

Acoustic Associates Sussex Ltd

Permitted Development Commercial Noise Assessment

Site: 15 Beach Road, Littlehampton, West Sussex. BN17 5HT
Client: Sussex Properties Ltd

Report by: Martyn Chambers BA (Hons) PGDip: Acoustics AMIOA

Date: 07/09/2020
Project: J2986
Issue 1



Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics B883 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

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Acoustic Associates Sussex Ltd., 8 Highdown House, Shoreham Airport, Shoreham-by-Sea, West Sussex BN43 5PB

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Report by: Martyn Chambers BA (Hons) PGDip: Acoustics AMIOA
Checked by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA

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1 Introduction and Executive Summary

Acoustic Associates have been appointed to undertake a commercial noise assessment relating to a proposed permitted change of use from offices to dwellings.

The property is located at 15 Beach Road, Littlehampton. The proposal is to change the first and second floor office spaces into 2 separate 2 self-contained flats. The ground floor is proposed to remain as a commercial unit. The changes are covered by the permitted development scheme. While transportation noise is not assessed under the permitted change of use, it is stated in amendment 7 to the Town and Country (General Permitted Development) (England) Order 2015 that an assessment should be made on “*impacts of noise from commercial premises on the intended occupiers of the development*”.

Therefore, an assessment has been conducted of the varying commercial noise at the rear of 15 Beach Road. The results have been compared against:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- Pro-PG (Planning and Noise Guidance) 2017

Within this report, the soundscape of the site has been assessed with noise mitigation measures recommended where appropriate. A Sound Reduction (SRI) of 30dB(A) would be required from the building envelope, to ensure future residents are protected against the surrounding commercial noise

If the mitigation measures are implemented by the developer it is considered that from the perspective of acoustics, there is no reason the planning application should not be granted.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

2.1.1 Location and Existing Soundscape

The front of the property faces onto Beach Road, Littlehampton. On this facade the noise is dominated by road traffic noise. The rear of the property faces in towards Manor House carpark. On this facade there are a variety of sources from commercial premises.

These include a flue and several condensers from the neighbouring oriental restaurant Chopsticks, that has opening hours of:

- Monday, Wednesday & Thursday: 12:00–14:00, 17:30–23:00
- Friday & Saturday: 12:00–14:00, 17:30–00:00
- Sunday: 17:30–23:00
- Tuesday: Closed

Further noise sources include; a substation directly behind the property. Further away from the proposed development, there are an additional number of fixed plant that supply local business, notably the Cinnamon Takeaway flue and a Ladbrokes condenser.

There are also 3 external wall mounted condensers that supply the current office units at 15 Beach Road, these would be removed or relocated away from the residential development as part of the proposed change of use. This will be covered in a separate planning application. The condensers serving the office uses at 15 Beach Road will have contributed to the current measured soundscape during their use within the daytime period.

Commercial noise from fixed plant has an obvious impact on the soundscape at the location. It should be noted that during the day time hours when Acoustic Associates visited the site, transportation noise was subjectively the dominant noise source. However, the sound from the transportation noise cannot be accurately deducted from that of the surrounding commercial noise and therefore will be taken into account as part of the assessment.

Figure 1 below shows the site location and figure 2 discussed commercial noise sources.

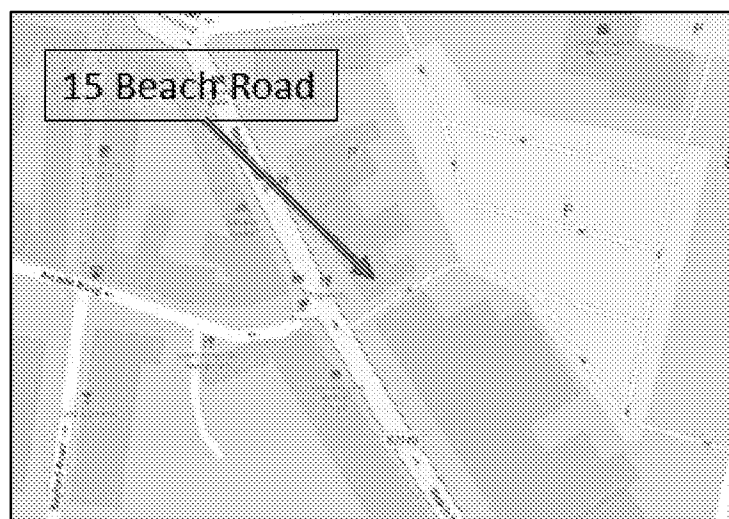


Figure 1: Site Location

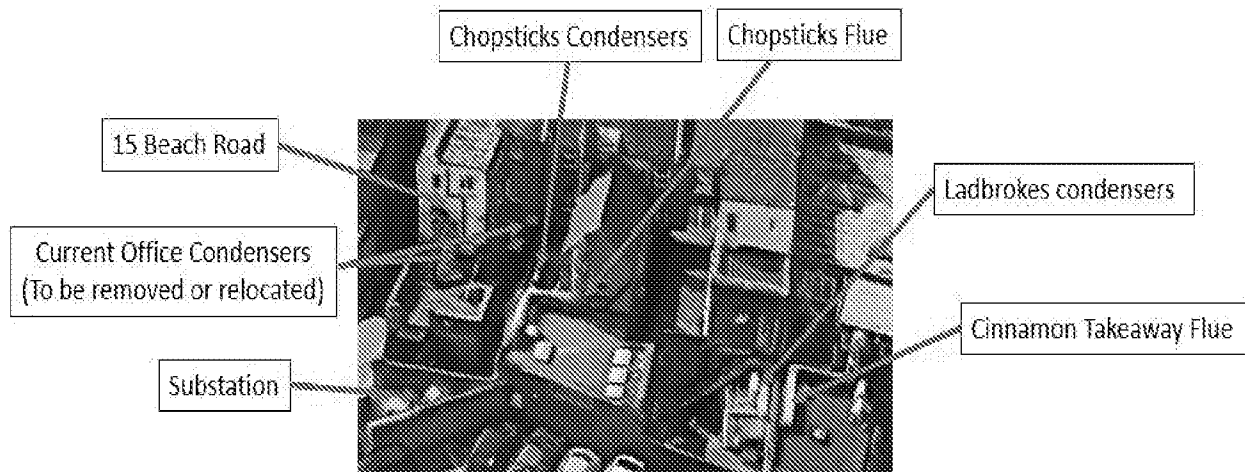


Figure 2: Surrounding commercial noise sources

2.1.2 Planned Development

The proposed development will convert the 1st and 2nd floor offices into 2 residential flats. The first floor flat, Flat A, will have 1-bedroom. The bedroom will face towards Manor House carpark. The second floor flat, Flat B, will have two bedrooms on the Beach Road facade. Figure 3 below shows the proposed layout of the flats.

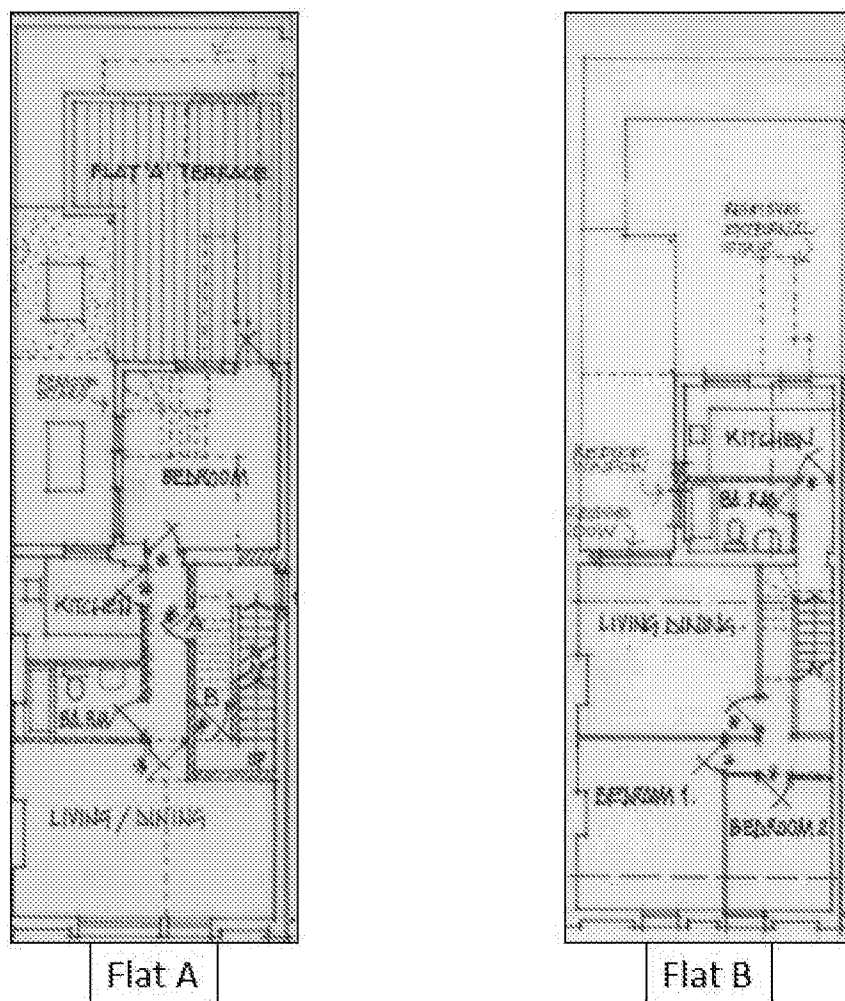


Figure 3: Proposed flat layout

3 Relevant Standards and Assessment Methodology

3.1 BS8233:2014 Noise Criteria

Table 1 of BS8233 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1: BS8233:2014 Criteria

3.2 WHO Internal Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type Target Maximum Internal Level - L_{Aeq} dB (A)

Living rooms 35 (Daytime only)

Bedrooms 30 (Night)

Room Type Maximum Internal Level – L_{Amax} dB(A)

Bedrooms 45 (not more than 10-15 times per Night)

The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window would be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

3.3 WHO External Noise Criteria

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

3.4 Noise Policy Statement for England (NPSE)

The document "Noise Policy Statement for England" sets out the following vision for on-going noise policy:

"Promote good health and quality of life through the effective management of noise within the context of Government policy on sustainable development."

This vision should be achieved through the following Noise Policy Aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: avoid significant adverse impacts on health and quality of life; mitigate and minimize adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life".

3.5 ProPG –Planning and Noise: new residential development

The following has been copied from the Association of Noise Consultants' (ANC) website:

Over recent years, we have seen the introduction of the Noise Policy Statement for England, as well as substantial changes in national planning policy. But these developments have not been accompanied by detailed technical acoustic advice.

The lack of detailed guidance can lead to inconsistent application of policy, that may in turn result in unsatisfactory development and affect quality of life.

To fill that gap and facilitate efficient and consistent decision-making in the development control process, the Institute of Acoustics, the Association of Noise Consultants and the CIEH have joined to produce a Professional Practice Guidance (ProPG) focussing on noise sensitive development.

The following extract has been taken (Figure 2, Page 13) from the May 2017 ProPG document:

ACTIVITY	LOCATION	07:00 – 23:00 HRS	23:00 – 07:00 HRS
Resting	Living room	35 dB $L_{Aeq,15hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,15hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,15hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,15min}$ (max 2)

NOTE 1 The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,15min}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,15min}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (see Section 3.D).

Figure 4: ProPG Criteria

3.6 Methodology and Approach

As mentioned in the introduction to the current report, the site is covered by the permitted development scheme and therefore only commercial noise needs to be assessed as part of the application.

When introducing a new commercial noise source into an environment where there are noise sensitive receptors, a BS4142 assessment is required. However, when the scenario is reversed and noise sensitive receptors are introduced into a soundscape with existing commercial noise then alternative standards would need to be referenced. See also section 8.5 of BS4142

The 'Agent of Change' principle within the policy of the National Planning Policy Framework NPPF 2019, displayed in section 3.8, must also be taken into account to ensure noise from existing commercial activities have been suitably mitigated against when a new development is proposed. This was done by conducting a noise survey at the location and comparing the sound level to the noise criteria within BS8233(2014) Noise Criteria, WHO and ProPG. While it is unlikely that $L_{A,Max}$ events that occur at the location would be attributed to commercial noise, to ensure a robust report these events will be taken into consideration.

4 Noise Survey Baseline Conditions and Results

A noise survey was carried out from the 27th August 2020 to the 2nd of September 2020 in order to assess the soundscape of the site. The microphone placement was chosen so that is was close to the proposed bedroom of Flat A which is the reception point that has the lowest noise level criterion and is closest to the various discussed commercial noise sources. The microphone position was not placed directly outside the proposed bedroom window, as this location is currently occupied by existing plant that, as previously stated, will be removed or relocated as part of the development. It should be again noted that while the microphone position was not placed directly next to the to be removed/relocated plant it is likely that the sound levels recorded were still affected by these pieces of plant.

The noise monitoring location and accompanying weather station can be seen below in Figure 5.

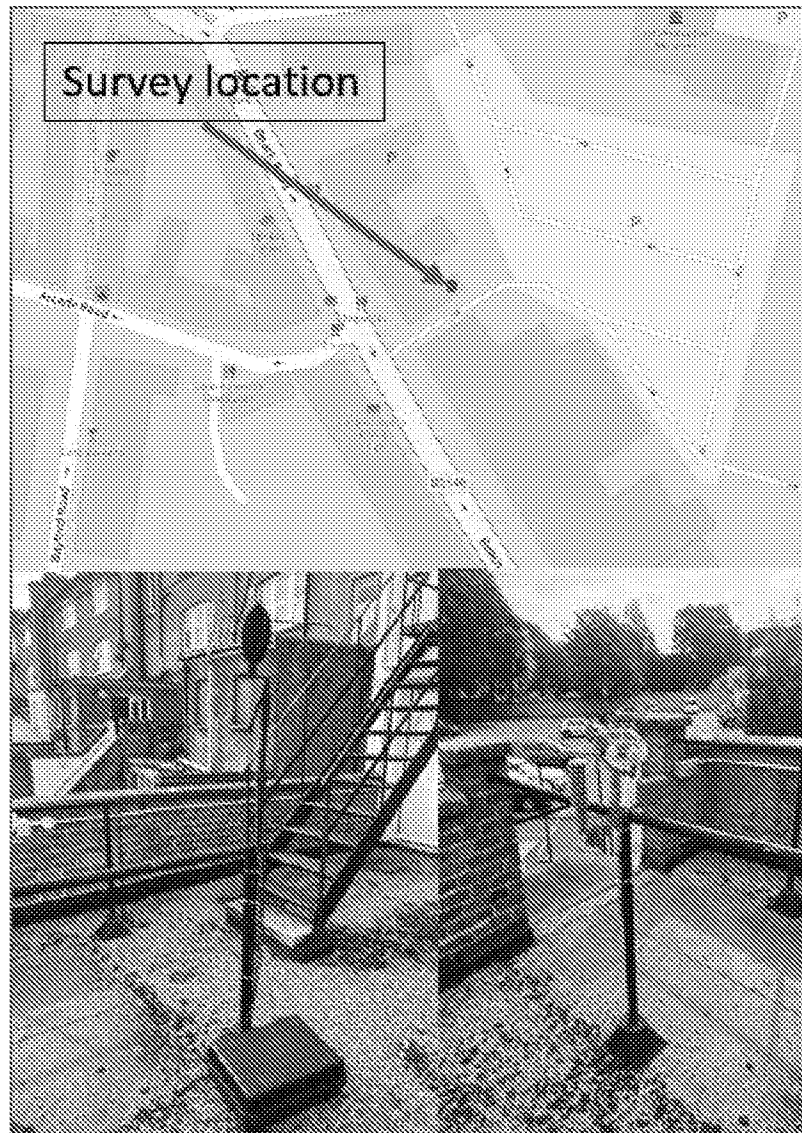


Figure 5: Survey Location and accompanying weather station

4.1 Baseline Conditions

- Survey carried out by:
 - Martyn Chambers BA (Hons) PGDip: Acoustics AMIOA
- Equipment used:
 - Castle Mirus GA117
 - Maplins Easy Weather Station

The Meter was calibrated before and after commencing the noise measurements (@94dB no drift).

The survey location was at the rear of 15 Beach Road on top of a monopole which was approximately 1.8m in height in free field conditions.

4.2 Weather Conditions

Weather conditions were mostly dry and below 5ms in terms of wind speed. It has not been necessary to remove any measurements from the survey due to weather conditions.

Figure 6 below shows the wind measurements during the survey period

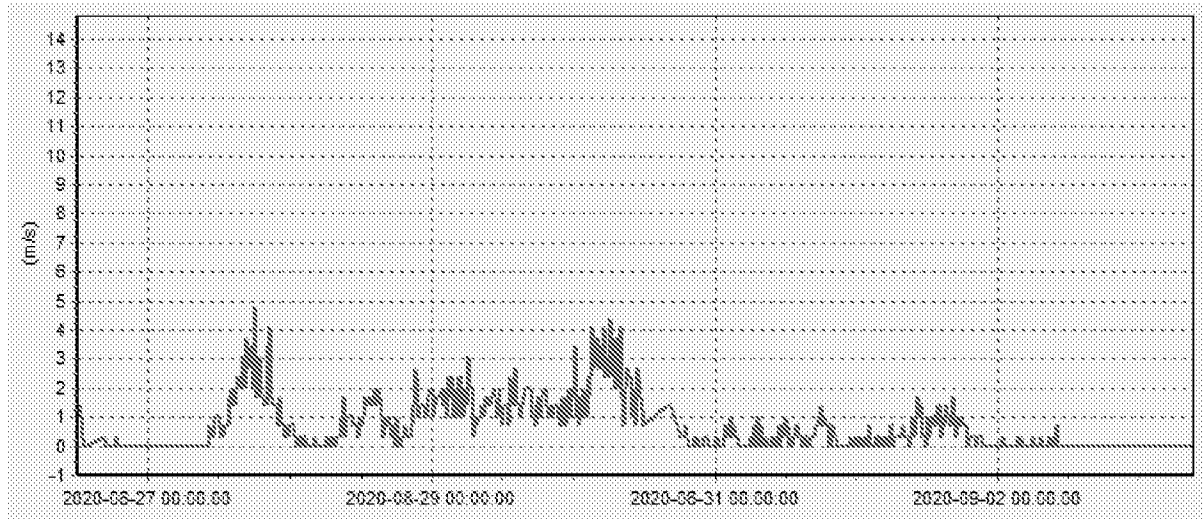


Figure 6: Wind Speed during survey period

4.3 Noise Survey Results

The survey data has been used to calculate the 16hr day time and the 8hr night time period sound levels. Table 2 below shows the entire day and night time period noise levels that were measured at the survey position.

Date (2020)	Day	Time Period	Free field Level $L_{Aeq,16hr/8hr}$ dB(A)
28 th August	Friday	07:00-23:00hrs	55.5
29 th August	Saturday	07:00-23:00hrs	53.6
30 th August	Sunday	07:00-23:00hrs	55.0
31 st August	Monday	07:00-23:00hrs	53.3
1 st August	Tuesday	07:00-23:00hrs	51.7
Average	All days	07:00-23:00hrs	53.8
27 th /28 th August	Thurs/Fri	23:00-07:00hrs	53.5
28 th /29 th August	Fri/Sat	23:00-07:00hrs	55.6
29 th /30 th August	Sat/Sun	23:00-07:00hrs	49.7
30 th /31 st August	Sun/Mon	23:00-07:00hrs	50.2
31 st Aug/ 1 st Sept	Mon/Tues	23:00-07:00hrs	50.4
1 st /2 nd August	Tues/Weds	23:00-07:00hrs	50.5
Average	All Nights	23:00-07:00hrs	51.6

Table 2: Survey Noise Levels

4.4 Fixed Plant Noise

A statistical analysis to establish the most commonly occurring value for the day and night time periods was conducted. This has been completed using that L_{A90} statistical value. L_{A90} is the A-weighted, sound level just exceeded for 90% of the measurement period and calculated by statistical analysis.

This was conducted as the noise level from the fixed plant at the location will, in general, be at a steady level.

Figures 7 and 8 below show the most representative measured value for the $L_{A90, 15minutes}$ for the day and night-time periods.

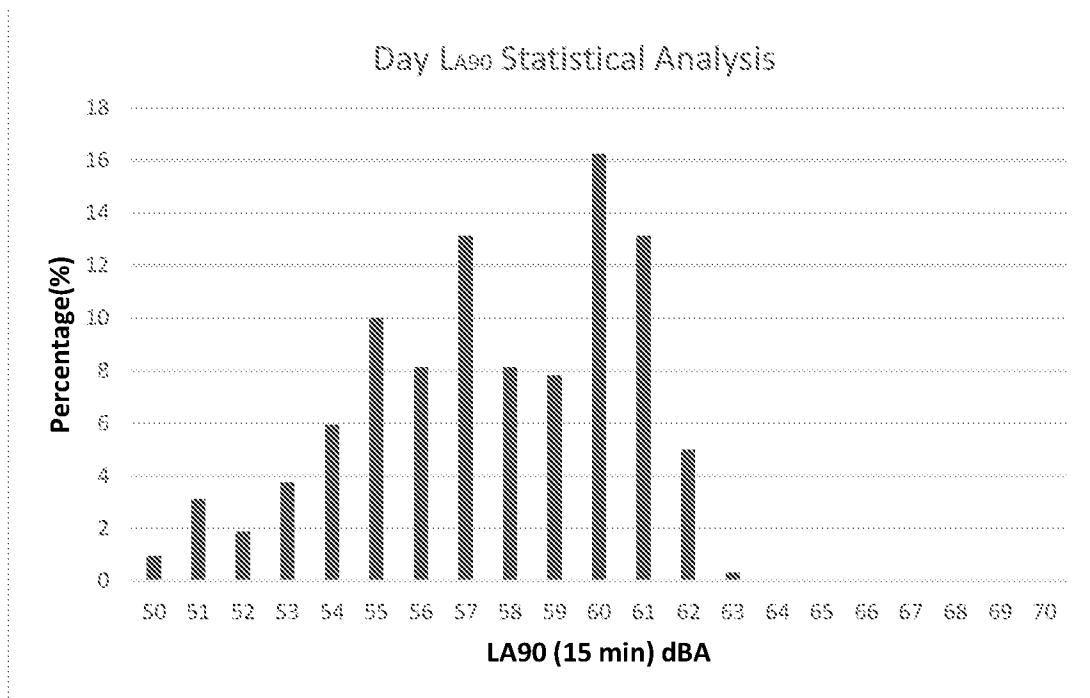


Figure 7: Day LA₉₀ Statistical Analysis

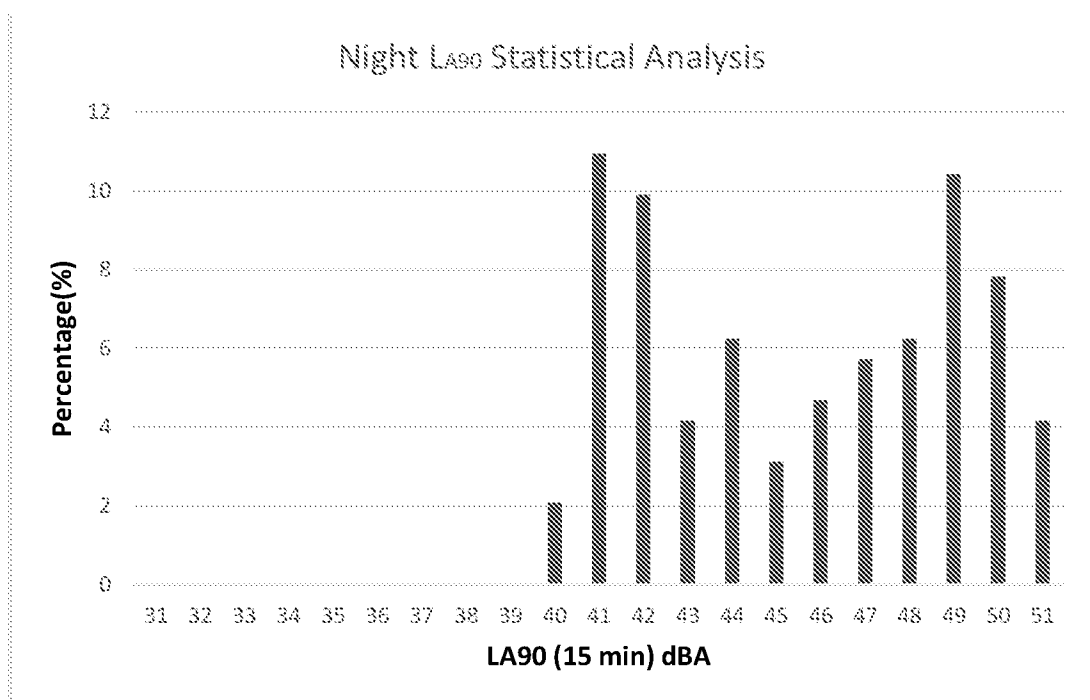


Figure 8: Night LA₉₀ Statistical Analysis

The most frequently occurring residual sound levels are therefore:

- Day-Time period: **60dB L_{A90, 16hr}**
- Night-time Period: **41dB L_{A90, 8hr}**

As there is a significant contrast between the day L_{A90, 16hr} and night time L_{A90, 8hr} Levels, a time history of the L_{A90, 15min} measurements during the survey was plotted to determine the source of the contrast in sound levels over a full 24-hour period. This is shown below in figure 9. For ease of reference significant aspects of the data shown in the graph have been labelled.

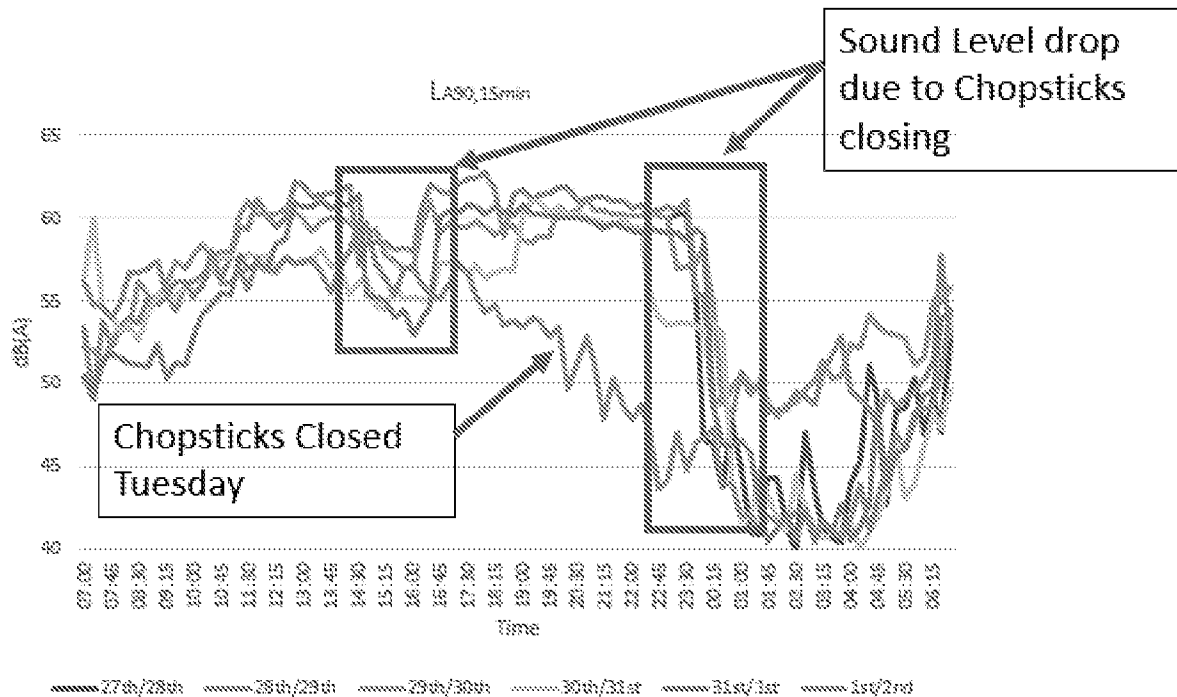


Figure 9: LA90 15Mins Time History

As can be seen from the above figure 9 there is a clear contrast on the evenings when Chopsticks takeaway is open. The steep drop off in sound pressure levels around the 23:00-00:00 time frame coincides with the restaurants' closing times. Additionally, there is a drop in the sound pressure at the time periods when Chopsticks closes between lunch and evening service. Finally, on the Tuesday through to the Wednesday morning of the survey, marked as 1st and 2nd in the above graph, when the restaurant is shut the sound pressure levels are significantly lower. This analysis shows that fixed plant servicing the Chopsticks Restaurant are the dominant commercial noise source at the location.

5 Noise Mitigation Measures

5.1 Noise Criteria

5.1.1 Continuous Noise Levels

Having established the L_{Aeq} 16hr day and 8hr night sound pressure levels at the location, see table 2, comparisons were made to the BS8233:2014 and WHO noise criteria will be used to specify the noise mitigation measures for all habitable rooms. The average day and night sound pressure levels during the survey period were used for the comparison. The maximum internal noise level for each area is as follows:

- Bedrooms 35/30dB(A) Day /Night $L_{Aeq,16/8hr}$
- Lounges 35dBA Day $L_{Aeq,16hr}$

5.1.2 Road Noise Maximum Noise Levels

For L_{Amax} events the ProPG noise L_{Amax} criterion will be used to specify the noise mitigation measures for bedrooms only:

For a reasonable standard in noise sensitive rooms at night (e.g. bedrooms) individual noise events should not normally exceed 45dB L_{AFmax} more than 10 times a night.

The above is similar to guidance in the WHO Guidelines for Community Noise 1999 document. However, the ProPG criteria suggests limiting the number of L_{Amax} events (over 45dB(A) to less than 10 times a night as opposed to less than 10-15 times a night as stipulated by the WHO

5.2 Required Sound Reduction of Building Envelope – Continuous Noise levels

The SRI has initially been calculated so that the continuous noise level criteria can be achieved (L_{Amax} discussed in next sub section).

The worst-case location of the rear bedroom of flat A has been considered for the calculation, as a bedroom at this location would have the strictest criteria to be compared against. The bedrooms for Flat B are at the front where the soundscape is dominated by transportation noise and not subject to an assessment under the principles of the permitted change of use scheme.

Table 3 below shows the required Sound Reduction (SRI) which will have to be achieved by the building envelope.

Location	Ext. Noise Level Day	Criterion	ReqSRI	Ext. Noise Level Night	Criterion	ReqSRI
Flat A bedroom	53.8	35	18.8	51.6	30	21.6

Table 3: Required SRI

5.3 Required Sound Reduction of Building Envelope – L_{Amax}

As shown in Table 3, for the worst-case bedroom to achieve the continuous noise level criterion, an SRI of 21.6dB is needed.

However, using this level of SRI to calculate the number of $L_{Amax,5min}$ events in the bedroom, on all 6 of the nights surveyed, there would have been over 10 $L_{Amax,5min}$ Events. As detailed in section 5.1, ProPG 2017 suggests limiting the number of L_{Amax} events (over 45dBA) to no more than 10 occurrences. Raising the SRI to 30dB the number of $L_{Amax,5min}$ on all of the nights surveyed would drop to below 10 occurrences, which would bring it in line with ProPG 2017 criteria. This can be seen in table 4 below.

Reception Point	Night 1	Night 2	Night 3	Night 4	Night 5	Night 6	Average
Flat A bedroom	4	2	2	9	3	2	3.7

Table 4: $L_{Amax,5min}$ with Suggested SRI of 30

Table 4 shows that even on the worse night (nights 3 & 4) the L_{Amax} criterion will be achieved if the bedroom envelope SRI is at least 30dB(A).

5.3.1 The Relevance of L_{Amax}

It should be noted that the $L_{A,max}$ events are unlikely to be due to commercial noise, which is the basis of the current assessment. Upon studying of the $L_{A,max,5min}$ from the sound survey it becomes clear that the $L_{A,max}$ events generally occurred around the period of the dawn chorus and are therefore likely attributed to seagull noise. Figure 10 shows the $L_{Amax,5min}$ measurements over the 6 nights of the survey.

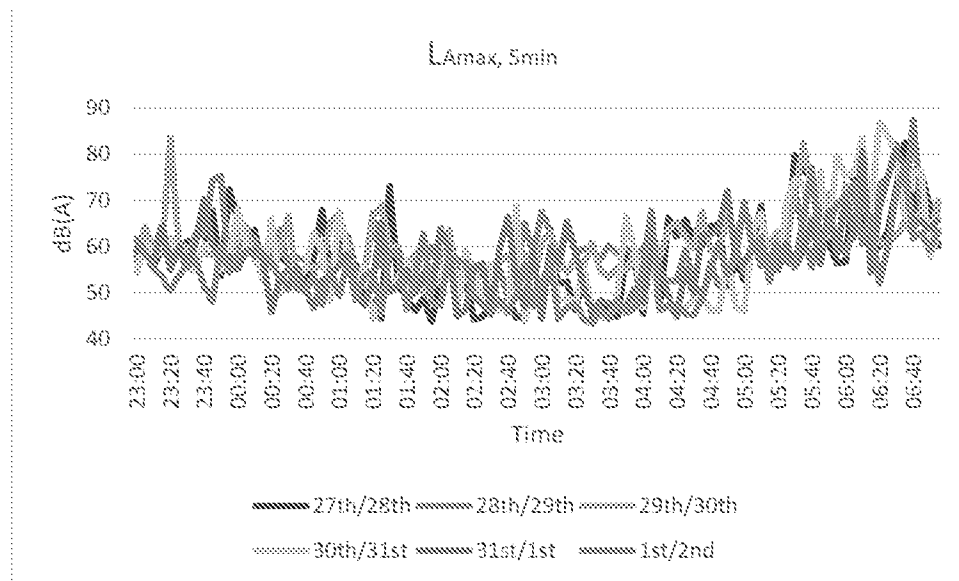


Figure 10: L_{Amax} time history

The calculation has however been conducted to provide a robust report that will guard against the worst-case sound levels for future residents. It is also worth noting that an SRI of 30dB(A) would also mitigate against the commercial noise from chopsticks restaurant fixed plant that during the hours of use provides a most frequently occurring background sound levels of 60dB L_{A90} (see section 5.4).

5.4 Glazing and Trickle Vents

The BS8233 “Rigorous Calculation” has been used to predict the sound insulation provided by the building envelope (Calculation detailed in BS8233 (Annex G.2) and full details of the calculation can be found in the appendix of the report.

Calculations have been completed to demonstrate how the required SRI can be achieved. For the sake of simplicity only the worst-case scenario of Flat A bedroom has been calculated. The calculation has been conducted using off the shelf products to show the feasibility of achieving the required SRI.

For the Rigorous Calculation Pilkington 10-12-4 glazing and Simon Acoustic EHA trickle vents have been used to show how the required SRI could be achieved in the worst-case room.

A summary of the BS8233 “Rigorous Calculation” results can be seen in the table below:

Facade	Req SRI	Frame+Glazing Performance	Ventilator Performance	Predicted Building Envelope SRI
Flat A bedroom	30	$R_{traffic}^* \geq 29$	$D_{n,e,w} \geq 36$	30

Table 5: Glazing/Ventilation Specification

* This is the required $R_{traffic}$ of the frame and glazing together. If the glazing supplier has test results for the glazing on its own a $R_{traffic}$ value 2-3dB higher would be required (glazing tested on its own will outperform glazing that is tested within a window frame)

5.5 Ventilation

Due to the level of commercial noise from the nearby fixed plant, an alternative ventilation method to opening windows would be required. As section 5.4 shows, if trickle vents were installed, they would easily be able to meet the required SRI. If two trickle vents are needed in any one room to meet the required air changes needed, then this may increase the required $D_{n,e,w}$ value.

Ventilation and glazing are inextricably linked, as whilst glazing may provide protection against sound levels incident on the façade, any ventilation strategy must not inadvertently compromise the protection and performance provided by the glazing.

Ventilation requirements are dictated by the Building Regulations and currently Approved Document F. Designing a ventilation strategy for a property is not the role of an acoustic consultant and outside of the scope of the current report. It is therefore appropriate that a ventilation engineer or M+E consultant should check the proposals of this particular report to ensure that the requirements of Approved Document F are met in respect of the rooms and in particular to ensure adequate background ventilation.

5.6 Outdoor Amenity Spaces

The criterion laid out in section 3.3 of this report for external amenity spaces states that outdoor living spaces should not exceed 55 dB(A) $L_{Aeq,16hour}$. It should be noted that on 1 of the 5 days surveyed the sound level did exceed this level. However, the average over the 5 days was below the criteria.

It should also be noted that that Littlehampton beach is less than 5 minutes' walk from the location, providing any future residents with an alternative outdoor amenity space. The use of an offsite alternative outdoor amenity space would be in line with Element 3 of ProPG and consistent with NPPG (Noise) – July 2019.

6 Uncertainty

While a permitted change of use noise assessment should only consider commercial noise, there are uncertainties and difficulties in distinguishing commercial noise from transportation noise or environmental noise. Furthermore, the measured sound levels at the site are likely to have been influenced by existing plant that is planned to be removed or relocated as part of a separate planning application.

The current report has dealt with these uncertainties by assessing the whole soundscape and ensuring that the mitigation methods recommended are capable of meeting the relevant criterion under these conditions.

7 Conclusion

An assessment has been conducted of the varying commercial noise at the rear of 15 Beach Road. The results have been compared against:

- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- Pro-PG (Planning and Noise Guidance) 2017

Within this report, the soundscape of the site has been assessed with noise mitigation measures recommended where appropriate. A Sound Reduction (SRI) of 30dB(A) would be required from the building envelope, to ensure future residents are protected against the surrounding commercial noise

If the mitigation measures are implemented by the developer it is considered that from the perspective of acoustics, there is no reason the planning application should not be granted.

8 Appendices

Non Frequency Dependent Variables			Key for Table Below	
Term	Derivation	Value	R_{wi}	Sound Reduction of Window (Octave)
A_0	Given in BS EN 20140-10 = 10 (m ²)	10	R_{ew}	Sound Reduction Index of External Wall (Octave)
S_i	Total Facade Area (m ²)	20.4	R_{rr}	Sound Reduction Index of Roof/Ceiling (Octave)
S_{wi}	Window Area (m ²)	4	A	Equivalent Absorption Area of Rx Room
S_{ew}	External Wall Area (m ²)	16.4	$D_{tr,e}$	Insulation of Trickle Vent (BS EN 20140-10)
S_{rr}	Ceiling Area (m ²)	0		
S	Total Area sound enters the room (m ²)	20.4		

Frequency Dependent Variables							
Term	Description	Octave Band Centre Frequency					
		125	250	500	1000	2000	4000
$L_{eq,ff}$	Free-Field External Noise Level	61.9	57.9	55.9	55.9	52.9	45.9
$D_{tr,e}$	Simon Acoustic EHA - Open	39.6	35.9	35.1	33	37.2	36.7
R_{wi}	10 12 4	25	22	33	40	43	44
R_{ew}	Sound reduction index (octave band value) of the external wall	40	44	45	51	56	56
R_{rr}	Sound reduction index (octave band values) of the roof/ceiling	28	34	40	45	49	49
A	Equivalent Absorption Area of Room (Copied from BS8233)	11.00	14.00	16.00	16.00	15.00	15.00

BS8233 Calculation Details						
Term From Equation Below	Octave Band Centre Frequency					
	125	250	500	1000	2000	4000
$L_{eq,ff}$	61.9	57.9	55.9	55.9	52.9	45.9
$A_0/S \cdot 10^{(-D_{tr,e}/10)}$	5.375E-05	0.000126	0.000151	0.00024568	9.34049E-05	0.000104802
$S_{wi}/S \cdot 10^{(-R_{wi}/10)}$	0.0006201	0.001237	9.83E-05	1.96078E-05	9.8272E-06	7.80602E-06
$S_{ew}/S \cdot 10^{(-R_{ew}/10)}$	8.039E-05	3.2E-05	2.54E-05	6.38578E-06	2.01936E-06	2.01936E-06
$S_{rr}/S \cdot 10^{(-R_{rr}/10)}$	0	0	0	0	0	0
$10 \log_{10}(S/A) + 3$	5.6823748	4.635021	4.055102	4.055101848	4.335389084	4.335389084
$L_{eq,2}$	36.357214	33.98131	24.35126	24.29557679	17.45767192	10.82827524
A-Weighting	-16.1	-8.6	-3.2	0	1.2	1
A-Weighted L_{eq}	20.257214	25.38131	21.15126	24.29557679	18.65767192	11.82827524

Predicted Building Envelope SRI	30
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Flat A Bedroom

BS8233 Calculation can be seen below:	
$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{tr,e}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$	

Table 6: BS8233: Rigorous Calculation