Acoustic South East

BS4142:2014+A1:2019 Assessment

Site: **Unit D, Foundry Close, Horsham RH13 5TX**
Client: **Horsham & District Laundry Ltd**

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Issue 2

Acoustic South East

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Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics BB93 - Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

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1 Introduction & Executive Summary

Acoustic South East have been appointed to undertake a BS4142:2014+A1:2019 assessment in support of a planning application for the extension of operating hours of Horsham & District Laundry Ltd. The site currently has permission to operate 06:00 to 21:00 Monday – Friday and 07:00-13:00 on Saturdays. The business would like to extend Saturday working hours to be allowed to operate from 07:00 -18:00 on Saturdays. The site address is Unit D, Foundry Close, Horsham RH13 5TX

The scope of the current assessment is as follows:

- Measure the background sound pressure levels at the application site at the nearest noise sensitive receptors (NSR).
- Calculate the impact of the partial change of use on the soundscape, with specific regard to the NSR
- Provide mitigation advice (if required.)

Standards and guidance referenced for this assessment include:

- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound
- Planning Noise Advice Document: Sussex, March 2021

Class one sound level meters were used to measure the representative background sound pressure levels (L_{A90}) at the nearest noise sensitive receptors (NSR). The sound surveys measured the soundscape when the site was operational as well as on a Saturday afternoon when the site does not currently operate.

A noise model was created to assess the impact of the application site without the impact of the surrounding business. The Noise model was calibrated to the worst-case hour.

The Rating Level ($L_{Ar,Tr}$) for a worst-case hour of current operations was shown to be 10dB above the existing Saturday afternoon L_{A90} background sound pressure level for the worst affected NSR on Parsonage Road. However, the $L_{Ar,Tr}$ for of the worst affect NSR on Crawford Gardens is 2dB below the existing L_{A90} background sound pressure level.

The report demonstrates how the installation of an acoustic fence to replace the existing wire fence on the north and east facades of the application site will lower the $L_{Ar,Tr}$ for of the worst affected NSR on Parsonage Road to 3dB above the existing Saturday afternoon L_{A90} background sound pressure level.

It is possible that taking into account the mitigation, the context of the site being located on an industrial estate, in addition to the proposal only being a 5-hour extension of current permitted site operations, that planning permission could be considered to be granted on these terms.

2 Context

Acoustic South East have been appointed to undertake a BS4142:2014+A1:2019 assessment in support of a planning application for the extension of operating times of Horsham & District Laundry Ltd. The site currently has permission to operates 06:00 to 21:00 Monday – Friday and 07:00-13:00 on Saturdays. The business would like to extend Saturday working hours to be allowed to operate from 07:00 -18:00 on Saturdays.

This is only an increase of consented operations by 5 hours. The increase is due to the demand from customers for a weekend service, a service the applications site cannot currently fulfil with its limited consented Saturday operating hours.

The site is located on an industrial estate at Foundry Close, Horsham RH13 5TX. The site location map can be seen in the appendices of the report.

2.1 Site Operations

Horsham & District Laundry is a supplier of hotel linen, restaurant linen, towels and bath robes as well as work wear and industrial garments. The business consists of the delivery, collections and cleaning of the aforementioned products.

The business operates 6 vans that conduct the delivery and collection service. The 6 vans depart in the morning, before returning at approximately around lunch time. They depart after lunch before returning before the business closes.

2.2 Sound Sources

In addition to the arrival and departure of the vans there are various sound sources from the site that impact the soundscape.

- 8 intake / extract flues towards on eastern façade
- 4 wall mounted condensers on west facade.

On top of the external fixed plant elements, noise break out from within the unit is audible. In front on the roller shutter doors on the southern façade, noise from metal loading cages is audible as products are loaded onto the vans.

It is also noted that due to the heat produced by the plant within the laundry, the site needs to operate with windows and doors open. This makes the noise from the various internal fixed plant clearly audible externally on the northern and eastern facades.

2.3 Nearest Noise-Sensitive Receptors

While Horsham & District Laundry is located on an industrial estate, there are residential properties directly north of the site (Parsonage Road).

There are also residential properties on Crawford Gardens approximately 50 metres to the south-east of the application site. These properties have an approximately 2-meter fence separating them from the industrial estate.

2.4 Soundscape

The soundscape is dominated by traffic movements and light industrial works from business on the industrial estate.

At the industrial estate's boundary with Crawford Gardens, noise impact from operations at Horsham & District Laundry is not subjectively noticeable above the general activity on the industrial estate.

However, at the boundary between Horsham & District Laundry and Parsonage Road, noise breakout from plant and activities inside the application site is clearly noticeable above the background sound pressure level.

3 Methodology and Approach

The methodology used within the current report has been to conduct an unattended noise survey at the boundary with the nearest noise sensitive properties on Parsonage Road to the north of the site.

A second survey was set up on the south east corner of the application site. Due to security concerns of the sound monitoring equipment, it was not possible to set the sound level meter up on the boundary with Crawford Gardens. It should be noted that the chosen survey location was sheltered from the operations on the industrial estate and on the monitored Saturday afternoon, neither Horsham & District Laundry or its neighbouring business "Smiths" were operating. Southern Counties Glass (a business opposite Horsham & District Laundry) was however operating. Due to the sheltered survey location, it would not be significantly exposed to noise from commercial activities from this business. However, the boundary with Crawford Gardens would be exposed to noise from Southern Counties Glass. Therefore, the survey location at the south east corner of the application site demonstrates a worst-case background sound pressure level for the noise impact from Horsham & District Laundry on the properties at Crawford Gardens to be assessed against.

The survey data will be used to calculate the background sound pressure Level (L_{A90}) for the location during the proposed hours of use on a Saturday afternoon.

Manned measurements of the fixed plant and noise break has been used to create and calibrate a noise model of the site. Traffic movements/deliveries were considered as part of the noise model. The data from the unattended survey locations was used to corroborate the results of the noise model.

The results of the noise model have been assessed against the measured background sound pressure Level (L_{A90}). The calculations for the assessment were conducted in accordance with the methodology stated in BS4142:2014+A1:2019.

4 Relevant Standards and Guidance

4.1 The Behaviour of Sound

In order to appreciate noise reports, it is important to know how sound behaves and propagates. Some details are provided in the following paragraphs.

Sound is measured in decibels (dB) and is often a relative sensation as one sound can mask another.

The dB scale is a logarithmic scale as opposed to a linear scale and it is important to note the following:

- A change in 1dB is not considered noticeable by a human
- A change is 3dB is only just considered noticeable by a human
- A change in 10dB is classed as a doubling or halving of loudness to a human. If a sound is at least 10dB below existing sound levels, it is generally considered that it does not contribute to the existing environment.

Sound emanating from a point source (a stationary object) reduces by 6dB each time the distance from it doubles (this is known as the inverse square law).

Sound emanating from a continuous line source (such as a road or a railway) reduces by 3dB each time the distance from it doubles.

Sound measured 1 metre from a hard surface increase by 3dB due to the reflection effect of the surface (commonly referred to as a “façade level”).

For sound to be classed as “free field”, it should be at least 3m from a reflective surface in the plane where it is measured (for example, when measuring road noise, a wall is considered to be the reflective surface but the ground is not, however when measuring aircraft noise, the opposite is true).

The image below, gives typical sound level values for everyday examples:

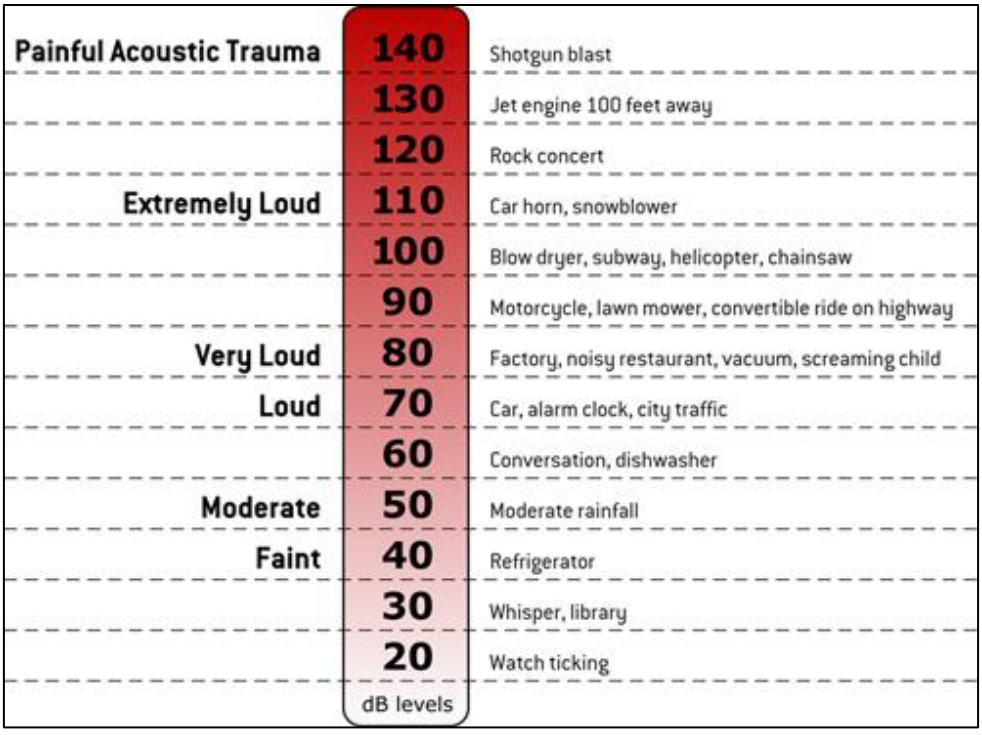

Figure 1: Typical Noise Level Examples

4.2 BS4142: 2014+A1:2019: Methods for rating and assessing industrial and commercial sound

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

a) Typically, the greater the difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

4.3 Target Noise Level Local Planning Authority Requirements

Annex 1 of the Planning Noise Advice Document Sussex dated 2021 states that for the sound pressure levels from commercial activities to be deemed acceptable, then after all corrections have been made in line with BS4142: 2014+A1:2019, the Rating Level ($L_{Ar,Tr}$) must not exceed the background sound level (L_{A90}) at the NSR.

5 Background Sound Survey Baseline Conditions & Results

A background sound survey was carried out between the 8th and 13nd of June 2023 using class 1 sound level meters. Unfortunately, due to a fault with the meter used at SP2, the data set for this survey location was corrupted. The SP2 survey was therefore repeated between the 16th and 19th of June 2023. Both survey date ranges included a Saturday. On both Saturdays monitored Horsham & District Laundry Ltd was closed for the entire day and therefore had no impact on the soundscape.

- SP1 – Was located near the northern boundary with the residential properties on Parsonage Road. The microphone was located on a tripod approximately 2m from the ground. The survey location will be classed as freefield.
- SP2 – Was located on the south east corner of the application site. The microphone was located on a tripod approximately 2m from the ground. The survey data will be used as an area background sound pressure level to assess the impact on the properties on Crawford Gardens. The survey location will be classed as freefield.

A photographs and locations of the environmental noise surveys can be seen in the appendices of the report.

5.1 Baseline Conditions

- Survey carried out by:
  - Martyn Chambers: BA (Hons) MSc MIOA
- Equipment used:
  - SP1 - Svantek 971
  - SP2 – Castle Mirus
  - The meter was calibrated before and after commencing the noise measurements (@94dB no drift).
- Weather conditions: Variable: Wind: variable direction less 5ms^{-2}.

5.2 Representative Background Sound Levels

The survey position was chosen as the measurements taken at the location will best represent the current sound levels at the locations of the proposed plant. BS4142 states the following on page 11 (Note 1):

To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum/modal value.

As noted, the proposed extension of the operating hours is between 13:00 and 18:00 on a Saturday afternoon.

Figures 2 & 3 below show the representative measured value for the $L_{A90,\ 15minutes}$ for the assessment period.

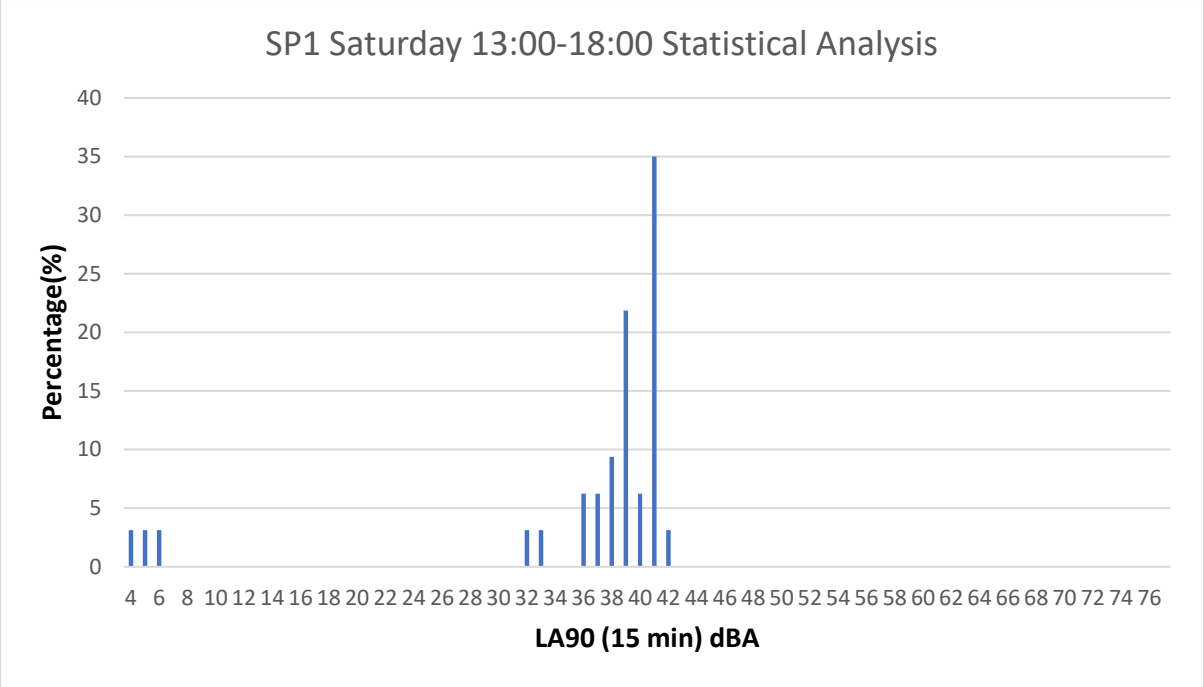

Figure 2: SP1 Statistical Analysis for Saturdays 13:00-18:00 $L_{A90\ (15\ min)}$ dBA

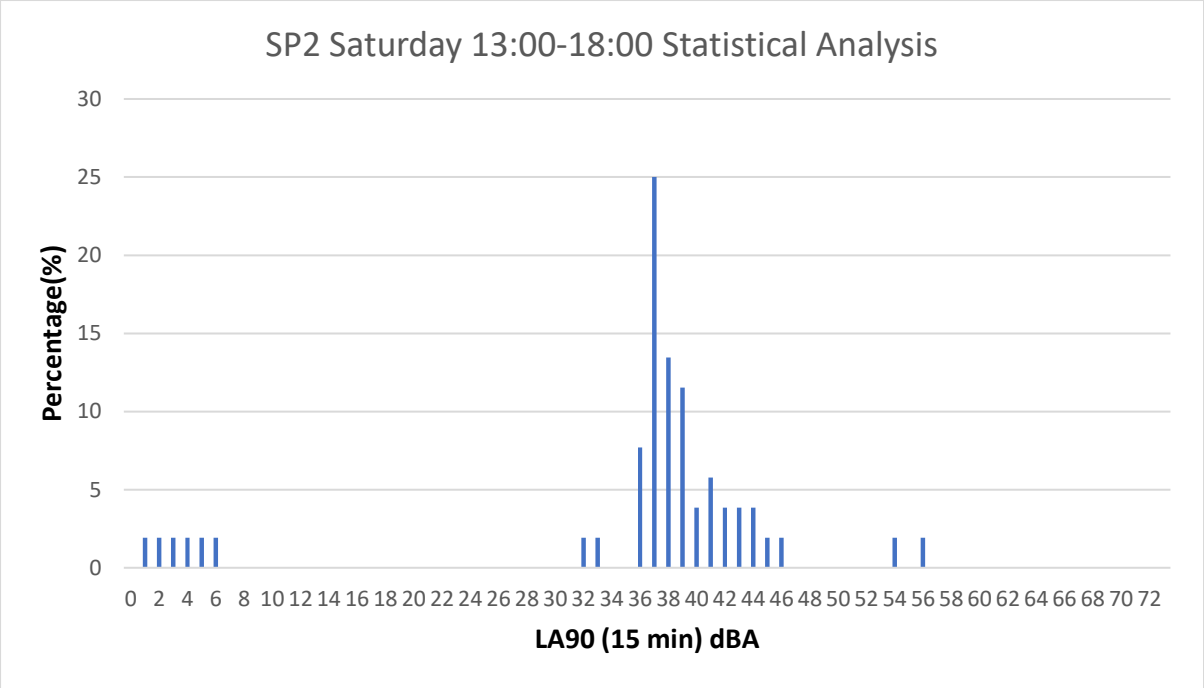

Figure 3: SP2 Statistical Analysis for Saturdays 13:00-18:00 $L_{A90\ (15\ min)}$ dBA

5.3 Summary of Background Sound Pressure Levels at the site

The representative Background Sound Level (L_{A90}) for the proposed hours of use is therefore:

- SP1: 41dB $L_{A90.}$
- SP2: 37dB $L_{A90.}$

The survey data from SP1 will be used to assess the impact of the properties on Parsonage Road. The survey data from SP1 will be used to assess the impact of the properties on Crawford Gardens.

6 Computer Noise Model

In order to see how noise varies at different positions around the proposed development it is possible to produce a noise contour map. A computer noise model has been completed using the computer package IMMI. IMMI faithfully implements the propagation method of ISO-9613:1996; Acoustics – Attenuation of sound during propagation outdoors.

The surrounding structures, dwellings and topography were acoustically accurately recreated within the model. Reception points were then added to the model in representative locations of the nearest noise sensitive receptors (NSR) as well as the representative locations of SP1 and SP2.

6.1 Noise Model Inputs

Horsham & District Laundry was created as an area sound source, with openings to represent the fire escapes, windows and front roller shutter doors. Point sources were also created in their representative locations which represent the 8 intake and extracts on the eastern facade. The sound pressure level from the external condensers included as part of the roller shutter door sound source as measuring the noise from the sound sources separately was not possible due to the operational reequipments on site. The sound pressure data used for the calibration was with the roller shutter door open and condensers running.

Measurements were then taken at representative locations around the building of each sound source. The frequency spectrums from each measurement were then added to their corresponding sound source in the model. The full frequency spectrums can be seen in the appendices of the report.

The sound pressure level from the sound sources were then adjusted until it matched the worst-case hour measured at each survey location. For SP1 this was 59.8dB(A) measured on the 13th of June at 10am. For SP2 this was 58dB(A) measured on the 19th of June at 10am.

6.2 Traffic Movements Model Inputs Sound Data

Traffic movements of vans arriving and departing the site were made on the 13th of June 2023.

An arithmetic average of the measurements is shown below in table below.

Measurement	SEL
Van Departure	71.8
Van Arrival	71.6
Arithmetic Average	71.7

Table 1 Van Noise Measurements (corrected for background sound)

6.2.1 SEL Definition

To help understand the following calculations the definitions (Taken from BS8233:2014 and CRN,1995 respectively) have been provided:

- $L_{Aeq,T}$ Is the value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound, that within a specified time interval, T.
- Sound Exposure Level (SEL) the level at a reception point which, if maintained for a period of 1 second, would cause the same A-weighted sound energy to be received as it is actually received from a given noise event.

6.2.2 Vehicle Noise Level

Horsham & District Laundry has 6 vans. Monday to Friday they depart in a morning and arrive back around lunch time, before departing after lunch and returning before the business closes.

Under the current consented operations for a Saturday the vans would only depart in the morning and arrive back at lunch time just before the business closes. If the Saturday hours were extended the vans would depart after lunch and return before the business closes at 18:00. This would create 12 additional traffic movements. However, all 12 would not happen in 1 hour, so a worst-case hour would be 6 additional traffic movements.

The measured SEL and the information regarding the number of vehicle movements can be used to predict the $L_{Aeq, 1hour}$.

6.2.3 SEL Calculations

$L_{Aeq, 1hour}$ = SEL – 10Log T + 10Log N

- *N = no. of movements (6)*
- *T = no. of seconds in period (3600 seconds in an hour)*

The predicted worst-case hour traffic noise levels can be seen below:

$L_{Aeq,T}$ = 71.7 – 10Log (3600) + 10Log (6) = 43.9dB (A)

6.2.4 Vehicle Noise Level Summary

Using this data, a line source (to represent the vehicle tracks into and out of the site) was calibrated to emit a sound pressure level of 43.9 L_{Aeq} dB(A) at the representative measurement location in the sites noise model.

6.3 Noise Model Results

The computer noise model can be seen in the below figure.

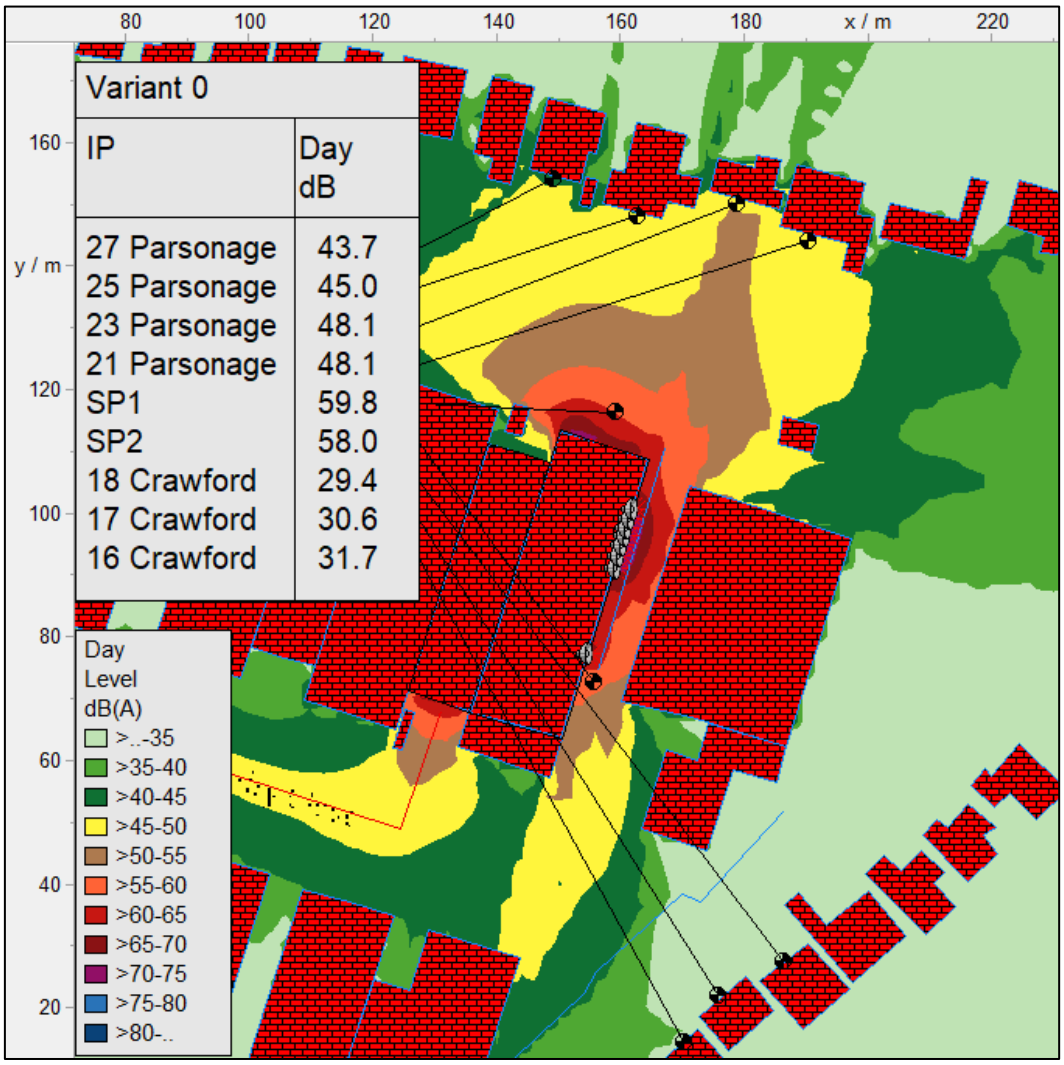

Figure 4: Computer Noise Model (Grid Height 2m)

6.4 Computer Noise Model Results

The table below shows the results of noise model predictions compared to the measured background sound pressure level detailed in section 5.3

Reception Point (RP)	Predicted Worst case Specific Sound Pressure Level $L_{Aeq,T}$	Representative Background Sound Level L_{A90}	Difference
21 Parsonage Road	48.1	41	7.1
23 Parsonage Road	48.1	41	7.1
25 Parsonage Road	45	41	4.0
27 Parsonage Road	43.7	41	2.7
16 Crawford Gardens	31.7	37	-5.3
17 Crawford Gardens	30.6	37	-6.4
18 Crawford Gardens	29.4	37	-7.6
SP1	59.8	N/A	
SP2	58.0	N/A	

Table 2: Computer Noise Model Results & L_{A90} Comparisons

7 Corrections to be Considered

7.1 Tonality

Tonality is expressed within BS4142:2014+A1:2019 as follows:

> The level differences between adjacent one-third-octave bands that identify a tone are:
>
> - 15 dB in the low-frequency one-third-octave bands (25 Hz to 125 Hz);
> - 8 dB in the middle-frequency one-third-octave bands (160 Hz to 400 Hz); and
> - 5 dB in the high-frequency one-third-octave bands (500 Hz to 10 000 Hz).

The noise from services were checked objectively and shown not to be tonal. .

7.2 Intermittency, Impulsivity and on-time corrections

Some of the noise propagating from Horsham & District Laundry would be classed as intermittent, therefore a 3dB penalty has been applied.

7.3 Noise Levels and Character Corrections Summary

Tables 3 and 4 below summarise the BS4142:2014:A1:2019 assessment made. The summary has been conducted for the NSRs on Parsonage Road and Crawford Gardens predicted to be most affected by the proposed extension of operating hours. It stands to reason if the noise level from the partial change of use is within the standards for the worst affected NSR then the SPL levels at more distant locations will be further below the required level.

Results	**Measurement Parameter**	**dB**	**Relevant Clause**
Combined specific sound level Day	$L_{Aeq,\ 1\ hour}$	48	7.3.4
Ontime correction	$L_{Aeq,\ 1\ hour}$	+ 0	7.3.14
Acoustic feature correction	Intermittency	+ 3	9.2
Rating level Day		51	9.2
Background sound level	L_{A90}	41	8
Excess of rating level over background sound level	Daytime	10	11
Assessment indicates	Significant adverse impact for Saturday afternoons		11
Uncertainty of the assessment	Discussed		10

Table 3: Noise Levels and Character Corrections Summary Table for Parsonage Road

Results round to the nearest whole number

Results	Measurement Parameter	dB	Relevant Clause
Combined specific sound level Day	$L_{Aeq, 1\ hour}$	32	7.3.4
Ontime correction	$L_{Aeq, 1\ hour}$	+ 0	7.3.14
Acoustic feature correction	Intermittency	+ 3	9.2
Rating level Day		35	9.2
Background sound level	L_{A90}	37	8
Excess of rating level over background sound level	Daytime	-2	11
Assessment indicates	low impact for Saturday afternoons		11
Uncertainty of the assessment	Discussed		10

Table 4: Noise Levels and Character Corrections Summary Table for Crawford Gardens
Results round to the nearest whole number

8 Mitigation

As shown in table 3, if Horsham & District Laundry began operating on Saturday afternoons the impact on Parsonage Road, depending on context, could be deemed as significantly adverse.

In order to mitigate this impact, one option would be to replace the existing metal wire fence that is located on the small wall that runs parallel to the building on the north and east façade. Replacing this metal wire fence with a 2-metre acoustic timber fence would create a noise barrier between the site and the properties on Parsonage Road. The noise model has been altered to include this proposed barrier, the results are shown in figure 5 and table 5 below. The transmission loss for the barrier was based on IMMI stock data for timber barrier and is shown in the appendices of the report.

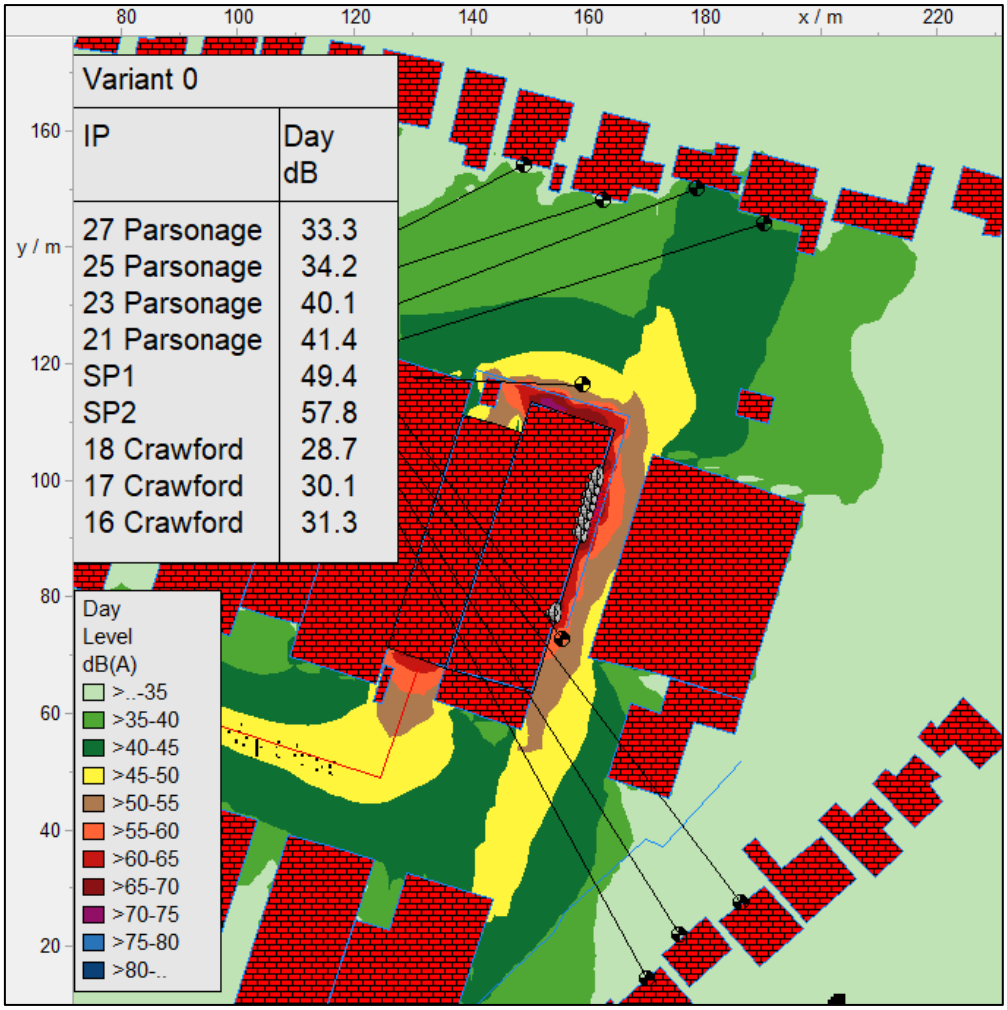

Figure 5: Computer Noise Model with Noise Barrier (grid height 2m)

Reception Point (RP)	Predicted Worst case Specific Sound Pressure Level $L_{Aeq,T}$	Representative Background Sound Level L_{A90}	Difference
21 Parsonage Road	41.4	41	0.4
23 Parsonage Road	40.1	41	-0.9
25 Parsonage Road	34.2	41	-6.8
27 Parsonage Road	33.3	41	-7.7
16 Crawford Gardens	31.3	37	-5.7
17 Crawford Gardens	30.1	37	-6.9
18 Crawford Gardens	28.7	37	-8.3
SP1	49.4	N/A	
SP2	57.8	N/A	

Table 5: Computer Noise Model with Noise Barrier Results & L_{A90} Comparisons

8.1 Noise Levels and Character Corrections Summary

Correction calculations have been conducted for the mitigation noise model following the same format as Tables 3 and 4. Tables 6 and 7 below summarise the BS4142:2014:A1:2019 assessment if the acoustic fence was installed.

Results	Measurement Parameter	dB	Relevant Clause
Combined specific sound level Day	$L_{Aeq,\ 1\ hour}$	41	7.3.4
Ontime correction	$L_{Aeq,\ 1\ hour}$	+ 0	7.3.14
Acoustic feature correction	Intermittency	+ 3	9.2
Rating level Day		44	9.2
Background sound level	L_{A90}	41	8
Excess of rating level over background sound level	Daytime	3	11
Assessment indicates	Just Noticeable Impact for Saturday Afternoons		11
Uncertainty of the assessment	Discussed		10

Table 6: Mitigation Noise Model Levels Character Corrections Summary Table for Parsonage Road

Results round to the nearest whole number

Results	Measurement Parameter	dB	Relevant Clause
Combined specific sound level Day	$L_{Aeq,\ 1\ hour}$	31	7.3.4
Ontime correction	$L_{Aeq,\ 1\ hour}$	+ 0	7.3.14
Acoustic feature correction	Intermittency	+ 3	9.2
Rating level Day		34	9.2
Background sound level	L_{A90}	37	8
Excess of rating level over background sound level	Daytime	-3	11
Assessment indicates	low impact for Saturday afternoons		11
Uncertainty of the assessment	Discussed		10

Table 7:Mitigation Noise Model Levels and Character Corrections Summary Table for Crawford Gardens

Results round to the nearest whole number

9 Discussion

The results from the initial assessment shown in table 4 demonstrate the noise impact on Crawford Gardens would be low if Horsham & District Laundry began operating on Saturday afternoons. Unfortunately, the results show that the impact on Parsonage Road, depending on context, could be deemed as significantly adverse.

If the discussed noise barrier was installed, the predicted rating level at the nearest NSR would only be 3dB(A) above the background sound pressure level. As discussed in section 4.1 this increase in sound pressure level would only just be noticeable to the human ear.

The installation of the noise barrier would also reduce the impact on the soundscape for the sites operations Monday to Friday.

Alternative mitigation would likely involve keeping all windows and doors shut at the site. Due to the heat produced by the machinery within the Laundry this would cause ventilation as well as health and safety concerns due to overheating of the staff. To counteract this, a substantial air conditioning system would likely need to be installed. This would not only be costly in terms of installation and energy costs; it would also require the installation of a significant amount of new external condensers which would have their own impact on the soundscape as well as require planning permission in their own right.

The context of the site should also be noted, the site is located on an existing industrial estate, and residential properties bordering the site would be accustomed to noise from activities on the estate being audible around their properties. This is demonstrated by the fact the client noted that the site is operating without any complaints filed against it. It is also noted that the site is only requesting a 5-hour extension to its already consented operational hours.

10 Uncertainty

The sound level meters used were calibrated on site at both the site set up as well as the decommissioning of the equipment to ensure that it was operating as intended. No significant drift was noted.

All the data used in both the BS4142 assessment and the traffic movement calculations are worst case. The noise model calibration was based against the worst-case hours at the survey locations.

11 Conclusion

Class one sound level meters were used to measure the representative background sound pressure levels (LA90) at the nearest noise sensitive receptors (NSR). The sound surveys measured the soundscape when the site was operational as well as on a Saturday afternoon when the site does not currently operate.

A noise model was created to assess the impact of the application site without the impact of the surrounding business. The Noise model was calibrated to the worst-case hour.

The Rating Level (LAr,Tr) for a worst-case hour of current operations was shown to be 10dB above the existing Saturday afternoon LA90 background sound pressure level for the worst affected NSR on Parsonage Road. However, the LAr,Tr for of the worst affect NSR on Crawford Gardens is 2dB below the existing LA90 background sound pressure level.

The report demonstrates how the installation of an acoustic fence to replace the existing wire fence on the north and east facades of the application site will lower the LAr,Tr for of the worst affected NSR on Parsonage Road to 3dB above the existing Saturday afternoon LA90 background sound pressure level.

It is possible that taking into account the mitigation, the context of the site being located on an industrial estate, in addition to the proposal only being a 5-hour extension of current permitted site operations, that planning permission could be considered to be granted on these terms.

12 Appendices



Figure 6: Application Site Location
Horsham District Laundry marked in red.

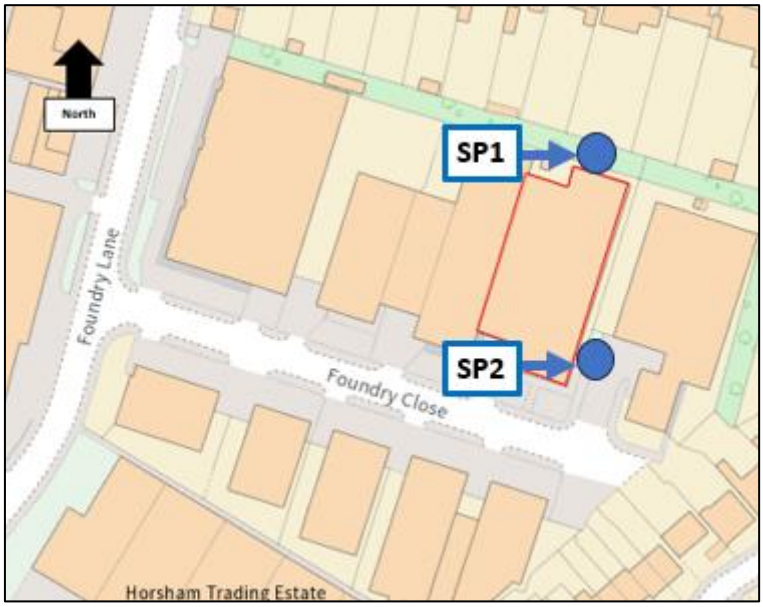

Figure 7: Survey Locations



Figure 8: Survey Photos

Frequency	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Wooden Fence Transmission Loss	16	25	26	24	30	36	36	36

Table 8: Wooden Fence Transmission Loss

Sound Source	$L_{Aeq,T}$	Frequency																												
		12.5 Hz	16 Hz	20 Hz	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1.0 kHz	1.25 kH	1.6 kHz	2.0 kHz	2.5 kHz	3.15 kH	4.0 kHz	5.0 kHz	6.3 kHz	8.0 kHz	10.0 kHz
Side Fire Escape	66.4	65.7	64	68.4	67.1	67.4	68.2	72.3	72.2	69.8	65.3	68.3	67	62.1	62.8	67.3	61.3	57.5	56.5	55.2	55.3	54.4	50.3	48.3	46.4	44.3	43	41.4	40.4	38.4	36.5
Extract 1	68.5	65.9	63.6	66.7	65	67.7	66.8	68.9	71.2	66.8	62.9	62.6	63	64.4	68.3	61.9	60.7	60.1	59.6	59.5	59.1	59.8	55.4	53.3	51.7	50.3	48.5	46.9	45.2	42.7	41.4
Extract 2	73.8	72.1	71.2	68.9	72.2	73.6	70.3	74.8	73.5	73.3	75	71.6	71.2	73.7	69	71.6	70.5	66.1	58.1	67.4	63	61.5	58.3	56.3	53.6	50.8	49.1	46.8	45.5	44.4	43.1
Extract 3	79.5	83.7	82.1	80.2	79.5	77.8	75	78.7	76.7	76.1	77	73.2	75.6	80.2	79.7	80.6	75.7	68.8	60.8	69.8	65.6	65.3	63.8	61.7	59	55.4	52.9	49.4	46.4	43.4	40.1
Extract 4	76.9	77.5	76.5	74.9	76.9	76.7	74.6	79	77.3	76.7	76.6	74.2	75.8	76.6	73.8	76.3	76.3	70.7	63	66	61.9	60.2	58.7	57	53.9	49.9	47.5	44.3	41.8	38.8	36.3
Extract 5	74.5	73.7	73.1	71.8	75.4	75.6	72	77.1	74.7	76.1	75.4	72.3	71.8	75.6	74.6	73.9	70.3	65.2	57.7	64.5	64.6	62.3	58.2	55.2	51.6	48.2	46.4	43.2	40.5	37.3	33.9
Extract 6	78.2	78.3	80	75.4	77.3	77.8	75.8	78.9	77.5	78.7	77.3	76.4	77.5	79.7	77.2	77.5	74.9	69.8	60.3	67.5	66.3	65.9	62.1	61.6	58.4	55.1	52.4	48.7	46.1	43.4	40.1
Extract 7	76.9	74.3	75.7	73.6	76.5	76.8	74.7	76.7	76.6	77.6	76	74.3	75.8	78.8	74.9	72.5	69.1	65.4	60.8	71.5	68.1	64.2	62.2	61.3	56.8	54.6	52.6	49.1	47.4	44.6	41.9
Extract 8	45.3	54.6	52.5	57	53.4	52.5	52.8	53.2	50.3	48.7	43.9	41.6	45.7	40.9	39.8	38.1	34.8	34.4	33.2	33.9	33.6	32.9	31.9	32.3	32	32.1	32.3	32.8	32.5	32.1	30.7
Infront of Roller Shutters /Condensers	59.4	62.3	62.5	65.2	62.3	60.2	57.7	61.1	55.7	55.7	57.6	56.6	52.9	54.1	52.7	54.4	53.8	51.5	50.1	48.3	48.5	47.7	47.9	47	46.4	45.6	44.4	42.7	41	38.9	38.3
Rear Right Corner Windows	59.4	62	63.1	65.9	63.7	61.1	60.8	63	59.7	62.4	61.5	57.1	58.7	55.4	50.9	49.8	50.8	49.2	49.2	49.3	46.7	47	47.2	48.7	43.2	46.8	45.8	49.4	42.8	39.9	39.6
Right Rear Fire escape	70.7	70	68.3	72.7	71.4	71.7	72.5	76.6	76.5	74.1	69.6	72.6	71.3	66.4	67.1	71.6	65.6	61.8	60.8	59.5	59.6	58.7	54.6	52.6	50.7	48.6	47.3	45.7	44.7	42.7	40.8
Rear Right window	70	64.9	66.6	70.1	69.8	60.1	60.9	65.4	64.4	62.4	60.2	64.2	69	64.3	61.1	61.6	63.2	63.3	59.1	59.2	57.4	57.2	57.4	58.6	56.2	56.1	57.4	58.9	52.8	51	51.8
Rear Left window	67.5	64.4	65	68	68.3	69.8	72.2	66	71.5	70.6	66.1	62.5	66.6	68.4	66.1	61.1	61.4	58.2	57.8	58.2	55.1	54.3	53.6	54.7	51.4	52	52.5	49.4	47	46	46.7
Right Rear Fire escape	72.4	67.3	70.1	73	71.5	69	66.5	65.5	69.1	70.7	65.8	66.5	67.6	66	67.4	64.4	63.1	61.6	60.8	64.6	58.4	57.6	59	63	56.9	56.7	56.3	52.8	54.3	66.5	52

Table 9: Noise Model Frequency Spectrums