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REPORT

of

SOUND ASSESSMENTS

at

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

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1.0 Summary and Conclusions

An outline planning application is being submitted for residential development on land off Bleachcroft Way, Stairfoot, Barnsley. The site is bounded to the west by a railway line and to the north and east by commercial premises and a supermarket, and for this reason the applicant has commissioned this survey of the existing sound levels at the sites. The report describes sound levels during periods of daytime and night and compares the results with guidance on the subject of noise affecting dwellings provided in BS 8233 and by the World Health Organisation.

1.1 The outdoor sound levels during the daytime were in the range 57-59 dB LA_{eq} adjacent to the railway boundary, 47-53 dB LA_{eq} adjacent to Bleachcroft Way / Stairfoot Way, 56-58 dB LA_{eq} adjacent to the delivery bay of the supermarket and 46-48 dB LA_{eq} across the rest of the site. At night the outdoor sound levels did not exceed 54 dB LA_{eq} at any part of the site.

1.2 The areas of the site immediately adjacent to the boundaries with Stairfoot Way and the Tesco supermarket receive sound from commercial sources. The illustrative site layout plan will shield most private rear gardens from commercial sound and it is recommended that outdoor barriers are provided to shield a minority of gardens in these areas from commercial sound sources. It is recommended that acoustic fences are provided to shield the gardens of dwellings at the west boundary of the site from railway sound.

1.3 The results show that the recommendations of BS 8233 and the World Health Organisation on interior sound levels inside dwellings can be achieved by the specification of glazing, ventilation and bedroom ceilings to the dwellings. However when the levels of commercial sound are compared against the low natural background sound levels of this location then it is anticipated that the commercial sound reaching outdoors at some dwellings on the developed site may be rated as having “adverse impact”.

1.4 The corresponding assessments in terms of the NPPF is that the impact of existing sound sources on the residential development would greater than the Lowest Observable Adverse Effect Level (LOAEL) but lesser than the Significant Observed Adverse Effect Level (SOAEL).

1.5 The Planning Inspector dealing with a previous Planning Appeal ref APP/R4408/A/09/2115994 on this site concluded in Decision Notice para 39 that sound from the railway line & commercial premises does not prohibit development and mitigation measures could be addressed within the detailed design of the scheme. The recommendations of this report are intended to comply with this approach.

2.0 Planning Requirements on Noise

At this stage there are no formal requirements on the interior or external sound levels at the proposed dwellings. A previous proposal for residential development of this site was discussed with the Local Planning Authority in 2009 when the design targets for sound levels were called for in accordance with acceptance criteria that were current at that time. Those previous guidance documents have since been withdrawn or revised.

As a starting point this report refers to the revised guidance of the criteria called for by the LPA, ie. recommendations on interior sound levels given in BS 8233 and by the World Health Organisation. These documents are summarised as:

2.1 BS 8233: 2014

BS 8233 provides guidance on interior sound levels inside various building interiors. It is recommended that the internal ambient sound levels in dwellings do not exceed:

Living rooms	35 dB LA_{eq}	from 07.00-23.00
Dining rooms	40 dB LA_{eq}	from 07.00-23.00
Bedrooms	35 dB LA_{eq}	from 07.00-23.00
Bedrooms	30 dB LA_{eq}	from 23.00-07.00
Gardens	50 dB LA_{eq}	is the desirable limit
	55 dB LA_{eq}	is the upper guideline value.

2.2 World Health Organisation: 2000

Guidance from the WHO gives values for sleep disturbance:

Bedrooms	30 dB LA_{eq} }	to avoid sleep
	45 dB LA_{max}}	disturbance

2.3 Interior Design Targets

From the above guidance the basis of sound insulation is that the outdoor sound levels must not cause indoor sound levels in excess of:

- 30 LA_{eq} or 45 LA_{max} in bedrooms from 2300-0700,
- 35 LA_{eq} in all habitable rooms from 0700-2300 hours.

2.4 Central Government Policies

Since the time of the previous proposal and the acceptance criteria agreed with the LPA in 2009 described above, the government has introduced new guidance on outdoor sound levels. The government's planning policies are described in the National Planning Policy Framework (NPPF) which includes consideration of potential adverse impacts of noise caused by new development. The NPPF makes reference to the Noise Policy Statement for England (NPSE) which includes an Explanatory Note describing three incremental categories of noise impact:

- No Observed Effect Level (NOEL) being the situation below which no effect caused by noise can be detected,

- Lowest Observable Adverse Effect Level (LOAEL) being the situation above which adverse effects caused by noise can be detected,

- Significant Observed Adverse Effect Level (SOAEL) being the level above which significant adverse effects caused by noise occur.

Stated objectives of the NPSE are:

1. Avoid significant adverse impacts, usually interpreted as calling for sound levels above SOAEL to be avoided.

2. Mitigate and minimise adverse impacts, usually interpreted as calling for noise mitigation to be used within the bounds of practicality for situations between LOAEL and SOAEL.

3. Where possible contribute to the improvement of health and quality of life, usually interpreted as calling for noise reductions to be made where possible for situations between NOEL and LOAEL.

Although introducing these subjective concepts for the assessment of noise impact, the NPPF and NPSE documents do not provide quantitative values against which the suitability of a site for development can be assessed in terms of sound levels. The guidance of BS 4142 provides quantitative values in this respect and is intended for the assessment of the impact of industrial and commercial sound affecting residential developments.

2.5 **BS 4142: 2014**

The sound rating method of BS 4142 is to measure the outdoor sound levels at noise-sensitive properties during the emission of noise from the industrial or commercial premises under consideration and measure the background sound level typical of that location in the absence of the industrial sound. A correction factor is applied if appropriate to the industrial sound levels for some acoustic features which affect its acceptability, described as tonal, impulsive or other characteristic features which are distinctive against the residual acoustic environment. The corrected measured level, the rating level, is compared with the background.

- If the rating level exceeds the background by around +10 dB or more then this is an indication of a significant adverse impact, depending on the context.

- A difference of around +5 dB is an indication of an adverse impact, depending on the context.

- The lower the rating level is relative to the background, the less likely it is that the industrial source will have an adverse impact.

- Where the rating level does not exceed the background, this is an indication of the industrial source having a low impact, depending on the context.

Situations where a noise impact assessment may need to be modified due to the context include those where:

- The residual sound levels in the absence of the industrial / commercial source are particularly high or low.

- The character of the residual sound has acoustic features comparable to those of the industrial / commercial sound.

- The sensitivity of the receptor is significant, and whether residential properties incorporate design measures that secure good internal or outdoor acoustic conditions.

3.0 Sound Sources

The residential development is proposed on land off Bleachcroft Way, Barnsley. The site is currently open grassland bordered to the east by a 24-hour Tesco supermarket, to the south by open undeveloped land, to the west by a railway line and to the north by small industrial units, two office blocks, two retail stores, a large vacant retail store and allotments,. As part of our previous survey visits were made to all of the premises bordering the site. Discussions took place with representatives of the various business premises during which we were advised of their activities and operating times. For this survey no further contact with the business premises was made at the request of the client, but observations were made to confirm that the current operations appeared representative of previously gathered information.

There are no main roads bordering the site, the only existing access being via Bleachcroft Way and Stairfoot Way that serve the commercial premises. Hunningley Primary School is situated 50m from the proposed development site at the opposite side of the railway line.

The dominant sound sources affecting the site are road traffic and commercial premises. The railway provides the maximum sound levels at the west side of the site but is secondary to other sources in terms of ambient LA_{eq} sound levels across the site generally.

3.1 Tesco Supermarket

The Tesco supermarket is open to the public 24 hours per day on Mondays to Fridays, from midnight to 22.00 on Saturdays and from 10.00 to 16.00 on Sundays. The delivery bay to the premises is in the elevation facing the proposed development site. Lorries are unloaded directly into the bays either using a forklift truck or wheeled off by hand if the products are delivered in cages. Sound levels from two non-refrigerated deliveries and one refrigerated delivery were monitored by direct measurement at the position of the nearest proposed dwelling.

The edge of the Tesco car park is visible from the proposed dwelling positions to the north of the development. Customers' vehicles could be seen arriving and departing from this position but no sound from them was measurable against the ambient from other sources.

Sound from the fixed plant at the supermarket was audible and was measured at the position of the nearest proposed dwellings. The loading area for home deliveries by van is between the plant area and the car park. Activities could be seen in this area from the development site but they were inaudible against other sources.

3.2 **Blakemore Wholesale**

Blakemore Wholesale are cash & carry wholesalers open to the public from 07.00 to 17.00 on weekdays and mornings only at weekends.

Deliveries to Blakemore are made at the rear of the premises at the opposite side of the building to the development site. We were advised that there were usually 6-7 deliveries per day between Monday and Friday. Forklift trucks are used for loading and unloading. A delivery took place during our survey period but sound from the delivery was not measurable against the background sound level at the proposed development site. Car arrivals and departures were audible but not of sufficient intensity to be measurable at the development site. There is no external plant with sound emissions at the premises.

3.3 **Wilsons Carpets**

Wilsons are retailers of carpets, laminate and other floor coverings. They have no external plant and receive one delivery every few weeks. Their opening hours are 09.00-20.00 on Mondays to Fridays, 09.00-18.00 on Saturdays and 11.00-17.00 on Sundays. No sound from the premises was audible at the proposed development site at any time during our survey periods.

3.4 **G.A Kelly Fruit Sales**

G.A Kelly are fruit wholesalers occupying the nearest industrial unit to the development site at the northern boundary. We were advised that activities at the premises remain exactly as during our previous survey in 2009, and the current sound measurements confirmed this. The premises is used for the wholesale distribution of food at ambient temperatures so there is no refrigeration plant at the premises. The premises is open from 04.00-15.00 with the busiest time usually from 06.00-09.00.

Deliveries are made at any time of day or night, often using articulated lorries. We were advised that some of the regular haulage operators have keys to the premises so that deliveries can be made at any time when the premises is not manned. Deliveries are made as stock is needed; there are no pre-set delivery times and we were advised that there may be as many as ten or as few as two deliveries in any 24-hour period. Doors to the premises consist of electrically operated roller doors. Lorries are unloaded using a forklift truck. A delivery to the premises by articulated lorry was observed and measured during our

night survey period. Normal operating sound was monitored during the daytime survey periods.

3.5 Barnsley Food Supplies

Barnsley Food Supplies are food wholesalers situated in the industrial unit adjacent to G.A Kelly. We were advised that activities at the premises remain exactly as during our previous survey in 2009. Sound from the premises was not problematic to the residential development in 2009 and remained so during our current survey periods. The premises is open 09.00-18.00 on Mondays to Saturdays and 11.30-16.00 on Sundays. The majority of vehicular movements are light vans. BFS use an electric forklift truck and there are occasional deliveries by HGVs. There are no activities at night

Some of the stock held by BFS is refrigerated and so there is an internal 'walk in' fridge inside the premises. Sound from the premises and in particular the fixed refrigeration plant was monitored during the daytime survey periods. There was no sound emitted from the premises during our night survey period.

3.6 Office Units

There are two office buildings to the north of the site, adjacent to G.A Kelly and Barnsley Food Supplies. One of the units is empty and one is occupied by a Building Control agency. They operate from 07.00-17.30 on Mondays to Fridays. There is no external plant. No sound was audible from the office buildings at any time during the survey periods.

3.7 Hunningley Primary School

Hunningley Primary School is situated at the opposite side of the railway to the proposed development site. During break times childrens' voices could be heard, as previously, and measured at the closest point of the development site to the school. The only audible sound from the school was from children playing; during class time no sound was heard from the school.

3.8 Allotments

There was no audible sound from the allotments during any of our current survey periods. During our 2009 survey geese, hens and cockerels were being kept at an allotment adjacent to the residential site and it was found in 2009 that noise from cockerels was audible and measurable at the development site during the daytime and night.

3.9 Site of Former B & Q Store

The B&Q store that previously occupied a large site adjacent to the north boundary of the proposed development is now closed and the premises vacant. There were no sound emissions from the premises during our survey periods but there is clearly a potential for sound to be emitted from future occupation of the premises. We are informed that permission exists for deliveries to be made between 0700-2100 Monday – Saturday and 0900-1700 on Sundays.

4.0 Sound Measurements

Sound levels were measured at the site during a previous survey in 2009 and at the following times during our current survey in September 2016 :

- 10.00 – 17.00 on Thursday 8th September 2016
- 22.00 – 03.00 on Thursday & Friday 8th/9th September 2016
- 10.00 – 17.30 on Sunday 11th September 2016

The microphone height for all measurements was 1.2m to 1.5m above ground level. Conditions during the Thursday daytime survey period were dry with a wind speed of 0-4 m/s, temperature of 18-21^{o}C and generally 10% cloud cover. At night there was no rain, a wind speed 3-4 m/s, temperature of 13^{o}C and around 70% cloud cover. The Sunday survey period was dry with a wind speed of 3-4 m/s, temperature of 16^{o}C and 60% cloud cover. All results were taken using a Bruel & Kjaer precision sound level meter type 2260 for which current calibration certificates are held.

The current survey repSPlicated our previous survey in 2009 by using the same sound measurement positions. In every case the 2016 results were compared to those from 2009 and were generally of the same order. In the following sections of the report the 2016 results are given and differences between the 2009/2016 results are only described where they were significant in value.

5.0 West of Site Adjacent to Railway Line

5.1 Survey Results

Sound measurements were taken at a position 15m inside the site boundary at the approximate position of the nearest proposed dwellings to the railway.

Sound Descriptor		Daytime 1100-1200	Daytime 1600-1700	Night 2200-2230	Night 0100-0130
Ambient	LA_{eq}	56.7	58.8	48.8	43.3
Background	LA_{90}	43.6	42.8	34.6	33.8
Maximum	LA_{max}	84.6	85.3	85.1	64.0

Sound frequency spectra are shown below of the highest results of day and night L_{eq} and the night L_{max} results:

Sound pressure levels dB linear:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	62.0	59.1	47.5	55.3	57.1	53.2	46.0	36.6
Night Leq	53.1	50.3	47.4	44.0	44.2	43.4	36.3	27.8
Night Lmax	84.3	86.7	71.6	79.0	82.7	77.6	70.0	63.3

5.2 Dwelling Elevations Facing Railway

The interior sound levels as required inside the proposed dwellings are described in section 2.3 of this report The sound insulation specifications needed to ensure these interior levels have been calculated using the “More rigorous calculation” method of BS 8233: 2014 (Annex G). The calculations are given in Appendix A1 to this report taking into account the outdoor sound levels from existing sources as measured during this survey. It is found that for dwellings at the west side of the site adjacent to the railway line the interior sound targets can be achieved against existing outdoor sound sources by the following specifications to elevations facing the railway:

- Double glazing to bedrooms consisting of one pane of 4mm float glass and one pane of 10mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-10) or the acoustic equivalent.

- Conventional double glazing to other habitable rooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent.

- Acoustic trickle ventilators such as Greenwood MA3051 wall-mounted vents or the acoustic equivalent to bedrooms facing the railway and trickle ventilators such as Greenwood 5000EA to all other habitable rooms.

- Ceilings on the upper floor constructed from two layers of 12.5mm plasterboard.

5.3 Other Dwelling Elevations at West Side of Site

Dwellings spaced further from the railway and the elevations of the nearest dwellings facing away from the railway will be shielded from railway noise by the dwelling buildings. The sound insulation specifications of these elevations can be reduced to:

- Conventional double glazing to all rooms including bedrooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4A) or the acoustic equivalent.

- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.

- Ceilings on the upper floor constructed from a single layer of plasterboard.

5.4 Gardens

The existing sound levels on the open site adjacent to the railway exceed the guidelines on outdoor levels in gardens as summarised in 2.1 of this report. In order to achieve the “desirable” situation described in BS 8233 it is recommended that the rear gardens of houses adjacent to the railway are constructed from an imperforate fence of height at least 2.0m. Recommendations on the specifications of the fences are given in section 10.5 of this report.

6.0 North of Site Adjacent to Stairfoot Way

There are two existing commercial units and two office buildings at the north side of the site adjacent to Stairfoot Way. The commercial units are occupied by Barnsley Food Supplies and GA Kelly Fruit Sales, one of the offices is occupied by a Building Control agency and the other office building is vacant. The Masterplan of the residential development shows these commercial and office premises being retained as now, whereas the Site Location Plan Option 2 drawing no. 16-030 SK02 revA shows the two commercial units forming part of the residential development. It is assumed for the purpose of this survey that the commercial units will remain in operation as now and that their sound emissions are to be taken into account.

6.1 Survey Results

Sound measurements were taken at the position of proposed dwelling elevations at 15m inside the site boundary facing the outdoor service yard of the commercial units. A second set of sound measurements was taken at the position of the proposed dwellings located opposite the office buildings and slightly further away from the service yard of the commercial premises. These two measurement positions are shown on the attached marked-up Masterplan.

Position Facing Service Yard of Commercial Units

Sound Descriptor		Daytime 1000-1100	Daytime 1400-1500	Night 2330-0030	Night 0200-0230
Ambient	LA_{eq}	53.1	46.5	54.2	41.1
Background	LA_{90}	45.5	43.4	35.6	33.6
Maximum	LA_{max}	72.6	63.1	74.9	58.4

Sound frequency spectra are shown below of the highest results of day and night L_{eq} and the night L_{max} results:

Sound pressure levels dB linear:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	63.5	54.3	51.8	50.6	50.8	46.3	42.0	36.2
Night Leq	58.2	52.8	50.9	48.5	50.0	47.6	40.1	34.6
Night Lmax	76.4	74.1	73.8	70.7	71.2	66.6	64.9	61.8

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

The highest sound levels at both of the measurement positions were caused by deliveries to G.A. Kelly Food Supplies. The above results included delivery vehicles to both commercial units during the daytime and to GA Kelly at night. During the daytime a conventional forklift truck was in use at GA Kelly and an electric forklift truck at Barnsley Food Supplies.

6.2 Dwelling Elevations Facing Commercial Units

The sound insulation requirements are calculated using the "More rigorous calculation" method of BS 8233 and are given in Appendix A2 to this report. For dwellings at the north side of the site with a direct view of the service yard of the commercial units the interior sound targets can be achieved against existing outdoor sound sources by the following specifications to elevations facing the commercial units:

- Double glazing to bedrooms consisting of one pane of 4mm float glass and one pane of 6mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-6) or the acoustic equivalent.

- Conventional double glazing to other habitable rooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent.

- Acoustic trickle ventilators such as Greenwood MA3051 wall-mounted vents or the acoustic equivalent to bedrooms and trickle ventilators such as Greenwood 5000EA to all other habitable rooms.

- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.

- Ceilings on the upper floor constructed from a single layer of 12.5mm plasterboard.

6.3 Other Dwelling Elevations at North of Site

Dwellings at the north of the site with no direct view of the service yard and the elevations of the nearest dwellings facing away from the commercial units will be shielded from delivery noise by the dwelling buildings. The sound insulation recommendations are:

- Conventional double glazing to all rooms including bedrooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4A) or the acoustic equivalent.

- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.

- Ceilings on the upper floor constructed from a single layer of plasterboard.

6.4 Gardens

The existing sound levels at the north side of the open site exceed the guidelines on outdoor levels in gardens as summarised in 2.1 of this report and receive adverse impact from delivery noise at the commercial units. In order to achieve the “desirable” situation described in BS 8233 it is recommended that the rear gardens of dwellings with a direct view of the service yard are constructed from an imperforate fence of height at least 2.0m. Recommendations on the specifications of the fences are given in section 10.5 of this report.

7.0 East of Site Adjacent to Supermarket

The dwellings proposed at the southeast corner of the site will receive sound from the delivery bay of the Tesco supermarket that is located at its rear elevation facing the development site.

7.1 Survey Results Facing Delivery Bay

Sound levels during deliveries

Sound measurements were taken at the position of proposed dwelling elevations facing the delivery bay of the supermarket. The daytime and night survey periods included deliveries in which cages of goods were wheeled by hand from HGVs directly into the supermarket storeroom .

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 overleaf 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 when no 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

7.2 Survey Results Facing Supermarket Car Park

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

7.3 Dwelling Elevations Facing Delivery Bay

The sound insulation requirements are calculated using the "More rigorous calculation" method of BS 8233 and are given in Appendix A3 to this report. The following specifications are recommended for dwelling elevations at the east side of the site with a direct view of the supermarket delivery bay:

- Double glazing to bedrooms consisting of one pane of 4mm float glass and one pane of 10mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-10) or the acoustic equivalent.

- Conventional double glazing to other habitable rooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent.

- Acoustic trickle ventilators such as Greenwood MA3051 wall-mounted vents or the acoustic equivalent to bedrooms facing the delivery bay and trickle ventilators such as Greenwood 5000EA to all other habitable rooms.

- Ceilings on the upper floor constructed from two layers of 12.5mm plasterboard.

7.4 Other Dwelling Elevations at East Side of Site

Dwellings facing the east boundary of the site at positions further north than the supermarket delivery bay will be shielded from delivery noise by the supermarket buildings. The sound insulation specifications of these elevations can be reduced to:

- Conventional double glazing to all habitable rooms including bedrooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent.

- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.

- Ceilings on the upper floor constructed from a single layer of 12.5mm plasterboard.

7.5 **Gardens**

The outdoor sound levels at the east side of the open site facing the delivery bay exceed the guidelines on outdoor levels in gardens as summarised in 2.1 of this report and receive adverse impact from delivery sound. On the developed site as currently proposed all rear gardens will be shielded from delivery sound by the dwelling buildings, with the exception of a small group of dwellings proposed in the extreme southeast corner of the site. The front elevations of dwellings at the southern end of the east boundary will receive delivery sound.

In order to achieve the “desirable” situation described in BS 8233 for private gardens, usually interpreted as rear gardens where relaxation and privacy is expected, and to reduce the exposures of the dwellings and open space in this area to delivery sound it is recommended that an outdoor barrier of height at least 2.0m in the form of an earth bund, imperforate fence or a combination of these is provided along the eastern edge of the open space proposed at this part of the site.. Recommendations on the specifications of the fences are given in section 10.5 of this report.

Dwellings, gardens and open spaces at the east side of the site with a view of the supermarket car park but not the delivery bay have outdoor sound levels within the “desirable” limit and do not need any sound mitigation in the form of acoustic fences or bunds.

8.0 Northeast Corner of Site Adjacent to Bleachcroft Way

There are two existing commercial units and the vacant former premises of B&Q at the northeast corner of the site adjacent to Bleachcroft Way. The commercial units are occupied by Blakemore Wholesale and Wilsons Carpets. The Masterplan shows proposed dwellings adjacent to the boundaries with Blakemore Wholesale and facing the car park of the vacant B&Q premises.

8.1 Survey Results

Sound measurements were taken at the position of proposed dwelling elevations nearest to the front service yard of Blakemore Wholesale. The only audible sound from either of the commercial premises was during the daytime survey periods 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 and for this reason the results of our 2009 survey are combined with the current results for this position on the development site.

Sound Descriptor		**Daytime**		**Night**	
		1000-1100	**1400-1500**	**2330-0030**	**0200-0230**
Ambient	LA_{eq}	47.6	45.2(2009)	38.1	36.4(2009)
Background	LA_{90}	44.0	39.7(2009)	35.2	33.0(2009)
Maximum	LA_{max}	59.5	62.8(2009)	54.4	44.3(2009)

Sound frequency spectra are shown below of the highest results of day and night L_{eq} and the night L_{max} results, inclusive of the 2009 and 2016 surveys:

Sound pressure levels dB linear:

Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Daytime Leq	56.3	47.4	42.0	42.7	44.2	39.8	32.3	24.7
Night Leq	52.2	46.3	38.8	37.2	38.9	32.2	29.5	19.6
Night Lmax	68.2	59.4	50.7	53.9	52.1	53.1	54.8	36.0

8.2 Dwelling Elevations at Northeast Corner of Site

Dwellings at the northeast corner of the site adjacent to Bleachcroft Way will achieve the interior sound targets against existing outdoor sound sources by the following specifications:

- Conventional double glazing to all rooms including bedrooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent.
- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.
- Ceilings on the upper floor constructed from a single layer of plasterboard.

8.3 Gardens

The gardens of these dwellings have outdoor sound levels within the "desirable" limit and do not need any sound mitigation in the form of acoustic fences.

9.0 Site Centre

9.1 Survey Results

Sound measurements were taken at the centre of the open site.

Sound Descriptor		**Daytime**		**Night**	
		1100-1200	**1600-1700**	**2200-2230**	**0100-0130**
Ambient	LA_{eq}	46.0	42.8	38.4	37.3
Background	LA_{90}	42.4	39.6	34.6	35.2
Maximum	LA_{max}	61.4	55.3	55.1	54.5

Sound frequency spectra are shown overleaf of the highest results of day and night L_{eq} and the night L_{max} results:

Sound pressure levels dB linear:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Daytime Leq	55.9	47.0	34.5	38.4	43.0	37.8	32.6	28.1
Night Leq	53.4	43.7	34.8	37.0	39.7	31.4	24.6	19.8
Night Lmax	66.0	54.8	49.6	54.7	53.2	54.4	56.1	43.9

9.2 Dwelling Elevations at Site Centre

Dwellings at the site centre generally and at all positions other than those described in sections 5.0 to 8.0 will achieve the interior sound targets against existing outdoor sound sources by the following specifications:

- Conventional double glazing to all rooms including bedrooms consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4A) or the acoustic equivalent.

- Trickle ventilators such as Greenwood 5000EA to all rooms including bedrooms.

- Ceilings on the upper floor constructed from a single layer of plasterboard.

9.3 Gardens

The gardens of these dwellings have outdoor sound levels within the “desirable” limit and do not need any sound mitigation in the form of acoustic fences.

10.0 Summary of Sound Insulation Specifications

The recommended sound insulation specifications given in sections 5.0 to 9.0 are summarised below for convenience.

10.1 Glazing

4-16-10
Double glazing consisting of one pane of 4mm float glass and one pane of 10mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-10) or the acoustic equivalent to:

- bedrooms facing the railway
- bedrooms facing the supermarket delivery bay

4-16-6
Double glazing consisting of one pane of 4mm float glass and one pane of 6mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-6) or the acoustic equivalent to:

- bedrooms facing GA Kelly Fruit Sales and Barnsley Food Supplies

4-16-4
Conventional double glazing consisting of two panes of 4mm float glass separated by a 12mm or 16mm airgap (eg. 4-16-4) or the acoustic equivalent to:

- all other habitable rooms

10.2 Trickle Ventilators

Acoustic vents
Acoustic trickle ventilators such as Greenwood MA3051 wall-mounted vents or the acoustic equivalent to:

- bedrooms facing the railway
- bedrooms facing GA Kelly Fruit Sales and Barnsley Food Supplies
- bedrooms facing the supermarket delivery bay

Conventional vents
Trickle ventilators such as Greenwood 5000EA to

- all other habitable rooms.

10.3 Ceilings

Double boarded
Ceilings on the upper floors constructed from two layers of 12.5mm plasterboard to:

- dwellings adjacent to the railway
- dwellings adjacent to the supermarket delivery bay

Single boarded
Ceilings on the upper floors constructed from a single layer of plasterboard to:

- all other dwellings.

10.4 Notes on Glazing Specifications

If alternative glazing specifications are being sourced then the sound reduction indices at each sound frequency must be examined as in the calculations of Appendix 1 to this report. The use of single-figure indices such as R_w, R_a, R_{tra}, etc. will not provide sufficient information on which to base an alternative specification.

The calculations and specifications of windows are based on the sound insulation properties of the glazing alone. When fitted into frames in situ in a building elevation there may be a reduction in overall performance, particularly if the frames incorporate large opening casements for access onto balconies. Some window frame manufacturers can supply test data on their frames with various glazing fitted, and it is recommended that this is checked and found to be equivalent to the acoustic performance of the specified glazing.

10.5 Acoustic Fence Specifications

Fences to an acoustical standard of height at least 2.0m are recommended along the following boundaries of gardens:

- adjacent to the railway
- with a direct view of the service yard to GA Kelly and BFS
- with a direct view of the supermarket delivery bay

Where a fence is to be used to reduce sound transmission then it must be completely imperforate with no airgaps. Overlapped or tightly butted

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. Timber of normal specification and thickness to form a garden fence eg. 18mm softwood would provide sufficient mass for this application. 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.

11.0 **Impact of Sound from Commercial Premises**

The impact of sound caused by sources at the commercial premises would normally be assessed by the rating method of BS 4142. In order to carry out assessments of the commercial sound levels to the method of the current BS 4142: 2014 it would be necessary to have a finalised site layout of the residential development and full cooperation of the operators of the commercial premises so that the sound sources and particularly the intermittency of delivery activities can be quantified.

The method of BS 4142 relies on a comparison between the levels of commercial sound and the background sound levels as summarised in 2.5 of this report. At this location the background sound levels are particularly low at night. From the tentative results on sound levels from the commercial premises as measured during this survey it is anticipated that a full BS 4142 assessment on the developed site is likely to conclude that there would be “adverse impact” but lesser than “significant adverse impact” at dwellings adjacent to the commercial premises.

The proposals for the external sound insulation to dwellings and the provision of acoustic fences along some boundaries will ensure that the usual acceptance criteria will be achieved inside dwellings and in gardens. For this reason it may be that a BS 4142 assessment against the natural background levels is not required. If a full BS 4142 survey is required then it would need to be carried out at a later stage as described above.

The corresponding assessments in terms of the NPPF summarised in 2.4 of this report is that the impact of existing sound sources on the proposed residential development would greater than the Lowest Observable Adverse Effect Level (LOAEL) but lesser than the Significant Observed Adverse Effect Level (SOAEL).

APPENDIX A

INTERIOR SOUND CALCULATIONS

MORE RIGOROUS CALCULATION METHOD OF BS 8233: 2014

The method in BS 8233:2014 requires certain building parameters to be known or assumed as part of the calculation procedure. The parameters that have been used in this calculation are taken for typical residential rooms as shown in the table below:

Areas of building elements

Building Element	Area (m^2)
Reference absorption A_0	10
Total façade area S_f	7.8
Window area S_{wi}	2.8
External Wall area S_{ew}	5.0
Ceiling area S_{rr}	13.5
Total area $S = S_f + S_{rr}$ calculated	21.3

The sound reduction indices of the recommended elevation building specifications given in section 5.2 and 5.3 are:

Sound reduction indices. dB

Frequency (Hz)	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Outer Walls	34	41	45	50	56	65	69	72
4-16-4 glazing	18	22	20	26	36	39	31	35
4-16-10 glazing	24	28	23	32	38	42	44	48
5000EA ventilator	32	41	40	34	47	43	47	48
MA3051 Acoustic Vent	45	48	46	49	54	65	66	68
Ceiling R	35	40	46	51	55	52	54	56

A1.1 Dwelling Elevations Facing Railway- Daytime

The overall outdoor-to-indoor sound level difference represented by the building elements is calculated using the method in BS 8233:2014 as:

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Overall Loss	20	25	24	29	39	39	35	39

The calculations involved in obtaining the 'Overall Loss' are lengthy, so the workings are omitted from this report for conciseness and readability. All calculations are held on disk and can be provided if necessary.

The worst-case internal daytime sound levels in residential rooms are calculated in the table below:

Sound pressure levels. dB LL_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	62.0	59.1	47.5	55.3	57.1	53.2	46.0	36.6
Calculated Loss	20	25	24	29	39	39	35	39
Indoor SPL	42	35	24	27	18	14	11	-3
A weighted	16	19	15	24	18	16	13	-5

The overall level represented by the above spectrum is **27 dB LA_{eq},** which is the worst-case predicted sound level inside habitable rooms caused by existing external sound sources between 0700 and 2300 hours.

A1.2 Dwelling Elevations Facing Railway - Night

The worst-case internal sound levels at night (2300-0700 hours) in bedrooms with windows adjacent to and facing the railway are:

Sound pressure levels. dB LL_{max}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	84.3	84.7	71.6	79.0	82.7	77.6	70.0	63.3
Calculated Loss	26	30	27	36	42	46	48	53
Indoor SPL	59	55	45	43	41	32	22	11
A weighted	33	39	36	40	41	34	24	9

The overall level represented by the above spectrum is **45 dB LA_{max}** which is the predicted worst-case maximum sound level in bedrooms caused by existing external sound sources between 2300 and 0700 hours. The equivalent night time-averaged sound level inside bedrooms is **14 dB LA_{eq}.**

A2.1 Dwelling Elevations Facing Commercial Units - Daytime

The worst-case internal daytime sound levels in residential rooms are calculated in the table below:

Sound pressure levels. dB LL_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	63.5	54.3	51.8	50.6	50.8	46.3	42.0	36.2
Calculated Loss	20	25	24	29	39	39	35	39
Indoor SPL	43	30	28	22	11	7	7	-3
A weighted	17	14	19	19	11	9	9	-5

The overall level represented by the above spectrum is **24 dB $LA_{eq,}$** which is the worst-case predicted sound level inside habitable rooms caused by existing external sound sources between 0700 and 2300 hours.

A2.2 Dwelling Elevations Facing Commercial Units - Night

The worst-case internal sound levels at night (2300-0700 hours) in bedrooms with windows adjacent to and facing the commercial units are:

Sound pressure levels. dB LL_{max}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL	76.4	74.1	73.8	70.7	71.2	66.6	64.9	61.8
Calculated Loss	21	25	26	29	41	40	43	46
Indoor SPL	56	49	48	41	30	27	22	16
A weighted	30	33	39	38	30	29	24	14

The overall level represented by the above spectrum is **43 dB LA_{max}** which is the predicted worst-case maximum sound level in bedrooms caused by existing external sound sources between 2300 and 0700 hours. The equivalent night time-averaged sound level inside bedrooms is **21 dB LA_{eq}.**

A3.1 **Dwelling Elevations Facing Supermarket Delivery Bay**

The worst-case internal sound levels at night (2300-0700 hours) in bedrooms with windows adjacent to and facing the delivery bay of the supermarket are:

Sound pressure levels. dB LL_{max}

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
Calculated Loss	26	30	27	36	42	46	48	53
Indoor SPL	48	39	43	34	30	17	14	6
A weighted	22	23	34	31	30	19	16	4

The overall level represented by the above spectrum is **38 dB LA_{max}** which is the predicted worst-case maximum sound level in bedrooms caused by existing external sound sources between 2300 and 0700 hours. The equivalent night time-averaged sound level inside bedrooms is **14 dB LA_{eq}** and the daytime time-averaged sound level inside living rooms is **30 dB LA_{eq}**.

The interior levels in bedrooms show considerable margins within the design targets but these are recommended in order to counter the additional annoyance to residents that would be possible at higher maximum LA_{max} values because of the impulsive character of the delivery noise at night.

APPENDIX B

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 and Stephen Garritt.

David Garritt has been a member of the Institute of Acoustics since 2005 and holds an honours degree in Electronic and Computer Systems Engineering. Stephen Garritt has been a member of the Institute of Acoustics (MIOA) since 1977 and holds an honours degree in Electrical Engineering. David and Stephen Garritt both teach acoustics at post graduate level on a part time basis.

Stephen and David have extensive experience in the preparation of surveys involving industrial sound sources directly comparable to the subject of this report.

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	29.09.17	CDK1307592
Microphone	4189 s/n 2395266	Bruel & Kjaer	29.09.17	CDK1307592
Calibrator	4231 s/n 2402706	Bruel & Kjaer	22.09.16	CDK140573

APPENDIX C – MEASUREMENT LOCATIONS



APPENDIX D – NOISE BARRIER PLAN

