

Acoustic Associates Sussex Ltd

Transportation Noise Assessment Residential Development

Site: Land Adjacent to L'Apache, Westergate Street,
Woodgate, Chichester PO20 3SQ

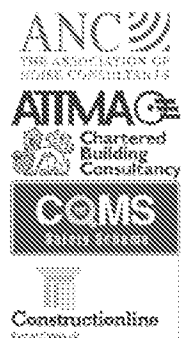
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Date: 30 August 2018

Project: J2516

Issue 1



Sound Insulation Testing • Acoustic Design of Buildings • BS4142 • PPB24 • Schools Acoustics BS683 •
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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment supporting the introduction of two residential properties adjacent to L'Apache, Westergate Street, Woodgate.

It is understood that this document will form part of the planning application for the proposed development. The purpose of this assessment is to assess transport noise levels and the associated internal/external noise levels for the proposed development. Located to the South of the application site is a twin track railway linking Barnham and Chichester stations in West Sussex.

Rail noise has been measured on the existing site with calculations undertaken using the Sound Exposure Level (SEL) methodology to determine the likely daytime and night-time levels from train passes. Site survey information has been applied to current train time tables to determine the likely noise to be experienced at the façade during the daytime and night time periods.

The rail noise levels for the daytime and night time period have been assessed in terms of and following the guidelines of the documents listed below:

- Calculation of Rail Noise (CRN) 1995.
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- Planning and Policy Guidance 24 (PPG 24 – now withdrawn see section 2.2)
- National Planning Policy Framework (NPPF) 2018
- ProPG Planning Guidance, June 2017

From the 4-hour survey carried out on 8th August 2018, and the information being projected against the current railway timetables, it is predicted that the daytime (07:00-23:00 hours) noise level will be 51 dB, $L_{Aeq,16\text{ hour}}$ measured as freefield. The night time period (23:00-07:00 hours), is predicted to be 45 dB, $L_{Aeq,8\text{ hour}}$ measured as freefield.

Whilst thermal double glazing will be sufficient for the ground floor living areas including the kitchen and rear living areas, the first-floor bedrooms on the Southern façade will require enhanced glazing (6/12/6.4 (PVB)) and acoustic trickle vents which have a minimum requirement of 38 dB D_{nEw} . The enhanced glazing and acoustic trickle vents allow background ventilation without the need to open windows which would likely lead to an increase in internal noise levels with the potential to disturb sleep.

Noise levels in the external amenity areas/garden, located to the North of the application site are predicted to be 37 dB(A) and 41dB(A) respectively, well below those levels in the World Health Organisation Guidelines for Community Noise for the daytime period (50 dB $L_{Aeq,16\text{ hour}}$) which relates to the onset of moderate annoyance.

It is noted from pre-application discussions with the local planning authority, that a Noise Exposure Category (NEC) assessment is required to ensure that residents will not be adversely affected by noise. Whilst the NEC style of assessment is likely to date back to the repealed PPG24 Guidance, the more recently published ProPG 2017 guidance is the relevant documentation. As per the assessment in 4.9.4 below, the site is considered to be negligible to low risk.

For the reasons above it is considered that planning permission would not likely be refused on noise grounds, assuming that the mitigation measures as reported in section 5 are implemented on site.

2 Planning Policy, Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

The proposed two properties will be built on an area of land adjacent to the East of an existing dwelling, L'Apache situated at the end of an unmade track by turning East off of Westergate Road. The proposed site plan is shown in Figure 1 below.

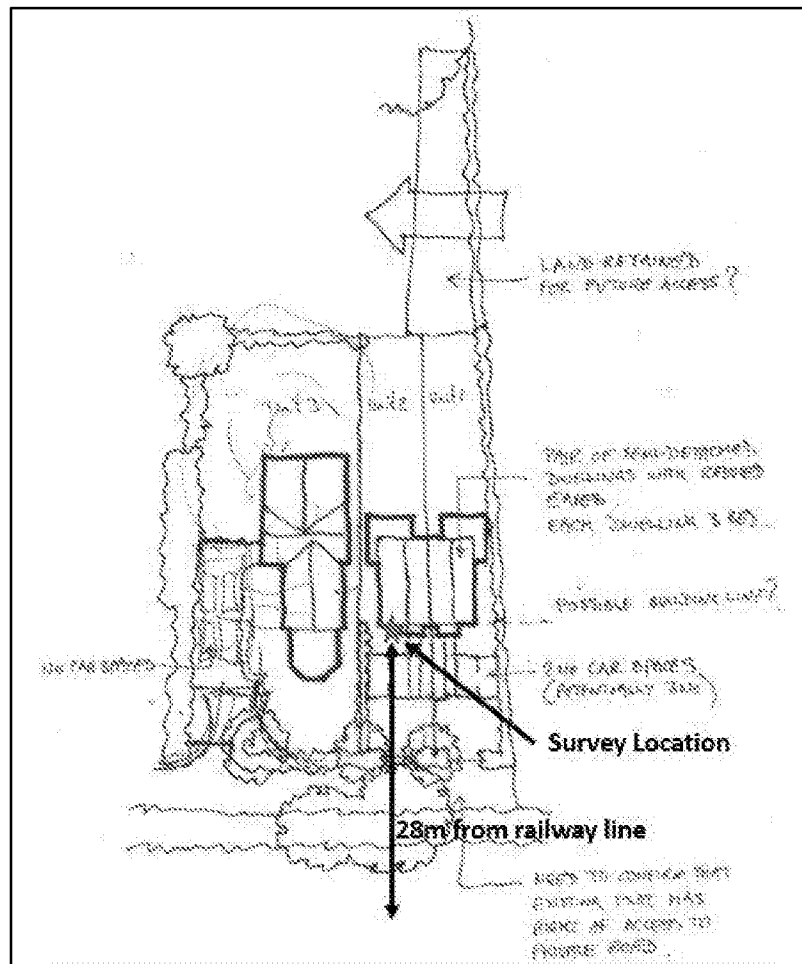


Figure 1: Proposed Site Plan

The existing railway line is approximately 28 meters South from the proposed property façade and runs East to West. The railway line is located in a small cutting with Barnham Station located approximately 1.85 km East of the application site and Chichester Station estimated as approximately 8 km West.

The soundscape observed on site consisted of birdsong, gulls and distant road traffic as well as passing rail traffic. The frequency of train passes was such that during the 4-hour monitoring period, 40 train passes were successfully measured, which was commensurate with that expected from the current train operating timetable.

The train operating company using the railway line was Southern Rail.

2.2 National Planning Policy Framework 2018

The National Planning Policy Framework (July 2018) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so.

The following paragraphs are relevant within NPPF Section 15 (Conserving and enhancing the natural environment) states the following:

Paragraph 170(e) - preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

Paragraph 180-Planning policies and decisions should also ensure that new development is appropriate for its location considering the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

Paragraph 182 - Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

Based upon discussions with the Local Authorities it is recommended in this case that appropriate criteria are provided by:

- Planning Noise Advice Document: Sussex, July 2015
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- World Health Organisation (WHO) - Guidelines for Community Noise 1999
- PPG24 (1994). Whilst withdrawn, factual information is still contained in Annex 6
- ProPG Planning Guidance, 2017

Assessment methodology and calculations of noise propagation will follow the principles detailed within:

- Calculation of Rail Noise (CRN) 1995.
- ISO9613 (1996) Attenuation of sound during propagation outdoors

2.3 WHO 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.

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.

2.4 BS8233 (2014) Noise Criteria

Table 4 of BS8233 provides the following guideline values:

Table 4 Indoor ambient noise levels for dwellings			
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq, 16hour}$	---
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	---
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

Table 1: BS8233 Criteria

2.5 Rail Noise Measurement and Prediction Methodology

The noise levels for the day and night time periods have been predicted, using on site measurements, rather than measuring constantly for 24 hrs or more. The predictions have been made using the following information:

- Current timetable data which details the number of passenger trains that pass by the site (between Chichester and Barnham stations).
- Train Sound Exposure Levels (SEL's) were measured on site during the daytime. These individual measurements were then grouped into train types based on train length and direction.

The individual SEL measurements have been averaged for each train type and direction in order to create a "typical" sound exposure level (SEL) for each train type. Figure 2 below shows the approximate location of the application site in relation to the existing rail network.

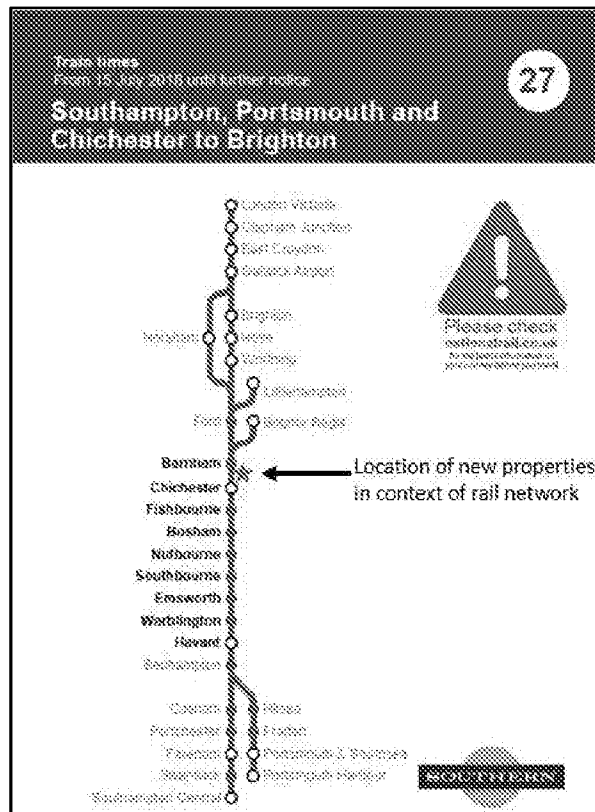


Figure 2. Railway line main stations and location of the new residential property

The above methodology is in accordance with Calculation of Rail Noise 1995 which states the following in section 43 paragraph 2 and 3.

"In order to determine the $L_{Aeq,16h}$ or $L_{Aeq,8h}$ noise level it may be necessary to carry out SEL noise measurements of each train pass-by over the full time period of interest. Exceptions to this may occur when the train mix and speed of individual train types remain reasonably constant over the relevant time period. For this situation, it is acceptable to measure a representative sample of individual train pass bys of each train type running on each track and determine an arithmetic mean value for the SEL for each case."

In paragraph 3, CRN goes on to say that having established by measurement the mean values for the SELs of each train type operating on the railway, the day and the night time noise levels ($L_{Aeq,16hr}$ and $L_{Aeq,8hr}$) should be calculated using a formula that is also stated in CRN. The SEL to $L_{Aeq,day/night}$ formula is detailed below and implemented in section 4.

For each train type: $L_{Aeq} = SEL - 10\log T + 10\log N$

- $N =$ no. of events in period (For each train type based upon timetable information)
- $T =$ no. of seconds in period (57600 seconds for the day and 28800 for the night)

In order to sample all types of train that travel on the particular line the survey was deliberately conducted over a duration that covered a busy and a quiet period of train operation (15:00 to 19:00 hours). Conducting the sampling in this way considers the fact that rail companies will try to match train type with demand.

It should be noted that a train SEL measured in the daytime is likely to be marginally higher than if an identical train SEL was measured at night time. This is due to the fact that in the daytime the background noise levels are generally higher than at night time and during the train SEL measurement background noise will be "captured" as well as the train noise.

2.6 Non-Passenger Train Activity

The effect of noise from freight train activity is sometimes difficult to assess due to the irregularity of freight operations and the non-existence of any useful timetable information.

Discussion with Network Rail Freight Operations team, indicates that there are no current freight operations on the line in question, however, as an operational railway, Network Rail do emphasise that there may be occasional infrastructure engineering trains which provide a similar dynamic to a freight train.

These may well be occasional leaf clearing or maintenance trains that operate during the day or night-time period. These trains will be seasonal/infrequent and it is very unlikely that there would be several in a week let alone more than one in any night time hour.

Because of the infrequency of such events, it has not been possible to carry out measurements of the rail traffic noise associated with them.

It should be borne in mind that such trains pass the site only on an occasional basis, as the need arises. Therefore, it would not normally be the case that planning decisions would hinge upon such irregular events.

2.7 ProPG Planning Guidance, June 2017

Recent planning guidance released in 2017 relates to new residential development and airborne transportation noise, which includes exposure to railway noise. Whilst ProPG, 2017 generally mirrors the requirements of BS8233:2014 and the World Health Organisation Guidelines, 1999, it goes further in setting a limit for inside bedrooms for L_{Amax} events and specifically, no more than 10 L_{Amax} events per night time period above 45dB(A).

ProPG, 2017 advocates that it is not necessarily about satisfying internal target criteria, but additionally that there should be a demonstration of good acoustic design. The format of ProPG, 2017 is followed and shown in the report.

3 Noise Survey Baseline Conditions

On 8th August 2018 rail noise levels were monitored at the proposed building facade location, approximately 28m North from the railway line. The position for the survey (Figure 3) was selected to represent the Southern façade of the property which will face the railway line.

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH PGDip Acoustics AMIOA
Equipment Used	Norsonic 118 (Serial 31769) - Type 1 Sound Level Meter
Equipment Used	Castle Group Acoustic Calibrator – GA607-Serial No. 040430
Equipment Used	Maplins Easy Weather Station
Location of Microphone	SU94039/04358
Duration of Survey	8/8/2018 15:00 to 19:11 hours
Height	1.5m

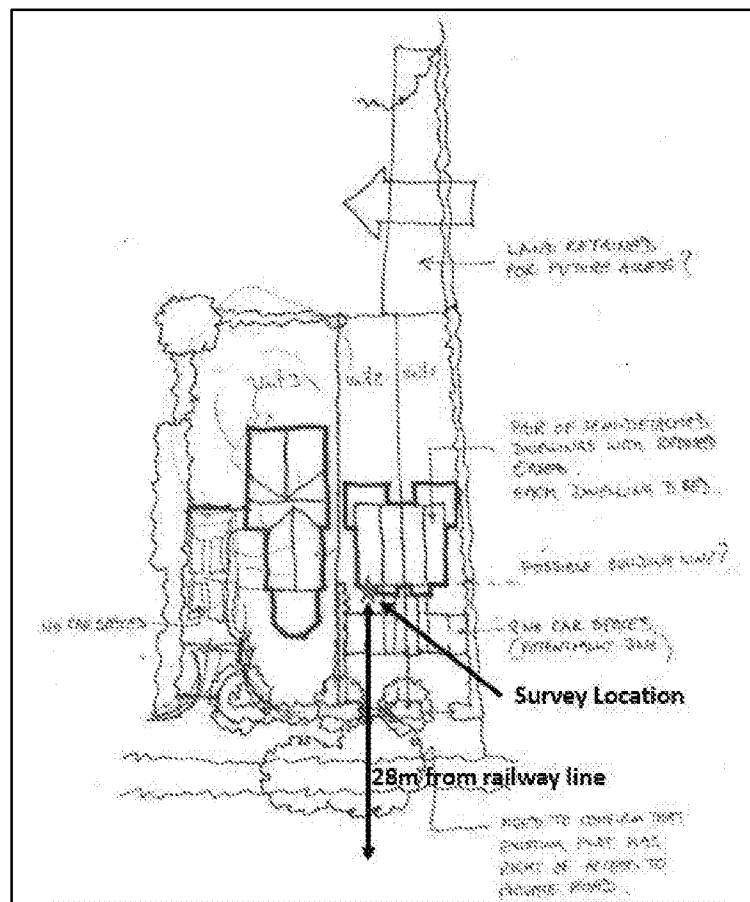


Figure 3. Site monitoring position

Figure 4 below shows both the survey instruments and the site in context with L'Apache shown on the left-hand side, and the tree/hedgerow screen in between the railway line and the access track.



Figure 4. Monitoring location with direct line of sight of the railway lines with the microphone and weather station shown

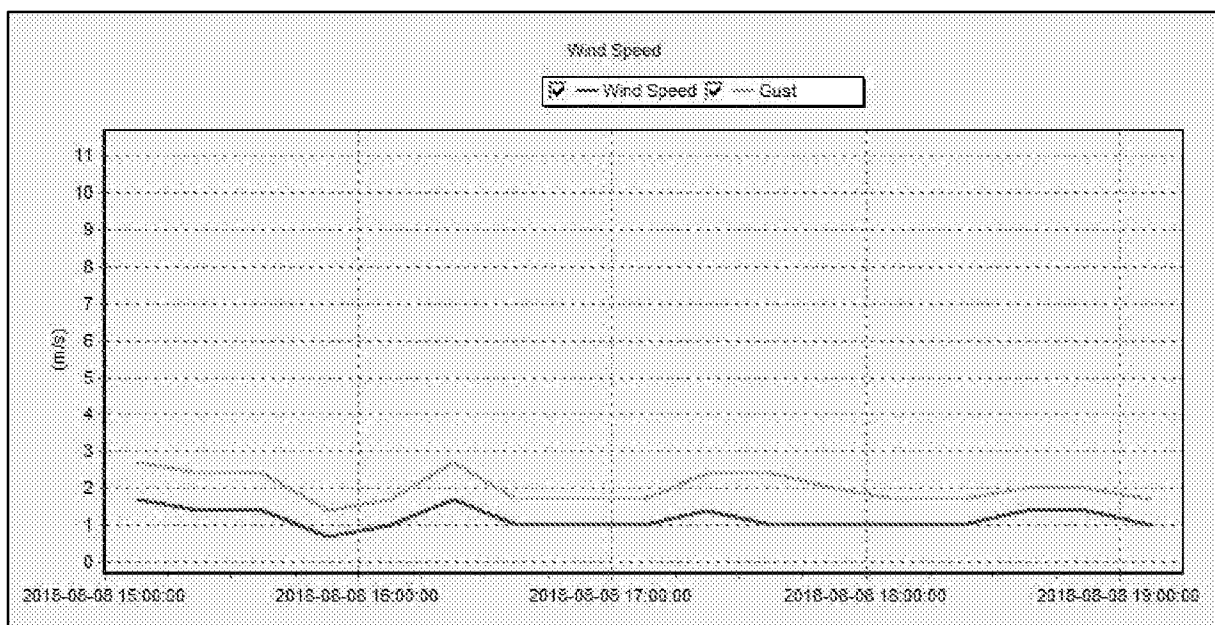


Figure 5. Windspeed data from co-located weather station

Figure 5 above shows that the wind speeds during motoring were ideal and commensurate with BS7445:2003 for environmental noise monitoring.

The sound level meter was calibrated before commencing the noise measurements (@94dB). The calibration was re-checked at the end of the measurements to ensure that no calibration drift had occurred. After survey the calibration showed no significant drift (94dB)

All measurements were taken with the microphone 1.5 m above ground. The microphone positions used during the noise survey are shown in Figures 3 and 4. The monitoring location is considered to be freefield.

The following acoustic functions were measured (fast time weighting):

- $L_{Aeq,T}$ Is the value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound, that occurs within a specified time interval, T.
- L_{Amax} is the highest A weighted noise level recorded during a noise event.
- Sound Exposure Level (SEL) is 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 is actually received from a given noise event.

4 Railway Noise Levels at Measurement Position

This section gives details of the noise survey measurements and details of how the day and night time period noise levels have been calculated.

4.1 Noise Survey Results

During the survey, 40 measurements were taken (Sound Exposure Level (SEL)) of the train pass-by events.

Ambient noise measurements were also taken. As the train noise measurements were at least 10dB greater than the ambient noise level, no correction has been applied.

Taking the (arithmetic) averages of the SEL values for each train type (and direction) provides the following results in Table 2:

Quantity		Train Operating Company	Train Carriage Length	Average SEL	
East	West			East	West
20	17	Southern	4 Coach	79	70
1	2	Southern	6 Coach	73	67
21	19	Total			

Table 2: Survey Noise Levels

Table 2 above shows that the trains travelling in the Eastern direction are the louder of the two directions.

4.2 Train Timetable

Train timetable information for trains operating between London and Southampton and more specifically, Chichester and Barnham were examined. The principle train operator was identified as Southern. Timetables were downloaded and considered to be valid from 15th July 2018 to date "*until further notice*". Analysis of the timetables suggests the following train movements past the site.

Train Type	Number of Trains			
	East		West	
	Day	Night	Day	Night
Southern	80	14	85	13

Table 3: Train timetable info.

The timetable information above and the survey information (Table 2) has been used to predict the number of trains of each type that will pass the site. The percentages observed during the survey period are seen below in Table 4 and have been applied to the rail timetable traffic in Table 3, providing an indication of the train carriage/coach composition and directions to populate Table 5.

Eastbound			Westbound		
Coaches	Passes	Percentage	Coaches	Passes	Percentage
4	20	95.23809524	4 Coach	17	89.47368421
6	1	4.761904762	6 Coach	2	10.52631579
Total		100	Total		100

Table 4. Percentages of trains observed during the survey period.

The percentages from Table 4 above are applied to Table 3 to determine the likely profile of trains passing the site from both an Easterly and Westerly direction.

Train Type	Number of Trains			
	East		West	
	Day	Night	Day	Night
4 Coach	76.19048	13.33333	76.05263	11.63158
6 Coach	3.809524	0.666667	8.947368	1.368421
Total	80	14	85	13

Table 5. Composition and number of trains passing the application site.

From Table 5 above, the SEL formula is applied to identify daytime and night time noise levels at the measurement position.

4.3 Converting Sound Exposure Levels (SEL) to L_{Aeq} Levels (measurement position)

In paragraph 3 CRN states that having established, by measurement, the mean values for the SELs of each train type operating on the railway, the day and the night time noise levels ($L_{Aeq,16hr}$ and $L_{Aeq,8h}$) can be calculated. The day and the night time period noise level relating to each train type can be calculated using the following formula

$$\text{Train Type } L_{Aeq, \text{ day/night}} = \text{SEL} - 10\log T + 10\log N$$

- N = no. of events in period (For each train type based upon timetable information)
- Day = 07:00-:23:00hrs & Night = 23:00-07:00hrs
- T = no. of seconds in period (57600 seconds for the day and 28800 for the night)

4.4 Train Type Day/Night Noise Levels

Table 6 below shows the calculated results of the train type noise levels with the formula from 4.3 and the SEL's from Table 5 applied for each train coach size and direction.

Train Type	Resulting Noise Levels from Passing Trains			
	East		West	
	Day	Night	Day	Night
4 Coach	50.21478	44.65546	41.20692	36.06246
6 Coach	31.20448	26.64516	34.91273	23.76827
Total	50.26899	44.72359	42.12266	36.31127

Table 6: Train Type Day/Night Noise levels

4.5 Total Noise Level at Measurement Position

The noise levels detailed above can be added together (logarithmically) to show the total received day time and night time noise level at the measurement position for all trains in both directions.

For daytime this would be $10\log(10^{5.26899} + 10^{4.212266}) = 50.91 \text{ dB(A)}$.

- $L_{Aeq,07:00-23:00} = 51 \text{ dB(A)}$
- $L_{Aeq,23:00-07:00} = 45 \text{ dB(A)}$

4.6 Predicted Noise Levels and Corrections

Given that railway noise is being assessed, it is appropriate to consider whether the same protection is afforded from thermal double glazing (6/12/6) as opposed to road traffic noise. PPG24, albeit withdrawn, still includes relevant detail concerning railway noise. Table 1 in Annex 6 shows that for electric locomotives, double glazing is likely to provide 36dB(A) difference between outside and inside levels. This is further reinforced in Pilkington Glass data sheets dated 2007 which state that $R_{RAIL} = R_{TRA} + 3$. Therefore, the protection afforded for thermal double glazing for this particular assessment is 36dB(A).

It is noted that whilst the survey position was free-field, there is a need to add 3dB(A) to represent façade conditions to allow the consideration of noise transfer from outside to inside. Additionally, with angle of view, both CRN and CRTN advocate that an adjustment may be applied. The angle of view adjustment is assessed using the angle of view of the windows against the railway line. Where this is 90°, a 3 dB(A) subtraction may be applied.

When using an SEL formula, there is no requirement for on time corrections, as this is already incorporated within the calculations.

With the 3dB(A) addition for a façade correction and 3dB(A) subtraction for angle of view, the following tables 8-11 below apply the correct continuous noise level data for the Southern façade which sees a kitchen at ground floor and a bedroom at first floor.

4.7 Proposed Internal Layout

The proposed layout is seen in floors as follows:

4.7.1 Ground Floor

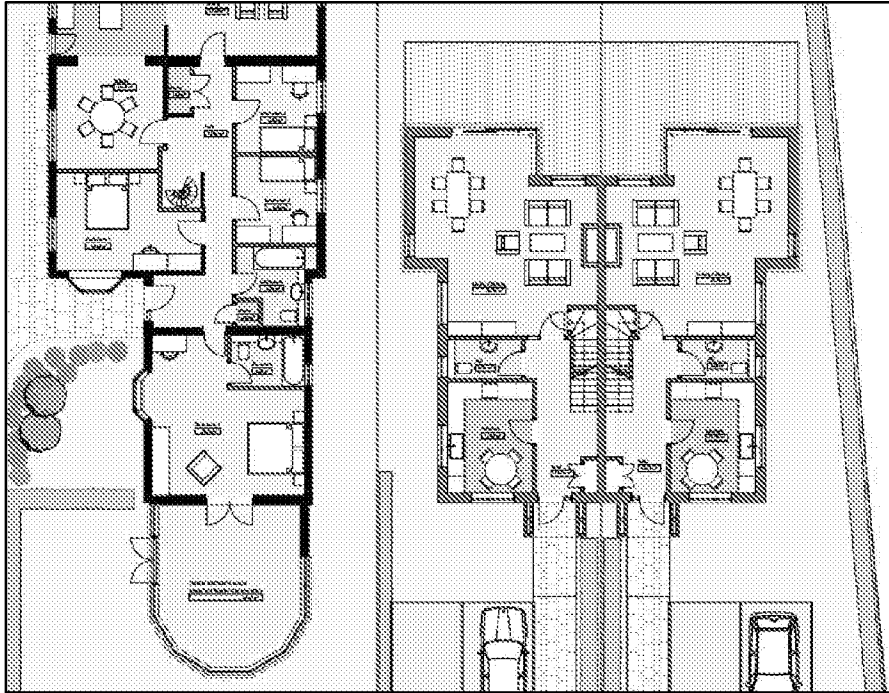


Figure 6. Ground Floor Layout

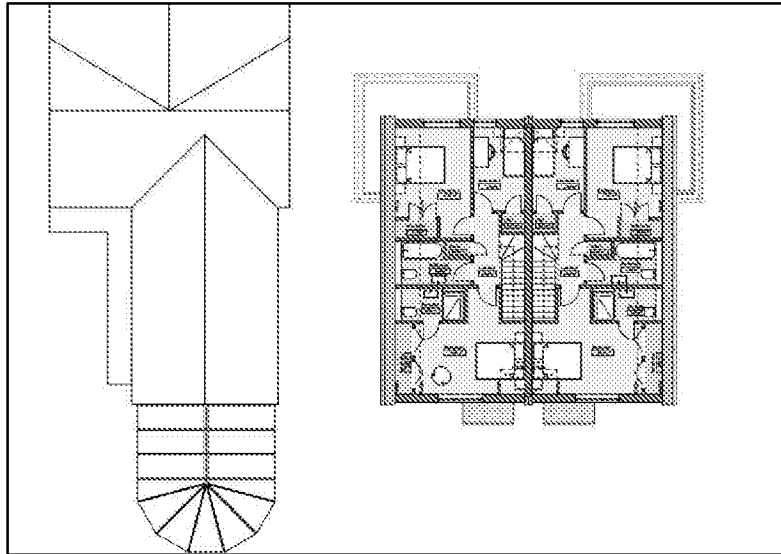
The windows to be assessed for internal noise levels from BS8233:2014 are the kitchen windows located on the Southern façade (see Table 8) and the dining/living area (see Table 9) located further to the rear of the property on the Eastern façade. Tables 7 and 8 show that thermal double glazing will be acceptable for the ground floor.

Ground Floor Kitchen Window						
Freefield Level	Façade Corrected	Open Window	Closed Window	BS8233 Target	Target Met	Required Glazing
51 dB L_{Aeq} , 16 hour	54 dB	39 dB	18 dB	40 dB	Yes	6/12/6

Table 7. Results of Ground Floor Kitchen Window

Ground Floor Living Area								
Freefield Level	Distance Correction (-2)	Angle of view (-3)	Façade correction (+3)	Open Window (-15)	Closed window (-36)	BS8233 Target	Target Met	Required Glazing
51 dB L_{Aeq} , 16 hour	49 dB	46	49	34	13	35	Yes	6/12/6

Table 8. Results for Ground Floor Living Area

4.7.2 First Floor**Figure 7. First Floor Layout**

The front bedroom is located on the Southern façade, but importantly, there are no windows on the Eastern or Western façades for the first-floor bedrooms. The remaining bedrooms have windows overlooking the Northern aspect.

First Floor South facing Bedroom						
Freefield Level	Façade Corrected (+3)	Open Window (-15)	Closed Window (-36)	BS8233 Target	Target Met	Required Glazing
45 dB LAeq, 16 hour	48 dB	33 dB	18 dB	30 dB	Not with window open	6/12/6

Table 9. Results for First Floor South Facing Bedroom

It is noted from Table 9 that whilst internal noise levels are met in the bedroom with the windows closed, opening the windows will cause the internal noise levels to be exceeded.

IMMI Noise modelling software was used to predict the rear/North facing first floor bedroom. It is noted that the building form acts a barrier and with a line source attenuating less, the sound levels incident on the Northern façade are significantly reduced from those on the Southern façade.

First Floor North facing Bedroom						
Freefield Level	Façade Corrected (+3)	Open Window (-15)	Closed Window (-36)	BS8233 Target	Target Met	Required Glazing
25 dB LAeq, 16 hour	28 dB	13 dB	-8 dB	30 dB	Yes	6/12/6

Table 10. Results for First Floor North Facing Bedroom

4.8 Discussion

It is apparent from the tables above that thermal double glazing with a 6/12/6 configuration will be suitable for the proposed habitable rooms on the ground floors. However, opening a window for ventilation in the bedrooms overlooking the railway is likely to compromise the internal sound levels.

4.8.1 L_{Aeq} Levels in Bedrooms

It is noted from table 9 above that whilst thermal double glazing is likely to be sufficient for the North facing bedrooms, opening a window in the south facing bedrooms which directly overlooks the railway is likely to lead to increased internal noise levels above those required in Table 4 of BS8233:2014.

Alternative ventilation is therefore needed for the bedrooms which overlook the railway line which prevents the need for windows to be opened, but still provide sufficient background ventilation. The performance required of the ventilation will be dictated by the L_{Amax} as discussed below.

4.8.2 L_{Amax} in Bedrooms

When examining the criteria for inside bedrooms (23:00-07:00 hours), it is important to note that whilst BS8233:2014 requires 30dB(A) for the night time period, the requirements of ProPG, 2017 also apply for transportation noise, in ensuring that L_{Amax} levels are no more than 45dB(A) for no more than 10 occurrences during the night time period (23:00-07:00 hours). The measured L_{Amax} events for each train type and direction are shown below in Table 11.

With Table 3 indicating a potential of 27 train passes during the night time period, the L_{Amax} events need to be carefully considered to ensure that internal noise levels do not exceed 45dB(A) L_{Amax} more than 10 times during a night.

To present a worst case and robust assessment, the highest L_{Amax} events from the train passes have been used in the assessment.

Coach	Worst Case			
	L _{Amax}	Façade Corrected	Open Window	Closed Window
East (4)	79	82	67	46
East (6)	68	71	56	35
West (4)	71	74	59	38
West (6)	62	65	50	29

Table 11. Worst Case L_{Amax} Events

The results of the train passes during the night time period in Table 5 are shown as follows in Table 12:

Results of Overnight Train Passes in terms of L_{Amax} events						
Coach Number	Direction	Frequency	Open window	ProPG L_{Amax} 45dB Exceeded	Closed Window	ProPG L_{Amax} 45dB Exceeded
4 Coach	East	13	67	Yes	46	Yes
4 Coach	West	11	59	Yes	38	No
6 Coach	East	1	56	Yes	35	No
6 Coach	West	1	50	Yes	29	No
Total		26				

Table 12. L_{Amax} events anticipated overnight by train type and direction with an open window

From Table 12 it is apparent that with a closed window, the East bound train passes would still exceed the requirements of Pro PG2017. Enhanced glazing is therefore required to protect the future residents for the first-floor bedrooms with direct line of sight of the railway line.

The glazing requirements are driven by the source noise (ie 82 dB L_{Amax}) minus the internal requirement of 45dB L_{Amax} . The minimum Sound Reduction Index (SRI) required is therefore 37 R_w .

Given that an open window would cause internal noise levels to be exceeded, acoustic trickle vents will be required to ensure that background ventilation may be provided. Any acoustic trickle vents must also have the same acoustic rating to prevent these acting as the weak point in the façade. The minimum D_{nEw} for any acoustic trickle vents is therefore 37dB.

Whilst the above is a simplistic subtraction of outside noise levels to those inside, this does not take account of the size of glazing in comparison to the façade. For example, with a larger glazed space, there will inevitably be a greater reliance on the acoustic performance of the glazing, frames and seals, as opposed to a smaller window. This may be checked using a rigorous calculation as per BS8233:2014 and is discussed further in 5.2

4.8.3 Outside/Amenity Areas

The external amenity areas, are likely to be located at the Northern end of the new build properties, furthest from the railway lines and using the building form as a natural barrier. With this in mind, IMMI noise modelling, was used to plot the existing and proposed buildings, with reception points placed at the rear garden areas at 1.5m in height. The results show a clear reduction in noise levels from the front to the rear, with the garden areas measuring specific noise levels of 37.4 dB(A) and 41 dB(A) respectively.

To provide context to these figures plans it is relevant to note the recommendations made in the World Health Organisation Guidelines for Community Noise dated 1999, BS8233:2014 and the National Planning Policy Guidance (NPPG), Noise, 2014. The guidelines suggest that for external areas, for daytime use there may be moderate annoyance above 50 dB $L_{Aeq, 16 \text{ hour}}$ and serious annoyance above 55dB $L_{Aeq, 16 \text{ hour}}$. Clearly the predicted external noise levels are well below the required criterion.

4.8.4 ProPG, 2017

ProPG, 2017 has its own risk assessment criteria which may be seen below. It is noted specifically, that the application must be considered on the applicable noise levels without any mitigation measures being applied. The risk assessment in Figure 8 below concludes a negligible to low risk.

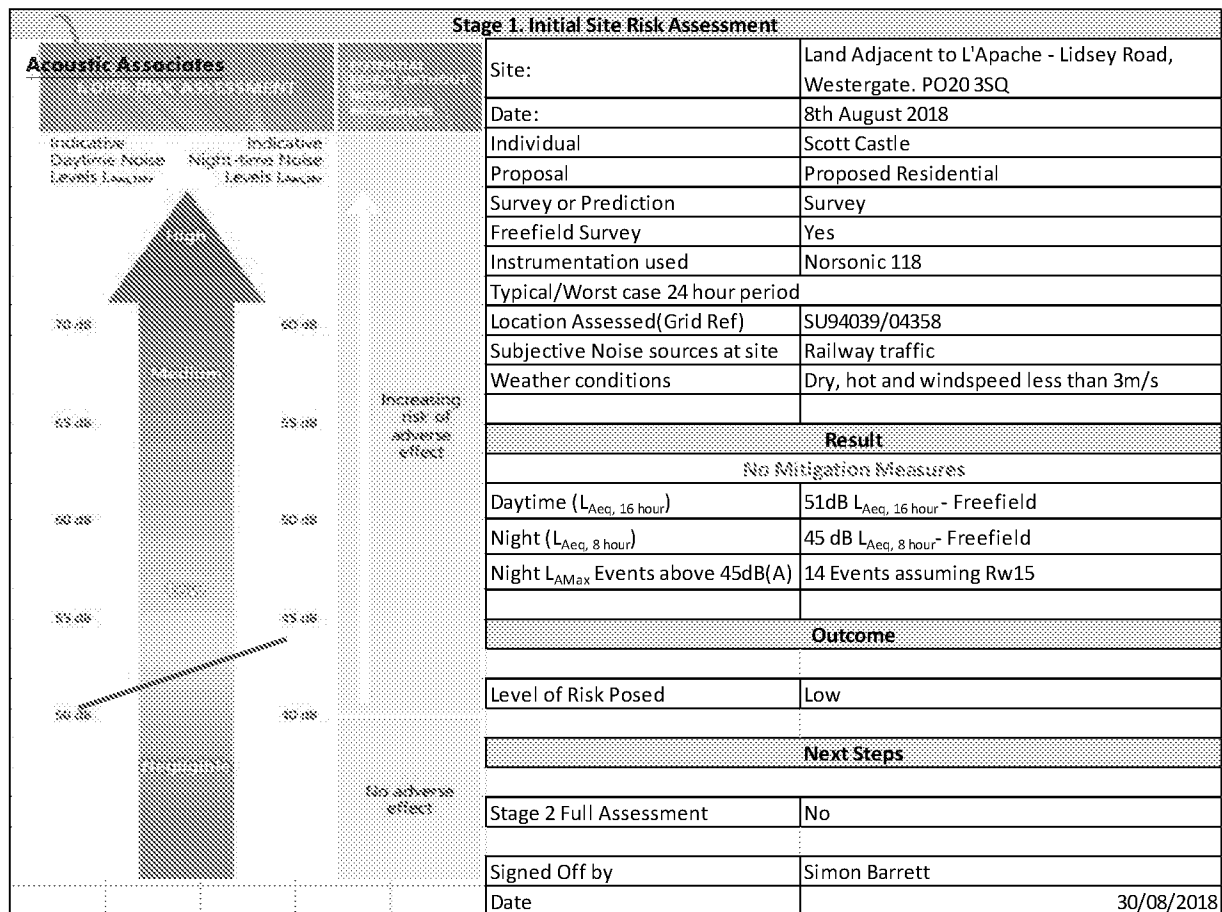


Figure 8. ProPG (2017) Initial Risk Assessment

The further stages of ProPG (2017) go onto describe and question whether design has been considered in the layout, orientation and materials being considered. ProPG places a high emphasis on external amenity areas being enjoyed as intended. From the negligible to low outcome of the assessment, there are no further requirements for assessment or justification of the layout and orientations of the proposed two dwellings.

The results from the noise modelling software predict specific noise levels significantly below those criteria required for external amenity areas in the World Health Organisation Guidelines dated 1999.

5 Noise Mitigation Measures

5.1 Ground Floor

Thermal double glazing with a configuration of 6/12/6 will be sufficient for the ground floor kitchens and living areas in both properties. Whilst the information has been derived from Pilkington Glass brochures, alternative suppliers may be selected on the basis of an R_{RAIL} of 29dB(A).

5.2 First Floor

As previously stated, it is the L_{Amax} levels generated by the East bound trains which are driving the requirement for improved glazing and/or trickle vents for ventilation accordingly. The bedrooms on the Southern façade which overlook the railway line directly will require enhanced glazing and acoustic trickle vents. To identify the exact requirements, a rigorous calculation has been carried out.

5.2.1 Rigorous Calculation

The rigorous calculation approach calculates the windows as a ratio to the remainder of the exposed facade and identifies what windows and trickle vents may be used. The relevant L_{Amax} spectral profile taken from the SEL measurement profiles were entered into the spreadsheet.

The measurement data has been determined for both L_{Aeq} data recorded from the loudest train pass with the window closed and additionally, the L_{Amax} spectral data with an open trickle vent to ensure that the L_{Amax} are reduced to 45dB L_{Amax} received inside a bedroom.

The enhanced glazing for the first-floor bedrooms is 6/12/6.4(P_{VB}) which will need to have an acoustic ventilator with a D_{nEw} of 38 dB.

Whilst the information has been derived from Pilkington Glass brochures, alternative suppliers may be selected on the basis of an R_{RAIL} of 30 dB(A).

5.3 Night Time L_{Amax} Levels

As discussed above, from trains assessed and the time table calculations, the L_{Amax} events in the bedroom would exceed the requirements of ProPG, 2017. As above, in addition to enhanced double glazing, there is a requirement for acoustic trickle vents to ensure sufficient ventilation with a D_{nEw} of 38 dB.

6 Conclusion

6.1 Noise Criteria (Continuous Noise)

From the 4-hour survey carried out on 8th August 2018, and the information being projected against the current railway timetables, it is predicted that the daytime (07:00-23:00 hours) noise level will be 51 dB, $L_{Aeq,16 \text{ hour}}$. The night time period (23:00-07:00 hours), is predicted to be 45 dB, $L_{Aeq,8 \text{ hour}}$. The information was measured from 40 separate train passes which is considered to be a sufficient number of train passes to be able to confidently categorise the application site.

6.2 External Amenity Areas

Noise levels in the external amenity areas/garden, assumed to be located to the North of the application site are predicted to be 37 dB(A) and 41dB(A), well below those levels in the World Health Organisation Guidelines for community Noise for the daytime period (50 dB $L_{Aeq,16 \text{ hour}}$) which relate to the onset of moderate annoyance.

6.3 L_{Amax} Levels

As previously discussed, it is the East bound 4 coach trains which are driving the requirement for enhanced glazing in the bedrooms on the first floor southern façade overlooking the railway.

This may be achieved with upgraded double glazing (6/12/6.4_(PVB)) or R_{RAIL} of 30dB used in combination with an acoustic trickle vent with a D_{nEW} of 38 dB or a through the wall ventilator to prevent the residents having to open windows for ventilation purposes.

6.4 Noise Exposure Category Assessment

It is noted from pre-application discussions with the local planning authority, that a noise exposure category assessment is required to ensure that residents will not be adversely affected by noise. Whilst the NEC style of assessment is likely to refer back to the repealed PPG24 Guidance, the more recently published ProPG 2017 guidance is the relevant documentation. As per the assessment in 4.9.4 above, the site is considered to be negligible to low risk.

For the reasons above it is considered that planning permission would not likely be refused on noise grounds, assuming that the mitigation measures as reported in section 5 are implemented on site.