown on the site plan below.

Site plan showing measurement positions

Measurement Position i was selected in order to assess typical industrial sound levels from the saw shed of the quarry. Measurement Positions ii and iii were selected in order to assess typical industrial sound levels at the site boundary.

7.5 Equipment

The following equipment was used to undertake the industrial sound survey.

Equipment	Manufacturer	Model	Serial No.	Calibration Date
Class 1 Sound Level Meter	Bruel & Kjaer	2250	2626230	17/10/2016
Preamplifier	Bruel & Kjaer	ZC-0032	21309	17/10/2016
Microphone	Bruel & Kjaer	4189	2621208	17/10/2016
Class 1 Sound Calibrator	Casella	120/1	3864878	13/11/2017
Windscreen	Bruel & Kjaer	UA-1650	-	-

Field calibration checks were performed on the sound level meter prior to and on completion of the survey and were found to be within acceptable tolerance limits.

7.6 Results

The results of the industrial sound survey measurements are presented in the table below.

Position	Measured Sound Pressure Level (dB)		
	L_{Amax}	L_{Aeq}	L_{A90}
i	67	53	50
ii	46	43	41
iii	49	42	38

The presented results for Position i have been corrected for reflections from the wall by subtracting 3dB from the measured sound levels in order to obtain free field sound levels.

The corresponding one third octave band L_{eq} sound pressure levels at Position i are presented in the table below.

Measured L_{eq} Sound Pressure Level (dB) at 1m at One-Third Octave Band Centre Frequency (Hz)								dBA
50	**63**	**80**	**100**	**125**	**160**	**200**	**250**	
48	44	47	42	43	45	41	40	
315	**400**	**500**	**630**	**800**	**1k**	**1.25k**	**1.6k**	
44	45	48	46	46	43	41	42	53
2k	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**	
39	38	39	36	33	31	26	22	

The presented results for Position i have been corrected for reflections from the wall by subtracting 3dB from the measured sound levels in order to obtain free field sound levels.

7.7 Discussion of Sound Climate

The dominant source of sound associated with the operation of the saw shed comprised continuous machinery cutting noise from within the building.

At Position i this was clearly audible above the residual noise level. At Position ii this was barely audible above the residual noise level. At Position iii this was inaudible above the residual noise level.

8.0 Industrial Sound Impact Assessment

8.1 BS 4142:2014

BS 4142: 2014 "Methods for rating and assessing industrial and commercial sound", describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems.

It should be noted that the determination of noise amounting to a nuisance is beyond the scope of BS 4142.

The likely impact is indicated by subtracting the existing background sound level from the rating level of the industrial and/or commercial sound. The standard states that:

> *"a) Typically, the greater this difference, the greater the magnitude of the impact.*
> *b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
> *c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.*
> *d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*
>
> *Note 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

The industrial and/or commercial sound is expressed as the specific sound level and given as a $L_{Aeq,Tr}$ sound level. Should the specific sound level exhibit any acoustic features (i.e. tonality, irregularity or impulsiveness) a character correction is applied. The rating level is the specific sound level with character correction applied (if applicable) and is given as a $L_{Ar,Tr}$ sound level.

The existing background sound level is given as a L_{A90}, T sound level.

The reference time interval, T_r, is 1 hour during the daytime period (07:00 to 23:00 hours) and 15 minutes during the night-time period (23:00 to 07:00 hours).

8.2 Assessment Method

The assessment will be undertaken in accordance with the method described in BS 4142: 2014 - See Section 8.1.

8.3 Industrial Sound Data

Industrial sound levels have been assessed based on the results of the industrial sound survey measurements detailed in Section 7.6.

BS 4142: 2014 provides an objective method for assessing the audibility of tones in sound. The one-third octave method states that if the level of a one third octave band exceeds the level of both adjacent one third octave bands by the following amounts, then a tonal component may be identified as present:

- 15dB in the low-frequency one-third-octave bands (25Hz to 125Hz);
- 8dB in the mid-frequency one-third-octave bands (160Hz to 400Hz);
- 5dB in the high-frequency one-third-octave bands (500Hz to 10kHz).

A review of the one-third octave band sound data for the industrial sound indicates that it is unlikely to exhibit a tonal component. As such, no character correction has been applied to the specific sound level for the industrial sound.

8.4 Operating Hours

It is understood that the saw shed of the quarry, situated adjacent to Blackmoorfoot Road, operates continuously 24 hours a day.

8.5 Background Sound Levels

The lowest representative night-time $L_{A90,15min}$ background sound levels measured at each position during the survey period are detailed in Section 5.6. A worst case assessment has used the lowest representative night-time $L_{A90,15min}$ background sound level measured from all 4No. positions to represent that at the nearest proposed residential property.

This is $L_{A90,15min}$ 30dB as measured at Position D. This will be used to assess the industrial sound against.

8.6 Assessment

The table below presents the assessment of existing industrial sound to the nearest proposed residential properties.

Descriptor	Night-time (23:00 to 07:00)
Calculated Industrial Sound Rating Level $L_{Ar,Tr}$ (dB)	35
Lowest Representative Night-time $L_{A90,15min}$ Background Sound Level (dB)	30
Difference (dB)	+5

As can be seen, the assessment indicates that the rating level of existing industrial sound is likely to achieve a difference of up to +5dB when compared to the lowest representative night-time background sound level at the nearest proposed residential properties (limited to a small number of properties situated to the north east of the site along the boundary with the caravan storage facility).

This is therefore an indication of the existing industrial sound having up to a potentially adverse impact at the nearest proposed residential properties during the night-time period.

8.7 Context

BS 4142: 2014 states the following with regard to the context of the industrial/commercial sound:

> *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."*

BS 4142: 2014 states the following with regard to the circumstances of the proposed development:

> *"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."*

In addition, BS 4142: 2014 states the following:

> *"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.*
>
> *3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
> *i) facade insulation treatment;*
> *ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
> *iii) acoustic screening."*
>
> *"The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels."*

In order to place the industrial sound in context the following points have therefore been considered:

- Existing adjacent residential properties are already subject to the existing industrial sound and situated closer than the nearest proposed residential properties;
- The rating level of existing industrial sound is likely to achieve a difference of up to +5dB when compared to the lowest representative night-time background sound level at only a small number of the nearest proposed residential properties;
- The rating level of existing industrial sound is likely to achieve less than the lowest representative night-time background sound level at the vast majority of the proposed residential properties thereby indicating a low impact;
- Future residents of the nearest proposed residential properties will not notice any 'change' due to the existing industrial sound since it already forms a component of the acoustic environment;
- BS 4142:2014 only uses outdoor sound levels to assess the likely effects of sound.

Based on the above, it is considered that the existing industrial sound is likely to have a low impact at the nearest proposed residential properties during the night-time period. This conclusion is reached by professional judgement, taking context into consideration.

8.8 Uncertainty

Weather conditions during the survey period are considered to be suitable for undertaking measurements of sound levels. Measurement positions were selected that were representative of the proposed noise sensitive receptors. Measurements were undertaken over a 24 hour period to establish the lowest daytime and night-time environmental sound levels. Whilst environmental sound levels have the potential to be lower than those measured on some occasions, they are likely to be similar to those measured for the vast majority of the time. As such, uncertainty in the survey methodology is considered to be of marginal significance.

The survey was undertaken using Class 1 equipment which had been calibrated within the required intervals. In addition, field calibration checks were performed on the sound level meter prior to and on completion of the survey and were found to be within acceptable tolerance limits. As such, uncertainty in the survey equipment is considered to be of negligible significance.

Assessment data including sound data and operating hours has been based on site measurements and observations. A character correction has been applied as deemed appropriate. As such, uncertainty in the assessment data is considered to be of marginal significance.

Calculations have been undertaken in accordance with recognised procedures and have been performed in a spreadsheet. As such, uncertainty in the assessment is considered to be of negligible significance.

Based on the above, overall uncertainty in the assessment is considered to be of marginal significance.

9.0 Conclusions

The Local Authority's acoustic requirements for the proposed residential development have been established.

A detailed environmental sound survey has been undertaken in order to establish existing environmental sound levels at the proposed development due to surrounding transportation sound sources.

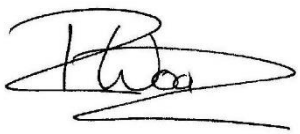
A detailed sound map of the proposed site layout has been produced based on information received from the developer/architect and the results of the environmental sound survey. A detailed sound assessment has been undertaken to establish the acoustic specification for glazing/ventilation elements required across the proposed development in order to achieve the acoustic requirements of the Local Authority. Additionally, the assessment indicates that the external daytime acoustic requirements of the Local Authority are likely to be achieved in rear gardens across the site.

No significant sources of industrial sound were audible within the site from either the caravan storage facility or the quarry during the time on-site during the daytime period. As such, it is a good indication that an industrial sound impact assessment is unlikely to be required for the daytime period.

Since the saw shed of the quarry is understood to operate continuously 24 hours a day, a return site visit was made during the evening period once residual noise levels had reduced in order to measure industrial sound levels from the saw shed.

An assessment of the existing industrial sound upon the proposed development indicates that the existing industrial sound is likely to have up to a potentially adverse impact at the nearest proposed residential properties during the night-time period.

Taking context into consideration, the existing industrial sound is likely to have a have a low impact at the nearest proposed residential properties during the night-time period.



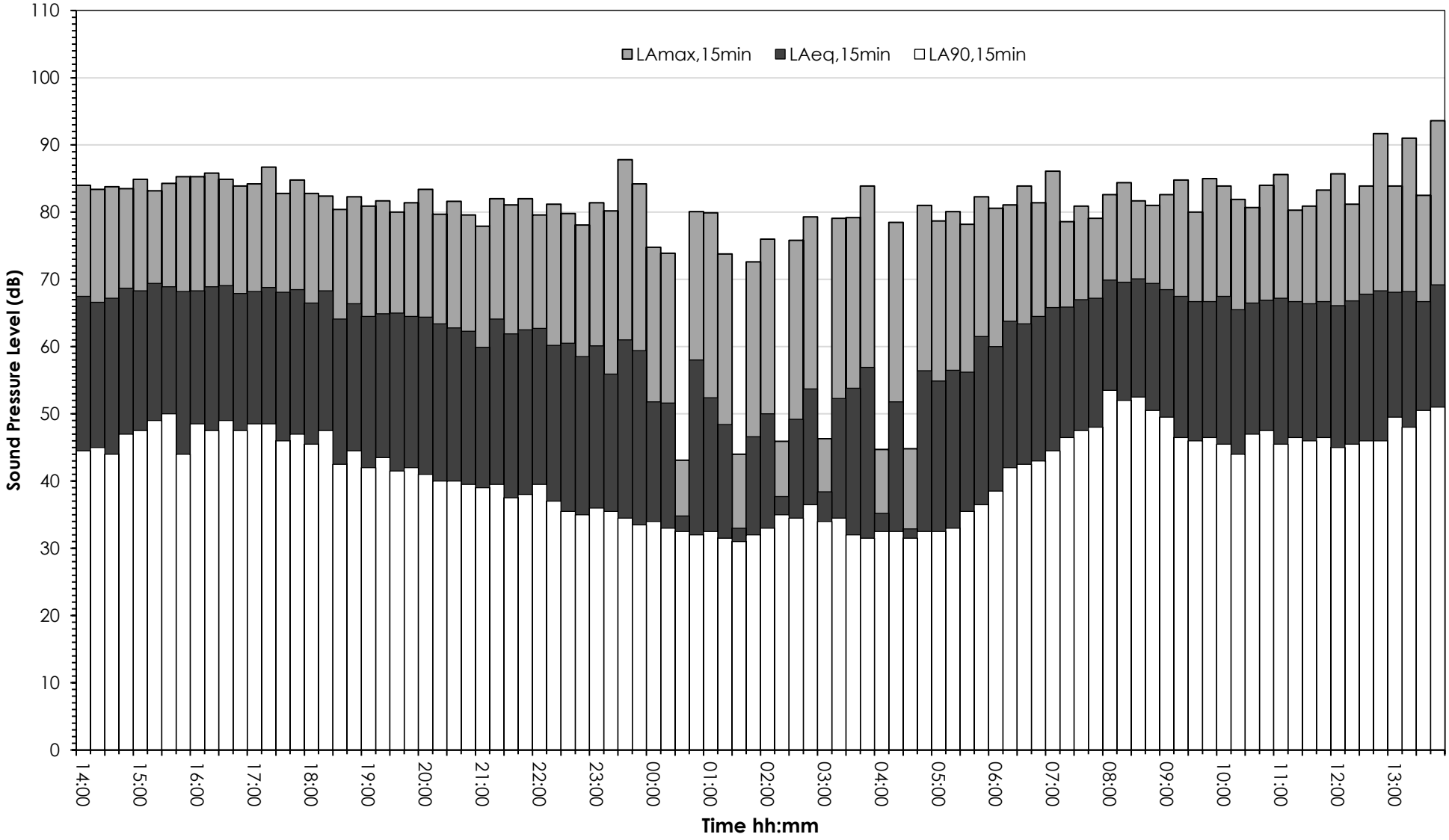
Robin Wood
LIGHTHOUSE ACOUSTICS

0276/THG1

Land off Blackmoorfoot Road and Felks Stile Road, Huddersfield

Time History Graph - Monday 11 December 2017 to Tuesday 12 December 2017

$L_{Amax,15min}$, $L_{Aeq,15min}$ & $L_{A90,15min}$ Noise Levels at Position A

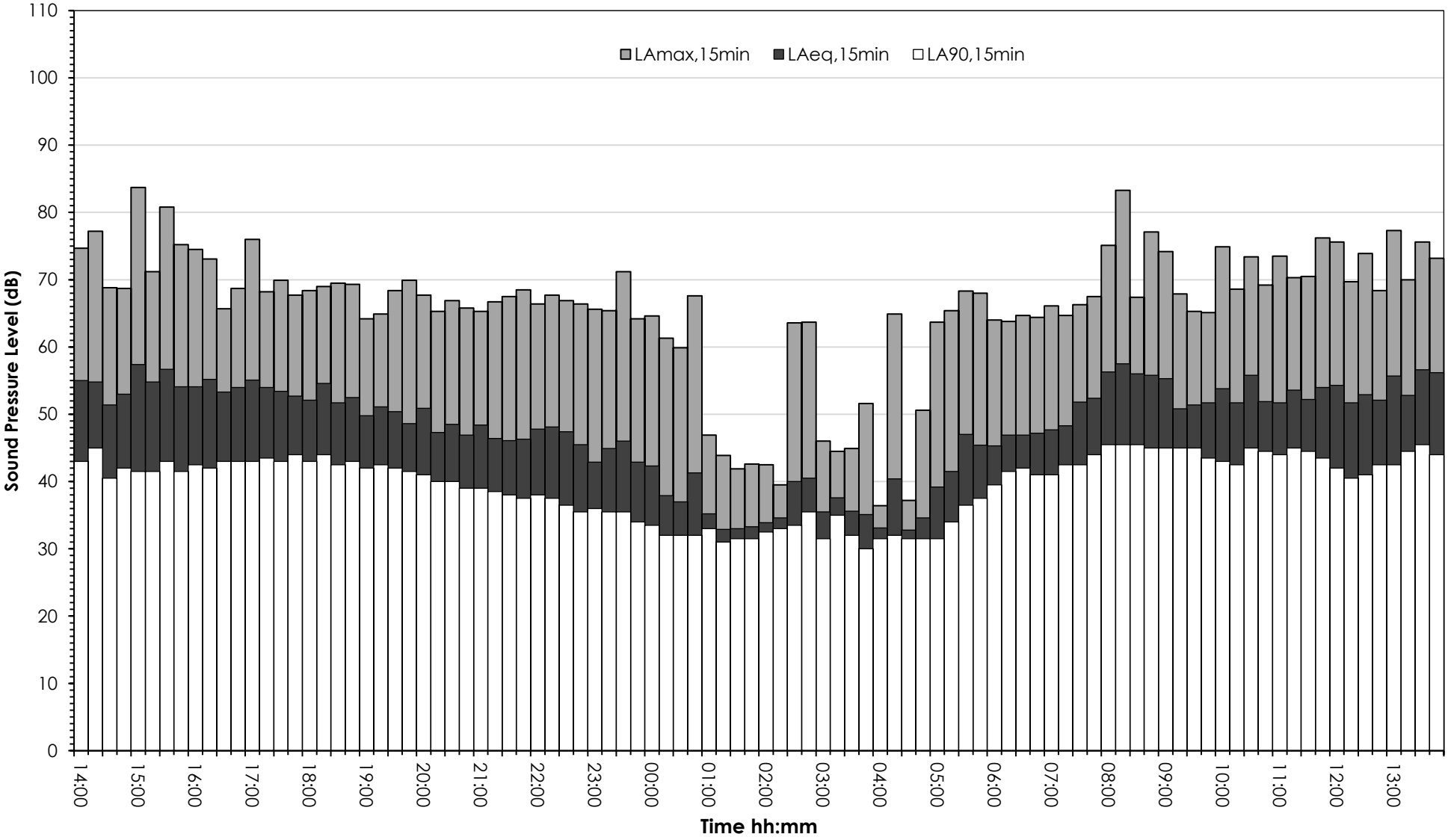


0276/THG2

Land off Blackmoorfoot Road and Felks Stile Road, Huddersfield

Time History Graph - Monday 11 December 2017 to Tuesday 12 December 2017

$L_{Amax,15min}$, $L_{Aeq,15min}$ & $L_{A90,15min}$ Noise Levels at Position B

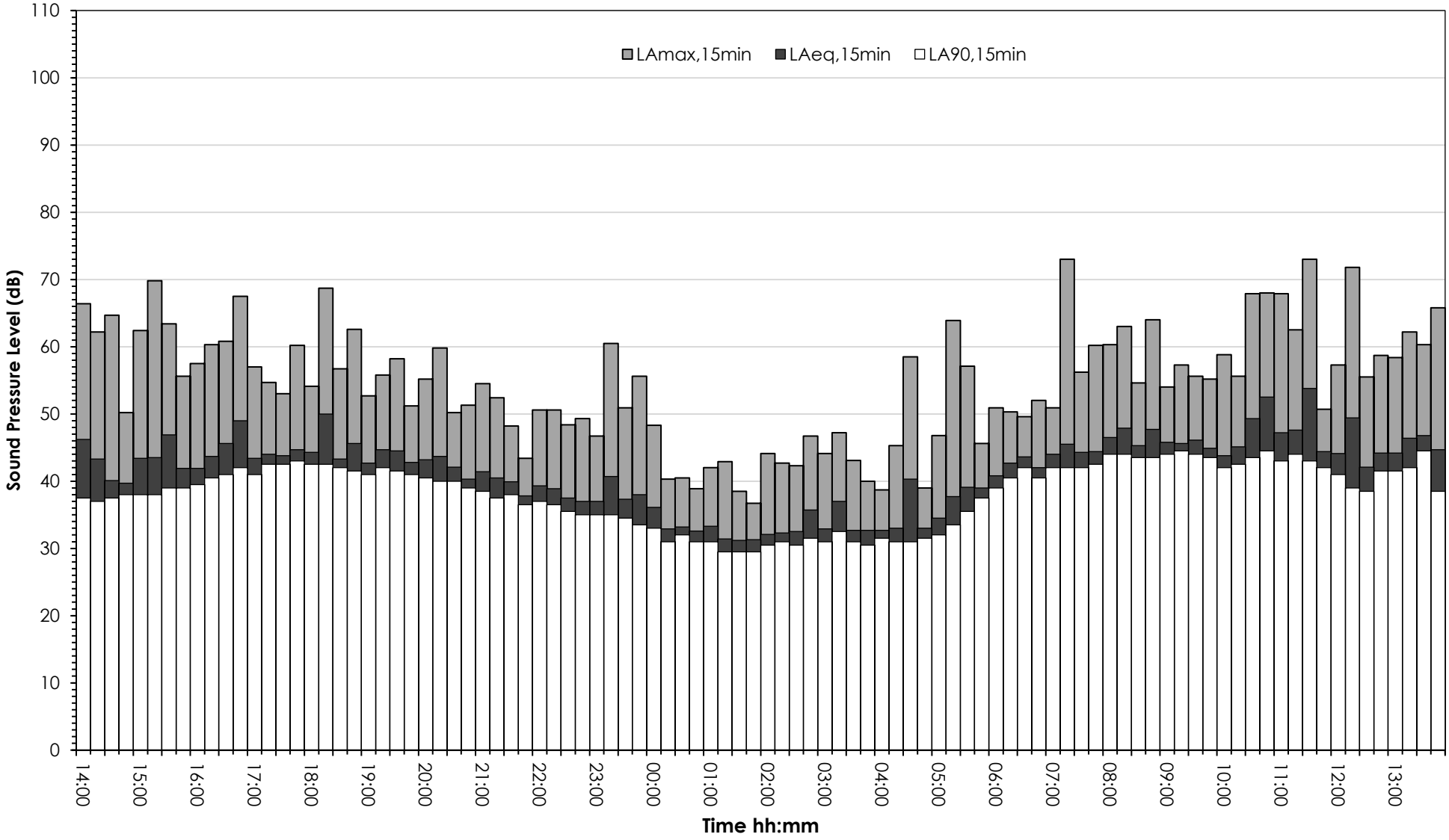


0276/THG3

Land off Blackmoorfoot Road and Felks Stile Road, Huddersfield

Time History Graph - Monday 11 December 2017 to Tuesday 12 December 2017

$L_{Amax,15min}$, $L_{Aeq,15min}$ & $L_{A90,15min}$ Noise Levels at Position C



0276/THG4

Land off Blackmoorfoot Road and Felks Stile Road, Huddersfield

Time History Graph - Monday 11 December 2017 to Tuesday 12 December 2017

$L_{Amax,15min}$, $L_{Aeq,15min}$ & $L_{A90,15min}$ Noise Levels at Position D