

ADDENDUM TO REPORT

of

SOUND ASSESSMENTS

at

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

Dates of measurements: 8th, 9th & 11th September 2016
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1.0 **Summary and Conclusions**

Our report dated 21st November 2016 described the sound levels at the site of a proposed residential development on land off Bleachcroft Way, Stairfoot, Barnsley. There are commercial premises adjacent to the site that could not be visited during the 2016 survey such that an impact assessment to the method of BS 4142 could not be carried out fully at that time. The LPA has now asked for a BS 4142 survey and this forms the subject of this addendum to the report.

1.1 The typical outdoor sound levels from commercial sources as affecting the nearest proposed dwellings were measured at:

- 42-55 dB LA_{eq} (1-hour) during the daytime and 45-58 dB LA_{eq} (15-min) at night from goods deliveries to the supermarket,
- 45 dB LA_{eq} (1-hour) the daytime from the home delivery van area and 46 dB LA_{eq} (1-hour) from 07.00-08.00 hours during van horn checks at the supermarket,
- 43 dB LA_{eq} at all times from fixed plant at the supermarket
- 42-43 dB LA_{eq} (1-hour) during the daytime from the car park,
- 50-51 dB LA_{eq} (1-hour) during the daytime and 53-54 dB LA_{eq} (15-min) at night from G.A. Kelly Fruit Supplies.

1.2 The average background levels during our survey periods were 43 dB LA₉₀ during the daytime and 34 dB LA₉₀ at night,

1.3 It is proposed to erect acoustic fences and earth bunds to shield the proposed dwellings from the commercial sound sources. With these in place the commercial sound levels are rated at

- Below the daytime background at all dwellings across the site except during the one-hour period from 07.00 to 08.00 when van horns are tested daily at the supermarket, and at some dwellings facing G.A. Kelly that cannot be practicably shielded by fences or bunds. The daytime rating levels are 3-4 dB above background in these situations.
- 3-10 dB above the night background at dwellings along the east boundary and up to 23 dB above the night background at dwellings facing G.A. Kelly.

1.4 The assessment method of BS 4142 calls for consideration of the “context” of the application. This includes “whether dwellings used for residential purposes incorporate design measures that secure good internal or outdoor acoustic conditions”. In this residential application the measures specifically described in this reference to “context” are all incorporated into the design proposal and will counter the exceedances above background that are summarised above.

2.0 **Planning Requirements on Noise**

Our report dated 21st November 2016 referred to the guidance given in BS 8233, the World Health Organisation and the National Planning Policy Framework. There is no change in these documents or in the sound insulation recommendations given in our report. The purpose of this addendum is to complement the findings of the report by assessing the outdoor sound levels caused by nearby commercial premises in accordance with the method of BS 4142.

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 commercial premises under consideration and measure the background sound level typical of that location in the absence of the commercial sound. A correction factor is applied if appropriate to the commercial 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 **Tesco Supermarket**

The Tesco supermarket adjacent to the east boundary of the site 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 bays to the premises and the area designated for loading home delivery vans are in the elevation of the store facing the east boundary of the proposed development site. The car park of the store is also adjacent to the east boundary of the site. Fixed plant for refrigeration and air handling is located on the roof of the store with the addition of five chiller condenser units near ground level on the elevation facing the development site.

3.1 **Goods Delivery Bays**

Delivery vans enter the service yard, turn and reverse on to the bays, are unloaded then depart direct from the bays onto the highway. Vans are unloaded directly into the two delivery bays from the rear doors of visiting vans. There are no forklift truck, pallet truck or hand wheeled cages in the outdoor service yard.

We were provided with the planned delivery schedule for Wed/Thurs 4th/5th October 2017 that showed deliveries at 12.10, 16.59, 19.06, 21.59, 22.59, 00.00, 00.59, 01.00, 05.47 & 06.45 hours with two further deliveries to be arranged as needed between 00.00 and 00.60. This shows that there are typically no more than one delivery during the daytime assessment period of one hour or the night assessment period of 15 minutes.

Specific Sound Levels

Sound levels from two non-refrigerated deliveries and one refrigerated delivery were monitored by direct measurement at the position of the nearest proposed dwelling. Cages of goods were wheeled by hand from HGVs directly into the supermarket storeroom. It was noted that sound levels of 56-58 dB LA_{eq} and 60-67 dB LA_{max} were generated when cages of goods were wheeled from HGVs into the bay and greater maximum levels at 65-70 dBA L_{max} were generated when empty cages were wheeled from the delivery bay into HGVs.



The ambient sound levels at the position of the nearest proposed dwellings were 55.8, 57.7 & 47.6 dB LA_{eq} during the whole periods of delivery that included arrival and turning of the HGV, unloading/loading and departure, normally around a 30 minute duration overall. Residual sound levels with no deliveries during these periods were 44-45 dB LA_{eq}.

It is concluded that the sound levels created by the deliveries alone were 45-58 dB LA_{eq} (corrected to the nearest whole decibel) and of duration around 30 minutes. In the assessment periods of one hour during daytime and 15 minutes at night the **specific sound levels from goods deliveries are typically 42-55 dB LA_{eq} (1-hour) during daytime and 45-58 dB LA_{eq} (15-min) at night.**

3.2 **Home Delivery Vans**

The home delivery service is a recent and developing method of shopping that is believed to be more active now than during our previous survey. The service has 14 fridge vans that are based and loaded in an area adjacent to the east boundary of the development site. The fridge van area is bounded on its west and south sides by car-port type structures that shield the van area from the development site. Each van is put through a series of checks between 07.00-08.00 hours that include sounding the van horn briefly. The vans are loaded then leave at around 08.00 hours, return sporadically, are reloaded and return throughout the working day. The total number of van movements in and out is typically 150 per day.



Specific Sound Levels

Sound levels were measured during a period of normal activity in which three vans were parked and being loaded, and two other vans entered the compound and parked. Sound sources were van movements, white noise type reverse alarms, trolley crates being wheeled and impacted together, doors closing and onboard fridges running intermittently

Source	Sound Level dB LA _{eq}	Distance
Roving measurement around all sources (1)	67.3	20m
Roving measurement around all sources (2)	64.5	20m
Fridge running on parked van (1)	73.6	2m
Fridge running on parked van (2)	72.8	2m
Horn test (2-second measurement period)	86.6	10m

A calculation is shown in Appendix A.1 to this report that takes account of the distance to the nearest proposed dwellings, the time durations of the sound emissions and the shielding effect of the car-port type structures from which it is concluded that the **specific sound levels from the home delivery van area are typically 45 dB LA_{eq} (1-hour) during typical daytime activities and 46 dB LA_{eq} (1-hour) from 07.00-08.00 hours during van horn checks.**

3.3 Fixed Plant Items

The majority of fixed plant is mounted on the roof of the store with lines of sight to the proposed dwellings broken only by the edges of the roof. There are also five small chiller condensers mounted near ground level on the elevation of the store facing the development site.





Specific Sound Levels

Measurements of the sound levels near the roof-mounted plant were restricted for safety reasons to permitted walkways on the store roof. Roving measurements across the roof area showed that the plant sound emissions are relatively uniform, being typically 61 dB LA_{eq} at 5m from plant items across the roof area. Individual measurements at 3m from single plant items on the roof were taken where available at 67-69 dB LA_{eq}. The sound levels from the ground level chillers were secondary, being 46-51 dB LA_{eq} at 1m distance.

A measurement taken on the development site at the nearest proposed dwelling to the store building and the fixed plant showed a result of 46.9 dB LA_{eq}. Plant sound was clearly audible within this result but there were contributions from other sources such as the car park, foliage sound and birdsong. The continuous sound level at this position was 42.8 dB LA₉₀.

Calculations are shown in Appendix A.2 to this report from which it is concluded that the **specific sound level from fixed plant items is typically 43 dB LA_{eq} (1-hour) during daytime and 43 dB LA_{eq} (15-min) at night.**

3.4 Car Park

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. The overall sound level from all sources affecting this position was measured at 46.9 dB LA_{eq} as described in 3.3 above. After allowing for the contributions from fixed plant and other sources, the **specific sound level from the car park is estimated at 42-43 dB LA_{eq} (1-hour) during daytime. There is no car park sound at night.**

4.0 G.A. Kelly Fruit Sales

G.A. Kelly are fruit wholesalers occupying the nearest industrial unit to the development site at the northern boundary. There are no changes to the sound sources or activities at the premises since our previous report. The premises is used for the wholesale distribution of food at ambient temperatures so there is no refrigeration plant. Working hours are 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.



Specific Sound Levels

Sound measurements were taken during the daytime and at night at the position of proposed dwelling elevations at 15m inside the site boundary facing the outdoor service yard of G.A. Kelly. The daytime measurement period included delivery vehicles to both G.A. Kelly and to the adjacent Barnsley Food Supplies but the highest sound levels were caused by deliveries to G.A. Kelly. A conventional forklift truck was in use at G.A. Kelly and an electric forklift truck at Barnsley Food Supplies. A delivery to G.A. Kelly by articulated lorry was observed and measured during our night survey period.

The results during deliveries to G.A. Kelly showed 53-54 dB LA_{eq} and were of 30 minutes duration against residual levels with no deliveries at 41-47 dB LA_{eq}. In the assessment periods of one hour during

daytime and 15 minutes at night the **specific sound levels from G.A. Kelly are typically 50-51 dB LA_{eq} (1-hour) during daytime and 53-54 dB LA_{eq} (15-min) at night.**

5.0 **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. Sound from the premises is not problematic to the residential development. 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 and found to be secondary to that from the adjacent premises of G.A. Kelly. There was no audible sound emitted from the premises during our night survey period.

6.0 **Office Buildings at North of Site**



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.

Sound measurements at the position of the proposed dwellings located opposite the office buildings showed that the highest sound levels at this position were caused by deliveries to G.A. Kelly Food Supplies.

7.0 **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.

8.0 **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.

9.0 **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.

10.0 **Background Sound Levels**

It has been agreed with the Environmental Health Officer who is handling this application that the results of background sound levels taken during our previous survey remain current and can be used in this latest assessment. The background sound levels were measured at the following values and positions:

Position on Site	Time of Day	Sound Level dB LA ₉₀
Daytime		
Nearest plot to Tesco delivery bay	13.02-13.17	40.4
Nearest plot to Tesco fixed plant	13.28-13.43	42.8
North of site	14.29-14.44	44.0
Opposite GA Kelly & BFS	14.50-15.05	43.4
West of site near railway (no trains)(1)	15.12-15.27	45.5
West of site near railway (no trains)(2)	15.30-15.45	43.6
Site centre	12.09-12.24	42.4
South of site	12.30-12.45	41.6
Night		
Nearest plot to Tesco fixed plant	00.04-00.19	42.6
North of site	02.10-02.25	33.0
Opposite GA Kelly & BFS	23.55-00.10	35.2
West of site near railway (no trains)(1)	23.05-23.20	33.4
West of site near railway (no trains)(2)	23.27-23.42	32.7
Site centre	00.40-00.55	35.0

The averages of the above values are **43.0 dB LA₉₀ during the daytime and 33.9 dB LA₉₀ at night**, ignoring the night result near Tesco that was raised by the operation of fixed plant items at the store.

The microphone height for all measurements was 1.2m to 1.5m above ground level. Conditions during the daytime survey period on 8th September 2016 were dry with a wind speed of 0-4 m/s, temperature of 18-21°C and generally 10% cloud cover. At night on 8th September there was no rain, a wind speed 3-4 m/s, temperature of 13°C and around 70% cloud cover. The survey period on Sunday 11th September 2016 was dry with a wind speed of 3-4 m/s, temperature of 16°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.

11.0 **BS 4142 Assessment - Tesco Supermarket**

11.1 **Sound Rating Levels**

The specific sound levels from the Tesco supermarket are:

- up to 55 dB LA_{eq} during the daytime and up to 58 dB LA_{eq} at night from the delivery bays,
- 45 dB LA_{eq} during daytime from the home delivery area, no sound at night,
- 46 dB LA_{eq} during the period 07.00 to 08.00 from the home delivery area when the van horns are tested,
- 43 dB LA_{eq} at all times of day and night from fixed plant,
- 43 dB LA_{eq} during daytime from the car park, no sound at night,

The sound from the delivery bays has characteristics that are neither tonal nor impulsive but are readily distinctive at the nearest proposed dwellings against the residual acoustic environment. A penalty of 3 dB is applied to sound from the delivery bays by the method of BS 4142.

Sound from the fixed plant items has a tonal character that is clearly perceptible against the night time residual level at the nearest proposed dwellings but not perceptible against the daytime residual level. A penalty of 4 dB is applied to the plant sound levels at night.

Sound from the home delivery area and the car park exists only during the daytime and has no discernible characteristics except during the first hour of daytime from 07.00 to 08.00 when all of the 14 van horns are tested. The maximum value of these is 60 dB LA_{max} at the nearest proposed dwellings and has a highly perceptible tonal character. A penalty of 6 dB applies to the sound from the home delivery area between 07.00-08.00 hours. The sound rating levels are:

Source	Daytime	Night
Delivery bays	58 dB	61 dB
Home delivery area	45 dB	n/a
Home delivery area 0700-0800	52 dB	n/a
Fixed plant	43 dB	47 dB
Car park	43 dB	n/a

11.2 **Comparison With Background**

Sound from the supermarket affects the east boundary of the development site generally but with the localised area adjacent to the delivery bays affected by sound from them. The BS 4142 comparisons are categorised into dwellings at the east boundary generally and dwellings specifically adjacent to the delivery bays.

Dwelling Position	Rating Level dB	Background Level LA₉₀	Comparison v. Background
Daytime			
East boundary	43-45	43	0-2 dB above
East boundary 0700-0800	52	43	9 dB above
Adjacent to delivery bays	58	43	15 dB above
Night			
East boundary	47	34	13 dB above
Adjacent to delivery bays	61	34	27 dB above

11.3 **Assessment with Mitigation in Place**

Mitigation of the sound levels from the supermarket is proposed by erecting an earth bund with an acoustic fence along its ridge along the boundary near the delivery bays and extending the fence along the existing ridge of the former watercourse at the northern end of the east boundary. Calculations of the sound levels at the nearest dwellings to the supermarket are given in Appendix A.1 to A.4 of this report. The predicted sound rating levels with the mitigation in place are:

Source	Daytime	Night
Delivery bays	38 dB	44 dB
Home delivery area	40 dB	n/a
Home delivery area 0700-0800	47 dB	n/a
Fixed plant	35 dB	37 dB
Car park	32 dB	n/a

Comparisons between the sound rating levels and the background levels are shown overleaf.

Dwelling Position	Rating Level dB	Background Level LA₉₀	Comparison v. Background
Daytime			
East boundary	35-40	43	3-8 dB below
East boundary 0700-0800	47	43	4 dB above
Adjacent to delivery bays	38	43	5 dB below
Night			
East boundary	37	34	3 dB above
Adjacent to delivery bays	44	34	10 dB above

11.4 **Conclusions with Mitigation in Place**

The conclusions at the proposed dwellings along the east boundary of the site, based on the above predictions with mitigation in place, are:

- “Low impact” from all sources at the supermarket during the daytime except during the hour from 07.00 to 08.00 when van horns are tested and the assessment then approaches “adverse impact”.
- Impact that is greater than “low” but less than “adverse” from all sources at the supermarket at night except at dwellings near the delivery bays where the assessment is predicted at “significant adverse impact”.
- However one component of the “significant adverse impact” near the delivery bays at night is the low background sound levels. The predicted outdoor sound level at the dwellings is 41 dB LA_{eq} (without the penalty correction of the BS 4142 method). After translating this to a sound level in bedrooms through windows with casements open for ventilation, the indoor level is lower than the recognised threshold at which sleep disturbance usually occurs. (Based on guidance from the World Health Organisation).
- The assessment method of BS 4142 calls for consideration of the “context” of the application. This includes “whether dwellings used for residential purposes incorporate design measures that secure good internal or outdoor acoustic conditions”. In this residential application the measures specifically described in this reference to “context” are all incorporated into the design proposal.

12.0 **BS 4142 Assessment - G.A. Kelly Fruit Sales**

12.1 **Dwellings at Northwest Corner of Site**

The sound levels at the northwest corner of the site were measured at 50-51 dB LA_{eq} (1-hour) during the daytime and 53-54 dB LA_{eq} (15-min) at night. It is proposed to erect an acoustic fence along this part of the north boundary as shown on the site layout plan which will shield the proposed dwellings from noise generated at G.A. Kelly. With a 2m high acoustic fence in place the daytime levels are predicted at 40 dB LA_{eq} (1-hour) and thereby below the 43 dB LA₉₀ background. The daytime assessment is predicted as “low impact”.

The fence would not mitigate sound at night since the receiving position is at bedroom window height. The sound from G.A. Kelly has characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment, and so a penalty of 3 dB is applied. The sound rating level would be 57 dB at night and thereby 23 dB above the 34 dB LA₉₀ background. The BS 4142 conclusions at these dwellings with the fence in place 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.

12.2 **Dwellings Facing Public Open Space**

The dwellings proposed at the north of the site facing a public open space will have direct lines of sight to the premises of G.A. Kelly but at progressively greater distances from it than the dwellings considered in 12.1 above. The sound levels at the nearest of these are predicted at 46 dB LA_{eq} (1-hour) during the daytime and 49 dB LA_{eq} (15-min) at night. The site layout is such that the dwelling buildings will shield their rear private gardens from sound generated at G.A. Kelly but the front elevations facing the open space will be unshielded.

The daytime sound levels are predicted at 3 dBA above the background at the front elevations of the dwellings and at least 5 dBA below the background at the rear. At night the sound rating level at the front elevations is predicted at 52 dB and thereby 18 dB above the night background. As in 12.1 above, 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.

13.0 **Acoustic Fence Specifications**

Fences to an acoustical standard of height at least 2.0m are proposed as shown on the site layout plan. 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.

The proposal includes acoustic fences to protect the rear gardens at the west boundary of the site from railway sound. This is described in our original report but does not form part of a BS 4142 assessment.

APPENDIX A

SOUND LEVEL CALCULATIONS

A.1 Home Delivery Vans at Tesco

Roving measurements around all sources during normal activities in the home delivery van area had results of 67.3 and 64.5 dB LA_{eq} at 20m distance. The distance to the nearest proposed dwellings is nominally 70m and the decay over this distance is given by the formula:

$$\text{decay} = 20 \log (70/20) \text{ dBA} = 10.9 \text{ dBA}$$

The activity area is shielded from the development site by the car-port type structures. The sound attenuation of these will depend upon the position of the sound sources relative to them, which will be variable, but the minimum attenuation will be 10 dBA as advised in BS 5228 Annexe F section F.2.2.2.1 (c) for situation where the screen completely hides the sound sources from the receiver.

Subtracting the distance decay of 10.9 dBA and the minimum shielding attenuation of 10 dBA off the average measured result at 20m distance gives a prediction of outdoor sound at the nearest proposed dwellings, caused by sources in the home delivery van area of:

$$65.9 - 10.9 - 10 = 45.0 \text{ dB LA}_{eq}$$

The activities and sound sources witnessed during our survey can take place throughout the daytime assessment period of one hour, so the specific sound level is predicted at 45 dB LA_{eq}(1-hour).

Horn Checks

The exercise of checking the operation of horns was measured during our survey at 86.6 dB LA_{eq} at 10m distance over a measurement period of 2 seconds per horn. There are 14 such horn checks daily in the hour between 07.00 and 08.00 hours. The overall sound level from the horn checks is 65.5 dB LA_{eq}(1-hour) at 10m distance. The distance decay to the nearest proposed dwelling is 16.9 dBA and the minimum shielding attenuation of 10 dBA will apply. The prediction at the nearest proposed dwellings is:

$$65.5 - 16.9 - 10 = 38.6 \text{ dB LA}_{eq}(1\text{-hour}).$$

A.2 **Fixed Plant Items at Tesco**

The roving sound measurements around the fixed plant items on the roof of the store showed a result of 61.0 dB LA_{eq} at an average distance of 5m the sound sources. The overall length of the 'line source' of sound was 50m and the distance from it to the nearest proposed dwellings is 75m. The decay of sound over outdoor distances from this line source is given by the formulae:

$$\text{decay}_{(1)} = 10 \log (16/5) = 5.1 \text{ dB}$$

over the distance of 5m to 16m from the plant where it acts as a line source,

$$\text{decay}_{(2)} = 20 \log (75/16) = 13.4 \text{ dB}$$

over the distance from 16m to 75m from the plant where it acts as a point source.

The overall outdoor decay of sound is $5.1 + 13.4 = 18.5 \text{ dB}$

The sound level at the nearest proposed dwellings is calculated at:

$$61.0 - 18.5 = 42.5 \text{ dB LA}_{eq}$$

The sound generated by the plant is continuous throughout all periods of day and night.

A.3 **Attenuation of Proposed Bund & Fence on East Boundary**

The sound reduction caused by outdoor barriers is quantified in BS 5228 Figure F.3. For the proposed bund and fence on the east boundary of this site the tentative dimensions will be:

Sound Source	Effective Barrier Height	Distances (m)			Path Difference
		a	b	c	
Plant items	1.0m	37.015	38.014	75.000	0.029m
Delivery bays	4.0m	13.601	35.228	48.000	0.829m
Van horns	2.0m	20.100	26.077	46.000	0.177m
Car park (nearest part)	2.0m	30.067	26.077	56.000	0.144m

The sound frequency spectra, distance decays, barrier attenuations and predicted sound levels at dwellings are shown overleaf.

A.3.1 Plant Items

The sound levels of plant items were measured at 5m distance

Sound pressure levels. dB LL_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL at 5m	74.1	69.5	61.8	58.7	55.2	49.6	44.4	38.4
Distance decay	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5
Barrier attenuation	5.0	5.0	7.0	8.0	9.0	10.0	12.0	14.0
SPL at dwellings LLeq	50.6	46.0	36.3	32.2	27.7	21.1	13.9	5.9
SPL at dwellings LAeq	25	30	27	29	28	23	15	4

The overall sound level at the nearest dwellings represented by the above spectrum is **35 dB LA_{eq}**. The A-weighted spectrum suggests that there will be a tonal component at 125 Hz that will be just barely perceptible above the 34 dB LA₉₀ night background level.

A.3.2 Delivery Bays

The sound levels from deliveries to the bays were measured directly at the position of the nearest proposed dwellings. The greatest of the results at 57.7 dB LA_{eq} is used in these calculations.

Sound pressure levels. dB LL_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Existing at dwellings	66.2	60.1	59.7	54.4	54.0	48.5	43.0	31.2
Barrier attenuation	9.0	11.0	14.0	17.0	20.0	23.0	23.0	23.0
Predicted at dwellings	57.2	49.1	45.7	37.4	34.0	25.5	20.0	8.2

The overall sound level at the nearest dwellings represented by the above spectrum is 41 dB LA_{eq}. After time-averaging as described in 3.1 the specific sound levels are **38 dB LA_{eq} (1-hour) during daytime and 41 dB LA_{eq} (15-min) at night.**

A.3.3 Van Horns

The sound levels during van horn tests were measured at 10m.

Sound pressure levels. dB LL_{eq}

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outdoor SPL at 10m	64.2	65.5	62.4	75.4	82.9	82.2	72.3	58.6
Distance decay	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
Barrier attenuation	7.0	8.0	9.0	11.0	14.0	16.0	18.0	20.0
SPL at dwellings LLeq	40.3	40.5	36.5	47.5	52.0	49.3	37.4	21.7
SPL at dwellings LAeq	14	25	28	45	52	51	39	20

The overall sound level at the nearest dwellings represented by the above spectrum is 55 dB LA_{eq}. After time-averaging as described in A.1 the specific sound level is **34 dB LA_{eq} (1-hour) during the daytime hour from 07.00 to 08.00**. The A-weighted spectrum suggests that there will be a tonal component at 1k & 2kHz that will be highly perceptible above the 43 dB LA₉₀ daytime background level. This attracts a penalty of 6 dB to the sound from van horn tests.

Applying the same calculation method to the sound from the home delivery area at other times of day gives a prediction of sound reaching the nearest dwellings with the barrier in place at **40 dB LA_{eq} (1-hour) during the daytime other than from 07.00 to 08.00**.

During the hour from 07.00 to 08.00 when there are normal activities in the home delivery area and also van horn tests the specific sound level is $34 + 40 = \mathbf{41\text{ dB LA}_{eq}\text{ (1-hour)}}$ and the sound rating level is 47 dB.

A.4 **Rating Levels at Dwellings near Tesco with Barrier in Place**

After taking account of any tonal or impulsive characteristics of the sound sources and the specific sound levels quantified above with the proposed barrier in place, the sound rating levels are:

Source	Daytime	Night
Delivery bays	38 dB	44 dB
Home delivery area	40 dB	n/a
Home delivery area 0700-0800	47 dB	n/a
Fixed plant	35 dB	37 dB
Car park	32 dB	n/a

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

UNCERTAINTY

It is a requirement of BS 4142: 2014 that the level of uncertainty in data and calculations should be considered. These uncertainties and how they have been minimised are considered in this section.

Sound data on all sources has been based on measurements taken at the premises under investigation under normal operating conditions.

Background sound measurements were taken during daytime and night periods when environmental conditions were suitable. A smaller sample of background measurements has been used than is recommended for a full BS 4142 assessment but this was agreed with the enforcement authority as being adequate for the assessment that is required at this stage.

The addition and subtraction of sound levels was done logarithmically on an energy basis, which is the correct method for decibel calculations. It is anticipated that this method would be considered by other suitably qualified acousticians to be relevant, correct and appropriate for this survey and is a method examined by the Institute of Acoustics on their post graduate diploma course.

All sound level measurements were taken with a calibrated type 1 sound level meter, which represents the most accurate type of SLM available. Sound levels were measured to the nearest 0.1 dB, time periods were measured and recorded to the nearest second. No rounding was done in any calculations, the only rounding being done on final results, in compliance with BS 4142 : 2014. The sound level meter was calibrated before and after each survey period and no drift was apparent.

It is concluded that the uncertainty in this survey has been minimised as far as possible and is believed to be below the level at which it would have an impact on the assessment conclusions contained in this report.