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REPORT

of

SOUND MEASUREMENTS AND RECOMMENDATIONS

at

**NEW RESIDENTIAL DEVELOPMENT,
LAND OFF BLEACHCROFT WAY,
STAIRFOOT,
BARNSLEY,
SOUTH YORKS.**

Dates of measurements: 8th, 9th & 11th September 2016, 29th March 2021
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Members of the Association of Noise Consultants (ANC) & Institute of Acoustics (IOA)
Originally established in 1981. Company number 4688174.

ANC ACOUSTICS & NOISE CONSULTANTS

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1.0 Introduction

Outline planning permission has been granted for residential development on land off Bleachcroft Way. Barnsley. We undertook acoustic surveys including predicted impact of different sound sources that surround the development site and resulted in some changes to the outline proposals.

Upon granting outline planning permission, a condition was included in the consent relating to internal sound level targets for dwellings (reproduced in the next subsection of this report).

An additional acoustic survey was commissioned by the developer to address the planning condition relating to noise and to provide a scheme of sound mitigation for the proposed dwellings, with report dated 6th October 2021. Since then, the site layout has been changed slightly and so this revision has been prepared to take account of the new layout.

The 2021 site survey was undertaken during some of the lockdown restrictions introduced to combat the coronavirus pandemic. A combination of those on-site measurements and our site investigations from the outline application stage have been used in this survey to maximise accuracy and minimise uncertainty. Full details of methodology are given later in this report.

1.1 Planning Condition & Site Plan

The planning condition relating to noise of consent 2017/0753 is:

20 A noise impact assessment shall accompany the reserved matters submission which shall have been used to inform the layout and design of the scheme such that mitigation to achieve the following sound levels are achieved within all dwellings;

o Bedrooms: LAeq (8 hours) - 30dB (2300 to 0700 hours);
o Living Rooms & Bedrooms: LAeq (16 hour) - 35dB (0700 to 2300 hours);
o Bedrooms: LAFmax - 45dB (2300 to 0700 hours).

Where the above noise criteria cannot be achieved with windows partially open, include a system of alternative acoustically treated ventilation to all habitable rooms.

The assessment shall be accompanied by a plan which clearly identifies the different types of mitigation measures proposed, where each type of mitigation is proposed and a programme of implementation. Thereafter the development shall be carried out in accordance with the approved measures.

A site plan showing the proposed development and surrounding sound sources is given overleaf.

Site Location Plan



1.2 Methodology

The most appropriate methodology for the site was discussed and agreed in advance with the Environmental Health Department of the Local Planning Authority.

Short duration attended sound were taken at the site on 29th March 2021 along with observations and investigations of current sound sources. In addition to these, the previous measurements taken by us during the outline application stage have been considered. These measurements were taken before the impact of coronavirus and while some of the surrounding retail premises were still trading.

The more rigorous method of BS 8233 : 2014 has been used for the calculation of internal sound levels. The acoustic specifications for dwellings have been designed to comfortably meet the quantitative requirements of the planning condition using this more rigorous method. Where the internal sound levels cannot be achieved with windows partially open, an alternative mechanical based ventilation system is suggested as required by the planning condition.

The outdoor sound levels, predicted indoor sound levels and suggested acoustic specification for each area of the site is considered in a different section of the report, with a map showing the suggested acoustic specifications for the whole site given in section 7, page 18.

2.0 West of Site, Railway

2.1 Outdoor Sound Levels

The measurements of sound from trains affecting the nearest dwellings to the railway ascertained using a combination of current measurements and those taken by us at the outline planning stage show:

- Ambient sound levels of 58 – 65 dB $LA_{eq,15mins}$ during the daytime and the last hour or so of night time as commuter and rail traffic increases. During night time periods of low train movement, ambient sound levels fall to 43 – 49 dB $LA_{eq,15mins}$.

- Background sound levels of 43 – 45 dB $LA_{90,15min}$ during the daytime and 33 – 36 dB $LA_{90,15min}$ at night.

- Short duration maximum sound levels of up to 85 – 88 dB $LA_{max,f}$ from the passage of trains.

The frequency spectra of the reasonable highest results, used in the calculation of internal sound level and required building envelope are:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Ambient Leq	55.7	52.8	49.7	57.7	64.2	58.3	51.1	41.9
Ambient Leq	64.0	61.1	49.5	57.3	59.1	55.2	48.0	38.6
Maximum Lmax	86.3	88.7	73.6	81	84.7	79.6	72	65.3
Maximum Lmax	75.4	74.4	72.0	79.5	86.3	80.4	73.1	63.7

2.2 **Acoustic Specification**

The suggested acoustic specification for the dwellings closest to the railway line (denoted by the blue lines on the plan overleaf) is:

- Bedroom windows facing the railway or on the side elevations of houses, 10mm float glass and 8.8mm acoustic glass such as Pilkington Optiphon (10-16-8.8). No Juliet doors.

- Living Room or other non bedroom habitable room windows facing the line or on side elevations, 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (4-16-6.8). Any patio doors should have a high standard of fit and seal.

- Mechanical ventilation system

- Top floor ceilings to be two layers of 12.5mm plasterboard

- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50

- Imperforate 1.8m – 2m timber fences around private rear gardens

For elevations facing away from the railway, denoted by the dashed blue lines, the acoustic specification is:

- Windows to all habitable rooms including bedrooms facing away from the line, 4mm float glass and 6.8mm acoustic glass (4-16-6.8). Any patio doors should have a high standard of fit and seal.

- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard
- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50
- The dashed blue line at this part of the site is at dwelling frontages only, where there is no private garden amenity.



The suggested acoustic specification for dwellings slightly further from the railway line at the north of the site (denoted by the **green lines** on the plan overleaf) is:

- All bedroom windows, 6mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (6-16-6.8). No Juliet doors.
- All Living Room and other non bedroom habitable room windows, 4mm float glass and 6.8mm acoustic glass (4-16-6.8). Any patio doors should have a high standard of fit and seal.
- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard

- If trickle ventilators are to be used they should be high performing models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50

- Imperforate timber garden fences



These mitigation measures also provide protection for dwellings from commercial sound.

The same acoustic specification is suggested for dwellings to the south of the site that face the railway line, but again are at a slightly greater distance from it than the closest dwellings. These are also denoted by **green lines** on the plan below



2.3 **Predicted Internal Sound Levels**

Ambient sound levels in bedrooms of 17 – 20 dB LA_{eq} are predicted, compared to the limit of 35 dB LA_{eq} during the daytime and 30 dB LA_{eq} at night. Short duration maximum levels from the passage of trains are predicted at 38 – 44 dB LA_{max} compared to the requirement to not exceed 45 dB LA_{max}.

Sound levels in living rooms are predicted at around 25 dB LA_{eq}, comfortably in compliance with the requirement to not exceed 35 dB LA_{eq}.

3.0 **Stairfoot Way & Dwellings Near GA Kelly**

3.1 **Outdoor Sound Levels**

The former B&Q store remains unoccupied, but clearly the possibility exists of it re-opening in a similar guise. We are informed that some supermarkets have expressed interest in the site, but no proposals have been confirmed. The Barnsley Planning Portal shows the following applications for the site:

- 2017/1267, demolition works and use of premises as a retail food store, with the decision that a lawful development certificate was granted.
- 2019/0104, change of use to class B8 storage and distribution and/or B1c light industrial, approved with conditions
- 2019/0980 use of former B&Q as non food retail, application withdrawn.

The dwellings closest to the former store have been orientated so that the front of them and driveways face the store, with private rear gardens benefiting from the barrier effect of the dwellings.

Acoustic line of sight exists to these commercial properties from the nearest dwellings. The operation of the commercial premises includes deliveries during night-time or early morning periods. For this reason, the specification of the dwelling envelopes is significantly improved to provide mitigation.

The sound from G.A. Kelly has characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment. The sound rating level identified in our previous report is 57 dB at night and thereby 23 dB above the 34 dB LA_{90} background.

The BS 4142 conclusions at these dwellings would be "significant adverse impact" at night. However design measures can be incorporated into the external fabric of the dwellings to ensure good internal acoustic conditions in all rooms including bedrooms in accordance with the "context" guidance of BS 4142 and the requirements of the planning condition.

Sound measurements were taken at the position of proposed dwelling elevations nearest to the front service yard of Blakemore Wholesale. These sound levels were also monitored during night-time deliveries and have been adjusted to represent the locations of the nearest dwellings on the current site layout.

The only audible sound from either of the commercial premises during the daytime survey periods was from customers' cars in the front service yard. There was no sound from the vacant B&Q premises but there is a potential for sound generation

Information was sought as to the current operational situation of these premises, which is the same as previously but G A Kelly were slightly less busy than before the coronavirus pandemic. We were informed that night-time deliveries still occur

Position Facing Service Yard of Commercial Units

Sound Descriptor		**Daytime**		**Night**	
		1000-1100	**1400-1500**	**2330-0030**	**0200-0230**
Ambient	LA_{eq}	59.1	52.5	60.2	41.1
Background	LA_{90}	45.5	43.4	35.6	33.6
Maximum	LA_{max}	78.6	69.1	80.9	58.4

Sound frequency spectra are shown below of the highest results of day and night L_{eq} and the night L_{max} results, peaks caused by activity at the commercial premises or HGVs.

Sound pressure levels dB linear:

Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Daytime Leq	69.5	60.3	57.8	56.6	56.8	52.3	48	42.2
Night Leq	64.2	58.8	56.9	54.5	56	53.6	46.1	40.6
Night Lmax	82.4	80.1	79.8	76.7	77.2	72.6	70.9	67.8

Position Facing Office Buildings

Sound Descriptor		Daytime 1000-1100	Daytime 1400-1500	Night 2330-0030	Night 0200-0230
Ambient	LA_{eq}	58.7	50.1	49.5	43.3
Background	LA_{90}	45.5	44.2	36.2	34.0
Maximum	LA_{max}	69.7	66.0	70.8	60.2

Current sound levels were measured as being 50 – 55 dB LA_{eq}, up to 73 dB LA_{max} and 45 dB LA_{90}, being of the same order as the original survey.

3.2 Acoustic Specification

The suggested acoustic specification for the dwellings closest to GA Kelly (denoted by the **blue lines** on the plan overleaf) is:

- Bedroom windows, 10mm float glass and 8.8mm acoustic glass such as Pilkington Optiphon (10-16-8.8). No Juliet doors
- Living Room and other non bedroom habitable windows facing commercial premises, 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (4-16-6.8). Any patio doors should have a high standard of fit and seal.
- Windows to all habitable rooms including bedrooms that are slightly further from the commercial premises, 4mm float glass and 6.8mm acoustic glass (4-16-6.8), denoted by the **dashed blue line**
- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard
- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50
- Imperforate timber garden fences



3.3 **Predicted Internal Sound Levels**

Predicted internal sound levels are given in detail in the appendices, but remain comfortably below the requirements of the planning condition to not exceed 35 dB LA_{eq} during the daytime, 30 dB LA_{eq} at night, with peaks below 45 dB LA_{max}.

The predicted internal daytime levels are 25 dB LA_{eq} in living rooms and 25 dB LA_{eq} in bedrooms. At night, the predicted sound levels are 20 dB LA_{eq} and 39 dB LA_{max} in bedrooms. This comfort margin between predicted levels and maximum requirements will assist in the preservation of living and sleeping amenity given the potentially annoying / disturbing type of sound being considered.

4.0 **Tesco**

4.1 **Outdoor Sound Levels**

The site layout has been modified during the planning process so that the small group of dwellings originally proposed closest to the delivery yard have been removed.

The distance from the loading bay to the nearest dwellings with direct line of sight is now around 85m, compared to the previous distance of 48m. The extra sound decay due to distance is 5 dBA.

The outdoor BS 4142 Rating Level from activity in delivery bay with mitigation in place is now between 2 dB below and 5 dB above the night time background. The previous situation of up to "Significant" adverse impact has been reduced to being of "Low" or "Adverse" impact. The BS 4142 Rating Levels are 32 - 39 dB at night compared to a typical background sound level of 34 dBA.

The front of dwellings now face the delivery yard; private rear gardens face away from yard where the dwellings will act as a noise barrier. This reduces the impact from activities at Tesco in rear gardens to "Low" at all times, even at night when use of private gardens is unlikely.

Sound Descriptor		**Daytime** 1200-1300	1300-1330	**Night** 2300-2330
Ambient	LA_{eq}	55.8	57.7	47.6
Background	LA_{90}	43.4	43.2	42.2
Maximum	LA_{max}	74.0	74.9	69.8

Sound frequency spectra are shown below of the highest day and night L_{eq} and the L_{max} results when deliveries were taking place.

Sound pressure levels dB linear:

Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Daytime Leq	66.2	60.1	59.7	54.4	54.0	48.5	43.0	31.2
Night Leq	56.0	48.7	47.1	45.5	43.8	37.9	32.5	30.7
Night Lmax	74.1	69.5	70.0	70.1	72.3	63.1	62.2	59.0

Sound levels without deliveries

Sound measurements were also taken at this position when no deliveries were taking place:

Sound Descriptor		**Daytime 1330-1400**	**Night 0130-0200**
Ambient	LA_{eq}	44.1	45.3
Background	LA_{90}	40.4	42.0
Maximum	LA_{max}	52.4	58.8

Home Deliveries

The BS 4142 Rating Level predicted in our planning report was 3 dB above background during the worst hour between 07.00 and 08.00 due to testing of horns. This is above “Low” impact and less than “Adverse” impact. The Rating Level is predicted as 46 dB during the worst case hour of 07.00-08.00. The specific sound level during this time is predicted as 40 dBA.

The front of dwellings and driveways face the home delivery yard; private rear gardens face away from Tesco where the dwellings will act as a noise barrier. This reduces the impact from activities at Tesco to being “Low” at all times in private rear gardens.

It is proposed to provide an increased specification of glazing and acoustic trickle ventilators to dwellings closest to the home delivery yard to offer further protection of amenity.

Fixed Plant

The BS 4142 Rating Level predicted in our original report was 3 dB above the background at night, and 8 dB below the background during the daytime. This predicts “Low” impact during the daytime and between “Low” and “Adverse” impact at night, at the front of the dwellings.

As with the dwellings discussed above, the front of dwellings and driveways will face the plant area; private rear gardens face away from the supermarket where they will benefit from the barrier effect of the dwellings. This reduces the impact from activities at Tesco to Low at all times in private rear gardens.

The dwellings closest to the plant area will also be provided with an increased specification of glazing and acoustic trickle ventilators to provide further protection of amenity.

It was found that at positions on the development site further north than the position described in 7.1 above there was continuous audible sound from plant items at the supermarket. The ambient sound level was 46.9 dB LA_{eq} with the following spectrum:

Sound pressure levels dB linear:

Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Fixed plant Leq	58.0	48.9	43.5	42.5	42.1	39.1	36.5	34.4

4.2 **Acoustic Specification**

The suggested acoustic specification for dwellings facing Tesco areas (denoted by the **green lines** on the plan overleaf) is:

- All bedroom windows on affected elevations, 6mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (6-16-6.8). No Juliet doors.

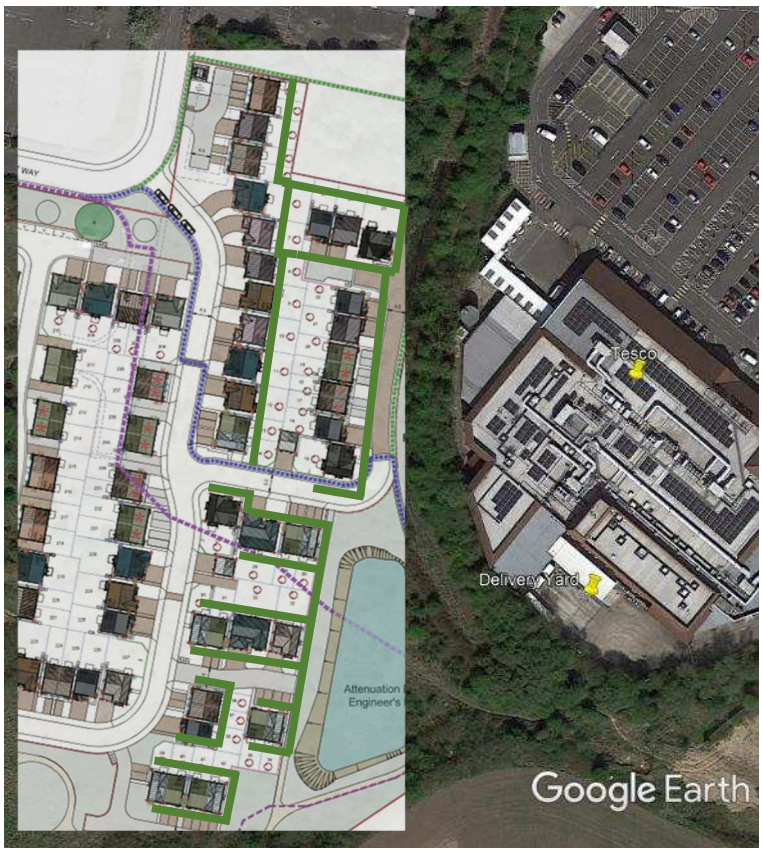
- All Living Room and other non bedroom habitable room windows on affected elevations, 4mm float glass and 6.8mm acoustic glass (4-16-6.8). Any patio doors should have a high standard of fit and seal.

- Mechanical ventilation system

- Top floor ceilings to be two layers of 12.5mm plasterboard

- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50

- Imperforate timber fences around private rear gardens



4.3 **Predicted Internal Sound Levels**

Predicted internal sound levels are comfortably within the requirements of the planning condition to not exceed 35 dB LA_{eq} during the daytime, 30 dB LA_{eq} at night, with peaks below 45 dB LA_{max}.

The predicted internal daytime levels are up to 24 dB LA_{eq} in living rooms and up to 23 dB LA_{eq} in bedrooms.

At night, the predicted sound levels are 11 dB LA_{eq} and up to 33 dB LA_{max} in bedrooms. This comfort margin between predicted levels and maximum requirements will assist in the preservation of living and sleeping amenity when potentially disruptive sources such as horn tests are being undertaken.

5.0 **Rest of Site**

Dwellings across the rest of the site not included in the previous sections may be constructed using the following acoustic specification:

- Windows comprising two leaves of 4mm float glass with a 12 – 16mm gap between, eg 4-16-4
- Top floor ceilings to be a single layer of 12.5mm plasterboard
- Good quality trickle ventilators with an outdoor to indoor level difference of at least 33 dB $D_{n,e,w}$ when open, for example Greenwood 5000 EA or Titon SFX V25.

6.0 **Outdoor Noise Barrier Specifications**

The proposals include the provision of outdoor noise barriers. There are different options for their final method of implementation, but there are certain common requirements that apply.

Any imperforate structure that is of sufficient mass can act as a noise barrier. Timber of normal specification and thickness to form a garden fence e.g. 18mm softwood would provide sufficient mass for this application. An earth bund makes a very effective noise barrier and there are also bespoke acoustic barrier products available. Where temporary noise barriers are needed, hay bales or shipping containers are sometimes used. The principle of having sufficient mass and being imperforate must apply and are common to all of these methods.

Where a fence is to be used to reduce sound transmission then it must be completely imperforate with no airgaps. Overlapped boards would be suitable but any features such as gaps between boards, whether or not they are offset by parallel boards to prevent visibility, would render the fence acoustically ineffective. There must be no airgap under the lower edge of the fence, usually achieved by fitting a continuous vertical board along the lower edge of the fence set into a trench of gravel, or by fixing the fence onto a low masonry wall.

Combinations of different noise barriers can be used effectively; a common solution is to combine an earth bund with timber fence on the top of it.

7.0 Summary of Sound Insulation Specifications

The recommended sound insulation specifications given in this report are summarised below for convenience. If patio doors are to be featured then they should have a high standard of fit and seal, as should windows with acoustic glass specification.

Continuous Blue Line

- Bedroom windows, 10mm float glass and 8.8mm acoustic glass such as Pilkington Optiphon (10-16-8.8). No Juliet doors.
- Living Room or other non bedroom habitable room windows, 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (4-16-6.8).
- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard
- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50
- Imperforate timber fences around private rear gardens

Dotted Blue Line

- Windows to all habitable rooms including bedrooms, 4mm float glass and 6.8mm acoustic glass (4-16-6.8),
- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard
- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50
- Imperforate timber fences around private rear gardens

Green Line

- All bedroom windows on affected elevations, 6mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon (6-16-6.8). No Juliet doors.
- All Living Room and other non bedroom habitable room windows on affected elevations, 4mm float glass and 6.8mm acoustic glass (4-16-6.8).
- Mechanical ventilation system
- Top floor ceilings to be two layers of 12.5mm plasterboard
- If trickle ventilators are to be supplied they should be high performing acoustic models such as Greenwood 5000 EAW.AC2 or Titon SFX V75 + C50
- Imperforate timber fences around private rear gardens



Other areas can have dwellings constructed using conventional double glazing with 4mm glass, single plasterboard ceilings on top floors, natural ventilation and conventional but good quality trickle ventilators with an outdoor to indoor level difference of at least 33 dB $D_{n,e,w}$ when open, such as Greenwood 5000 EA or Titon SFX V25

APPENDIX 1

EQUIPMENT AND QUALIFICATIONS

S & D Garritt Ltd are members of the Association of Noise Consultants (ANC). All work related to this report was undertaken by David Garritt.

David Garritt has been a full member of the Institute of Acoustics since 2005 and holds an honours degree in Electronic and Computer Systems Engineering. David teaches acoustics at post graduate level on a part time basis. David sits on the ANC Communications and PR Committee.

The equipment used during the site visits is shown in the table below. The sound level meter was calibrated before and after use; no drift was apparent.

Equipment Description	Type number	Manufacturer	Date of expiration of Calibration	Calibration Certificate Number
Sound Level Meter	2260 s/n 2409281	Bruel & Kjaer	07.10.2022	147227
Preamplifier	ZC 0026	Bruel & Kjaer	07.10.2022	147227
Sound Level Meter	XL2 TA s/n A2A-10019-EO	NTi Audio	25.08.2022	145408
Microphone	MK 224 s/n 210762A	Cirrus Research	20.08.2022	145404
Microphone	MK:224 s/n 212421D	Cirrus Research Plc	06.10.2022	147221
Calibrator	4231 s/n 2402706	Bruel & Kjaer	26.08.2021	145403

APPENDIX 2

SOUND LEVEL CALCULATIONS

Living Rooms Facing Railway

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Ambient Leq	55.7	52.8	49.7	57.7	64.2	58.3	51.1	41.9
Ambient Leq	64.0	61.1	49.5	57.3	59.1	55.2	48.0	38.6

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
4-16-6.8	19	20	26	35	47	46	52	55
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	55.7	52.8	49.7	57.7	64.2	58.3	51.1	41.9
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	21	23	30	39	50	49	55	58
Indoor SPL	35	30	20	19	15	9	-4	-16
A weighted	9	14	11	16	15	11	-2	-18

Equivalent to daytime 21.1 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	64.0	61.1	49.5	57.3	59.1	55.2	48.0	38.6
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	21	23	30	39	50	49	55	58
Indoor SPL	43	39	20	18	10	6	-7	-20
A weighted	17	23	11	15	10	8	-5	-22

Equivalent to daytime 24.6 dB LA_{eq}

Bedrooms Facing Railway

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Ambient Leq	55.7	52.8	49.7	57.7	64.2	58.3	51.1	41.9
Maximum Lmax	86.3	88.7	73.6	81	84.7	79.6	72	65.3
Maximum Lmax	75.4	74.4	72.0	79.5	86.3	80.4	73.1	63.7

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
10-16-8.8 optiphon	24	28	31	42	45	50	58	62
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	55.7	52.8	49.7	57.7	64.2	58.3	51.1	41.9
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	29	22	14	12	14	5	-8	-21
A weighted	3	6	5	9	14	7	-6	-23

Equivalent to daytime 17.0 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	86.3	88.7	73.6	81.0	84.7	79.6	72.0	65.3
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	60	58	38	35	35	26	13	2
A weighted	34	42	29	32	35	28	15	0

Equivalent to 43.6 dB LA_{max}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	75.4	74.4	72.0	79.5	86.3	80.4	73.1	63.7
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	49	43	36	34	37	27	14	1
A weighted	23	27	27	31	37	29	16	-1

Equivalent to 38.9 dB LA_{max}

Living Rooms Facing GA Kelly / Commercial

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	69.5	60.3	57.8	56.6	56.8	52.3	48	42.2

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
4-16-6.8	19	20	26	35	47	46	52	55
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	69.5	60.3	57.8	56.6	56.8	52.3	48.0	42.2
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	21	23	30	39	50	49	55	58
Indoor SPL	48	38	28	18	7	3	-7	-16
A weighted	22	22	19	15	7	5	-5	-18

Equivalent to daytime 26.5 dB LA_{eq}

Bedrooms Facing GA Kelly / Commercial

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	69.5	60.3	57.8	56.6	56.8	52.3	48	42.2
Night Leq	64.2	58.8	56.9	54.5	56	53.6	46.1	40.6
Night Lmax	82.4	80.1	79.8	76.7	77.2	72.6	70.9	67.8

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
10-16-8.8 optiphon	24	28	31	42	45	50	58	62
5000EAW.AC1 ventilator	33	39	38	31	44	43	46	49
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	69.5	60.3	57.8	56.6	56.8	52.3	48.0	42.2
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	43	29	22	11	7	-1	-11	-21
A weighted	17	13	13	8	7	1	-9	-23

Equivalent to daytime 20.3 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	64.2	58.8	56.9	54.5	56.0	53.6	46.1	40.6
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	38	28	21	9	6	0	-13	-22
A weighted	12	12	12	6	6	2	-11	-24

Equivalent to night time 17.5 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	82.4	80.1	79.8	76.7	77.2	72.6	70.9	67.8
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	26	31	36	46	50	54	59	63
Indoor SPL	56	49	44	31	27	19	12	5
A weighted	30	33	35	28	27	21	14	3

Equivalent to night time 38.7 dB LA_{max}

<u>Living Rooms Facing Tesco</u>

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	66.2	60.1	59.7	54.4	54	48.5	43	31.2

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
6-16-6.8	21	21	28	37	48	48	54	57
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	66.2	60.1	59.7	54.4	54.0	48.5	43.0	31.2
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	21	23	30	39	50	49	55	58
Indoor SPL	45	38	30	15	4	-1	-12	-27
A weighted	19	22	21	12	4	1	-10	-29

Equivalent to daytime 25.7 dB LA_{eq}

Bedrooms Facing Tesco

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	66.2	60.1	59.7	54.4	54	48.5	43	31.2
Night Leq	56	48.7	47.1	45.5	43.8	37.9	32.5	30.7
Night Lmax	74.1	69.5	70	70.1	72.3	63.1	62.2	59

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
6-16-6.8	21	21	28	37	48	48	54	57
5000EAW.AC1 ventilator	33	39	38	31	44	43	46	49
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	66.2	60.1	59.7	54.4	54.0	48.5	43.0	31.2
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	24	25	33	42	52	52	58	61
Indoor SPL	42	35	26	12	2	-4	-15	-30
A weighted	16	19	17	9	2	-2	-13	-32

Equivalent to daytime 22.5 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	56.0	48.7	47.1	45.5	43.8	37.9	32.5	30.7
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	24	25	33	42	52	52	58	61
Indoor SPL	32	23	14	3	-8	-15	-25	-30
A weighted	6	7	5	0	-8	-13	-23	-32

Equivalent to night time 11.2 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	74.1	69.5	70.0	70.1	72.3	63.1	62.2	59.0
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	24	25	33	42	52	52	58	61
Indoor SPL	50	44	37	28	21	11	5	-2
A weighted	24	28	28	25	21	13	7	-4

Equivalent to 32.8 dB LA_{max}

Living Rooms Facing Tesco Fixed Plant

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	58	48.9	43.5	42.5	42.1	39.1	36.5	34.4

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
6-16-6.8	21	21	28	37	48	48	54	57
5000EAW.AC2 ventilator	34	40	38	32	47	53	56	58
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	58.0	48.9	43.5	42.5	42.1	39.1	36.5	34.4
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	21	23	30	39	50	49	55	58
Indoor SPL	37	26	14	4	-7	-10	-18	-24
A weighted	11	10	5	1	-7	-8	-16	-26

Equivalent to daytime 14.4 dB LA_{eq}

Bedrooms Facing Tesco Fixed Plant

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	58	48.9	43.5	42.5	42.1	39.1	36.5	34.4
Night Leq	58	48.9	43.5	42.5	42.1	39.1	36.5	34.4
Night Lmax	74.1	69.5	70	70.1	72.3	63.1	62.2	59

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
6-16-6.8	21	21	28	37	48	48	54	57
5000EAW.AC1 ventilator	33	39	38	31	44	43	46	49
Ceiling R	35	40	46	51	55	52	54	56

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	58.0	48.9	43.5	42.5	42.1	39.1	36.5	34.4
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	24	25	33	42	52	52	58	61
Indoor SPL	34	23	10	0	-9	-13	-21	-27
A weighted	8	7	1	-3	-9	-11	-19	-29

Equivalent to 11.3 dB LA_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	74.1	69.5	70.0	70.1	72.3	63.1	62.2	59.0
Shadow Loss	0	0	0	0	0	0	0	0
Calculated Loss	24	25	33	42	52	52	58	61
Indoor SPL	50	44	37	28	21	11	5	-2
A weighted	24	28	28	25	21	13	7	-4

Equivalent to 32.8 dB LA_{max}